NATURAL HISTORY TRANSACTIONS

OF

NORTHUMBERLAND AND DURHAM;

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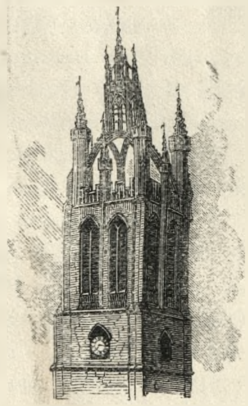

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NATURAL HISTORY

TRANSACTIONS

OF

NORTHUMBERLAND AND DURHAM.

I.—*Meteorological Report for* 1867. Edited by the Rev. R. F. Wheeler, M.A.

January.—The year 1867 commenced with severe cold. The 1st of January was an extremely cold day throughout England. At Wakefield, the thermometer fell to 5° Fahrenheit, or 27° below freezing point. The severest snow-storm known in London for some years began on January the 2nd. The lowest daily readings of the thermometer at Greenwich, January 1–5, were—January the 1st, 21·8°; January the 2nd, 15°; January the 3rd, 10·4°; January the 4th, 7·7°. The mean temperature of the month was 13·5°, or 23° below the average. It appears from the records of the daily temperature at Greenwich, that during the last fifty years only four days have had a lower mean temperature than January the 4th, 1867. In 1816 the mean temperature of February the 9th was 12·6°; 1823, January the 19th, 13·4°; 1838, January the 20th, 10·7°; 1841, January the 8th, 12·8°; 1867, January the 4th, 13·5°.

The four days (January 6–10) which followed this great frost were remarkable for their high temperature, accompanied by low atmospheric pressure. On the 11th another frost set in, and continued till the 22nd.

The mean temperature of January at Greenwich was 84·2°, being 2° below the average of the preceding ninety-six years, 4·1° below the average of the preceding twenty-six years, and lower than any of the preceding years.

Wylam.—A fine wintry month, with a good deal of snow and frost. Between the 5th and 8th the barometer fell (from 30·078 to 28·475) 1·603 inches very suddenly. There was a heavy gale in London and the Channel on the 8th, but it was almost calm at Wylam. A wind pressure of 35lb on the square foot was recorded at Greenwich. The mean height of the barometer at 9 A.M. was 29.540. The mean temperature $\left(\frac{\text{max.} + \text{min.}}{2}\right)$ was 32·2°, which is 4·7° below the average of the preceding twelve years.

Alston.—The lowest reading of the thermometer for the year was on the 3rd, when it fell to 1° degree below zero. Taking the mean reading of the thermometer, the coldest days of the year were the 3rd, 5th, and 13th January, on each of which days the average temperature was 14°. The least range of temperature throughout the year occurred on the 7th, namely 2°.

Wallington.—The first severe weather set in on January the 1st (thermometer down to 13°), and continued with frost and snow until the 13th. During the last week of the month the weather was mild and open.

Whitley.—Contrary to what is usually the case, the snow-storm seems to have been more severe here than in places much further inland. In some parts of the roads the drifts had to be cut through to a depth of more than six feet.

North Shields.—The lowest range of the thermometer during the year was 14° on January 1st. The lowest reading on the ground was 10° on January 4th.

Snow fell at Otterburn from the 1st to the 23rd. At Wolsingham, on the 2nd, 5th, 9th to the 12th, and 14th to the 22nd. At Seaham, on the 2nd, 4th to the 6th, 10th to the 14th, 17th, 20th, and 24th. At North Shields, on thirteen days. At Wallington, on the 1st, 2nd, and 10th to the 23rd. At Whitley, on the 1st to the 5th, 9th to the 15th, 21st, and 22nd.

Hail fell at North Shields on four days.

Lightning was seen, but thunder was not heard at Allenheads on the 12th. At Whitley, on the 29th and 30th.

February.—An old Latin weather proverb, quoted by Sir T. Browne in his "Vulgar Errors," tells us:—

> "Sic sol splendescat Maria Purificante,
> Major erit glacies post festum quam ante fuit."

Which is popularised in the not uncommon English lines:—

> "If Candlemas Day be fair and bright,
> Winter will have another flight;
> But if Candlemas Day brings clouds and rain,
> Winter is gone, and will not come again."

Candlemas Day, 1867, was remarkably fine over nearly the whole of England.

The Germans have also a couple of common proverbs about Candlemas Day:—

"The shepherd would sooner see the wolf enter his stable on Candlemas Day than the sun."

And, "The badger peeps out of his hole on Candlemas Day, and when he finds snow, walks abroad; but if he sees the sun shining, he draws back again."

The month of February was marked by high temperature, not only in the north, but throughout England.

At Greenwich, the mean temperature was 44·7°, being 6·4° higher than the average of the preceding ninety-six years, and higher than that of any year since 1779, when it was 45·3°. In 1794 and 1850 the mean value (44·7°) was obtained.

Wylam.—A very fine month, a remarkably even temperature prevailing throughout. A more sudden fall of the barometric pressure than that of last month took place between the 3rd and 6th, amounting to (30·155–28·341) 1·814 inches. The first twelve days of the month were generally windy, but the 6th was not more so than the rest; there was, however, a gale in London and the South of England on the 5th.

The mean height of the barometer was 29·907. The mean temperature, 43·02°, which is 4·4° above the average.

Alston.—The lowest reading of the barometer during the year was on the 6th, 28·445.

Wallington.—Until the 26th the weather was mild and fine. Many of the trees and shrubs were in bud, and many of the hardy flowers in blossom. During the last two days frost and snow set in, and hard weather continued up to March the 24th, which stopped all advance in vegetation.

North Shields.—The greatest depression of the barometer during the year, 28·492 inches, occurred at 2 P.M. on February the 6th.

Snow fell at Seaham on the 11th; at North Shields, on the 6th; at Whitley, on the 27th.

Hail fell at North Shields on the 27th.

Lightning was seen, but thunder was not heard, at Allenheads on the 6th.

Auroræ were seen at North Shields on the 8th and 17th; at Whitley (very brilliant), on the 8th.

Lunar halos were seen at North Shields, on the 13th and 16th; at Whitley, on the 25th; at Allenheads, on the 11th.

March.—" A wet March makes a sad autumn."—*Old proverb.*
The weather during March, everywhere throughout the kingdom, presented a marked contrast to that of February. Cold and bitter winds, snow and storms, were the characteristics of March.

The mean temperature of the month at Greenwich was 37·7°, being 3·3° below the average of the preceding ninety-six years, 4° below the average of the preceding twenty-six years, and 2·8° lower than in 1866.

On the 17th there were strong gales throughout the South of England, doing much damage to the shipping. No remarkable wind was felt in the north.

Wylam.—A bitterly cold month till the 23rd, with almost constant east winds, after that, a few beautiful days succeeded; but the month ended with very chill and piercing northerly winds.

The mean height of barometer, 29·713. The mean temperature, 36·21°, which is 4·2° below the average.

Alston.—The highest reading of the barometer (30·88 inches) during the year occurred on the 3rd; and at North Shields (30·753), at 9 A.M., on the same day.

Snow fell at Whitfield, without intermission, from 2 P.M. on the 7th to 2 P.M. on the 9th; altogether on sixteen days. At Whitley, on the 5th to the 22nd; at North Shields, on every day from the 6th to the 22nd, except the 10th and 21st; at Otterburn, from the 6th to the 23rd; at Wolsingham, from the 6th to the 14th, and from the 16th to the 22nd; at Seaham, from the 6th to the 9th, and on the 14th, 17th, 19th, and 20th; at Wallington, from the 6th to the 10th, and on the 12th, 15th, to the 17th, 19th, 20th, and 22nd.

Hail fell at Whitley on the 20th.

Solar halos were seen at North Shields on the 25th, at Allenheads on the 21st.

Auroræ were seen at Whitley on the 7th.

> "When April blows his horn,
> It's good for both hay and corn."
>
> "A cold April the barn will fill."
>
> —*Old Proverbs.*

April was a very unsettled month. Heavy gales of wind were general throughout the country. The mean temperature at Greenwich was 49°, being 3·1° higher than any year since 1845, excepting 1863, which was 49·1°.

Wylam.—A fine month, with a good deal of wind, mostly from the west, till towards the end, then cold winds from east and north. The mean height of barometer not perfectly kept. The mean temperature, 48·00°, which is 2·2° above the average.

Otterburn.—The month was warmer than April, 1866. The thermometer never reached 60°, nor fell below 32°.

Wallington—A fine growing month. Only three nights on which there was any frost.

Acklam, near Middlesbro'.—Cold and cutting winds were prevalent, more or less, until the end of the month.

Whitfield.—Rain began to fall at 7 P.M. on the 20th, and 1·23 inches fell before 8 A.M. on the 21st.

Thunder was heard at North Shields and Whitley on the 24th.

Hail fell at North Shields and Whitley on the 24th.

Solar halo was seen at North Shields on the 28th.

"A cold May and a windy
Makes a full barn and a findy."

"A May flood (*i. e.* a wet May) never did good."

—*Old Proverbs.*

May.—In the first days of May the weather was fine. On the 6th a remarkable change took place over the country generally. At Greenwich the temperature rose on the 6th and 7th to an excess of 15° and 17° above the average of those days. On the 12th of May in Northumberland, and on the 13th further south, a great change of weather took place. The summer-like weather which so suddenly set in, in the second week in May, was as suddenly succeeded by a period of severe cold weather. From the 21st to 26th, in Northumberland, the weather was very bleak and wintry. At Greenwich the temperature of those days was 10° to 14° below their average. The mean temperature of the month, however, at Greenwich was in excess, being 0·8° above the average of the preceding ninety-six years, and higher than either 1865 or 1866.

The cold weather of this month was not confined to Europe. In North America it was so general and persevering as to arouse even the rustic poets.

Wylam—From the 3rd till the 7th exceedingly warm and fine, when a thunderstorm occurred, and chill winds set in from the east and north till the 28th, after that it became very warm and fine, with wind from south-west.

The mean height of barometer not kept.

The mean temperature, which was 64·5° on the 7th, fell gradually till the 25th, when it was 39·5°. On the 23rd snow fell almost throughout England.

The mean temperature of the month was 49·48°, which is 1·6° below the average.

Otterburn.—On the 22nd every place was white with snow. The record of temperature was kept by a friend during Mr. Wearing's absence from home. Mr. Wearing remarks that he observed snow at Lacher See, in Germany, on the 22nd.

Wallington.—A fine month up to the 21st. Two degrees of frost were registered on the 22nd, 3° on the 23rd, and 7° on the 25th. Fruit trees and blossom generally much injured.

Acklam, near Middlesbro'.—The two first weeks were moderately fine; afterwards, cold northerly wind prevailed up to the 26th, and checked vegetation much. Subsequently to the 26th the weather was more genial.

Whitfield.—The thermometer fell to 29° on the 15th, and to 28° on the 22nd and 24th; 73° were registered in the shade on the 7th.

Whitley.—Much damage done to fruit trees and flowers by the bitter winds and frosts of the 21st, 22nd, and 23rd.

Snow fell at Whitley on the 22nd and 23rd; at Whitfield and Wallington on the 21st, 22nd, and 23rd; at St. John's, Wolsingham, on the 21st and 22nd; and at Seaham and Rothbury on the 22nd.

Hail fell at Rothbury on the 22nd, and at Seaham on the 21st and 22nd.

Thunder was heard on the 28th at Otterburn; at Seaham, on the 6th, 27th, and 29th; at Alston on the 6th, 27th, 29th, and 30th; at Wallington on the 6th, 9th, and 10th; at Whitley on the 8th, 10th, 27th, and 29th; at Whitfield on the 8th; at Allenheads on the 6th and 8th; at Bywell on the 6th and 7th; at North Shields on the 6th, 10th, and 28th; at Durham on the 10th; and at Harlow Hill on the 6th.

Lightning seen but thunder not heard at Rothbury on the 6th and 8th; at Durham on the 6th; and at North Shields on the 8th.

June.—The climate of June was about the average. The cold winds which prevailed more or less made it, however, not a very pleasant month. At Greenwich the mean temperature was 58°, being the same as the average of the preceding ninety-six years, and 1° below that of last year.

Wylam.—A fine month, with a good deal of warm sunshine, alternating with chill blasts of air from the north.

Barometer and thermometer both steady; the mean of the former, 30·004, that of the latter, 56·45°, which is 5° below the average.

Alston.—The greatest range of temperature on any one day throughout the year was on the 26th, when it amounted to 49°.

Otterburn.—Fine month, but cold. On four days only the thermometer marked 70°; on three days it was below 40°.

Thunder was heard at Wallington and Alston on the 14th, and at Whitley on the 5th and 15th, and at North Shields on the 7th.

July.—Spenser's description of July:—

> "Then came hot July, boiling like a fire,
> That all his garments he had cast away,"

would certainly not be descriptive of July, 1867. The amount of cloud was great, and there was little sunshine.

The mean temperature at Greenwich was 59·4°, being 2° lower than the average of the preceding ninety-six years, and lower than that of any year since 1841, excepting 1862, which was 59·1°.

The fall of rain throughout England was 3·2 inches above the average in July. On the 25th a heavy rain began to fall throughout the South of England, and continued almost uninterruptedly next day. The amount registered varied from 1½ to 3¾ inches, being probably the heaviest rainfall known there.

Wylam.—A fine month, with a good deal of chill, cold weather whenever the wind came at all from the north. Indeed this appeared to me (G. C. A.) to be unusually the case this year, and suggested the idea that the ice-line in the North Sea might be occupying a more southerly position than ordinary.

Mean height of barometer 29·768. Mean temperature, 57·51° which is 1·2° below the average.

The take of salmon in the Tyne this year has been enormous. On the 15th, 376 salmon (averaging 9℔ each, and no grilse or trout among them) were taken at the bar—*i. e.*, at the mouth of the Tyne—at one haul of the net; by far the largest haul within the memory of man. During the season, the price in the shops in Newcastle seldom fell to 10d. per ℔, or 9d. for an uncut fish; but at the fisheries whole fish were bought on two or three occasions as low as 6d. per ℔.

Sedgefield.—On the 29th more than an inch-and-a-half of rain fell (1·56 inches), and on the 31st more than two inches (2·05 inches), being the two heaviest falls during 1867.

Whitfield.—On the 11th, 0·80 inch of rain fell between 2 P.M. and 3 P.M. On the night of the 25th the thermometer fell to

36°, and there was ice on the water in the low grounds near the river.

Otterburn.—Cold month. On only five days a temperature of 70° was recorded. On three days it was below 40°. On the 11th, 1·1 inches of rain fell in an hour.

Hail fell at St. John's, Wolsingham, on the 10th.

Lightning was seen, but thunder was not heard, at Harlow Hill on the 10th.

Thunder was heard at Rothbury on the 8th, 10th, 11th, and 23rd; at Wallington on the 11th, 13th, 18th, 22nd, and 23rd; at Alston on the 10th, 11th, and 22nd; at Whitley on the 11th, 16th, and 23rd; at Harlow Hill on the 23rd; at Whitfield on the 10th and 11th; at Durham on the 10th and 11th; at Bywell on the 10th and 11th; at Allenheads on the 11th, 13th, and 23rd; and at North Shields on the 18th.

August.—The crops generally, throughout the kingdom, improved much during the month. The mean temperature of August at Greenwich was 62·0°, which was 1·3° higher than the average of ninety-six years preceding, and 1°2 higher than that of 1866.

Wylam.—A fine warm month. A great amount of disease prevailed among the grouse this year, especially in the eastern and midland parts of England and Scotland. So scarce were the grouse that in Northumberland many gentlemen did not shoot over their moors at all. The disease was not so bad among the black game; and in Argyleshire and the West of Scotland it scarcely showed itself at all.

Grouse in the shops in Newcastle were 6/ and 7/ per brace, their usual price being 4/ to 5/.

Mean height of barometer 29·707. Mean height of thermometer 59·19°, which is 4° above the average. Barometer and thermometer both very steady.

Alston.—The highest reading of the thermometer in the year was on the 13th, when it reached 87° in the shade. Taking the mean of the maximum and minimum daily readings, the 13th was also the warmest day during the year, the mean temperature being 71·5°.

North Shields.—The highest reading of the thermometer for the year was 73° on the 13th.

Otterburn.—On four days a temperature of 70° was recorded.

Thunder was heard at Otterburn and Rothbury on the 12th; at Wallington on the 8th, 9th, 12th, and 13th; at Allenheads on the 12th and 20th; and at North Shields on the 12th.

September.—The mean temperature of September at Greenwich was 57·6°, being 1·1° higher than the average of ninety-six years preceding, and 1·2° higher than 1866.

Wylam.—A very fine harvest month. Barometer and thermometer again steady, the former 29·851, and the latter 55·15°, which is 6° above the average.

Thunder was heard at Alston on the 3rd, and at Allenheads on the 4th.

Aurora very brilliant at Whitley on the 22nd.

October.—The harvest may be said to have been all but completed early on in October. The most reliable reports at the close of the harvest estimated the oat crop as the best of the season. Barley was the next best crop as regards bulk, but showed much variation as regards quality and weight. The wheat crop was also very varied, but was below an average. Beans a good crop. Peas were scanty. Potatoes much diseased in many places in the North of England.

The mean temperature of October was 48·7° at Greenwich, being 1° lower than the average of ninety-six preceding years, and lower than the corresponding temperature of any year since 1854.

At Greenwich, from October 1st to the 18th, the average deficiency of mean temperature amounted to 8¼° daily.

For several days preceding the 27th the wind was light at Greenwich; on the morning of that day a pressure of 4lb to the square foot was recorded. After 9 A.M. 17lb, and early in the afternoon, the extreme gust of 30lb was registered, and then the gale subsided.

Wylam.—A very fine, dry month. Barometer very steady till the 25th, when it fell (from 30·205 to 28·954) 1·251, with some heavy wind from the west.

On the 29th occurred the hurricane at St. Thomas', in the West Indies, and on November 1st a furious cyclone in the Bay of Bengal.

Volcanic convulsions seem to have been singularly frequent in all quarters of the world about this time.

The mean height of barometer was 29·717. The mean temperature was 47·23°, which is 1° below the average.

Otterburn.—A beautiful month. Cold, except for a few days in the early part. Temperature 60° on only one day. On four days it was below 32°.

Seaham.—Cold north-west winds prevailed at the beginning of the month. Thermometer fell to 31° on the 4th.

Alston.—The heaviest rainfall of the year was on the 26th, when 1·10 inches were collected.

Acklam, near Middlesbro'.—On the whole a fine month, but we had some stormy cold winds, with sharp frosts.

Whitfield.—The temperature was below 32° on ten nights. On the 3rd it fell to 27°.

Snow fell at Whitley on the 3rd, 4th, and 27th. On the 4th and 5th at Seaham.

Lightning was seen but thunder not heard at Whitley on the 2nd and 29th, and at Allenheads on the 17th.

November.—November was a remarkably fine and open month throughout the kingdom. The rainfall was most unusually small. The quantity which fell at each of the stations in various parts of the United Kingdom, from which monthly reports were sent to Mr. Symons, was below the average, varying from 14·12 inches in Borrowdale to 0·34 at Manchester. The quantity of rainfall measured was less than in any November for fifty years.

The mean temperature at Greenwich was 41·4°, being 1° lower than the average of the preceding ninety-six years, and lower than any year since 1861. The average deficiency of temperature from the 2nd November to the 1st December was 1·6° daily. This is somewhat remarkably in contrast with what was the case in the North of England. The meteoric shower on the 4th, which some persons expected would be more striking even than that of last year, was scarcely equal to that of ordinary years. At Greenwich only ten meteors were seen between 5 and 7·30 A.M.

At Washington Observatory, in America, this display is stated to have been the most brilliant since 1833. The maximum frequency was at about 4·25 A.M., the rate being nearly 6,000 meteors an hour.

Wylam.—A very fine month, with a very even temperature.

Mean height of barometer 30·181. Mean temperature 42·07, which is 0·8° above the average.

Otterburn.—A most remarkable month. Moors were burnt up by drought all the month. The oldest person cannot remember such an occurrence in any former year. On three days a temperature of 50° was recorded. On six days the thermometer was below 32°.

Whitfield.—The thermometer fell to 25° on the nights of the 4th, 5th, and 6th.

Hail fell at North Shields on the 16th.

Aurora was seen at Wallington on the 28th.

December.—December opened with storm and tempest everywhere in England, and out-door work was seriously interfered with for a time.

The mean temperature at Greenwich was 37·5°, being 1·6° lower than the average of ninety-six years, and 8° lower than that of 1866.

From the 2nd to the 10th the average deficiency of temperature was 9½° daily. A great change took place on the 11th: the frost departed, and the temperature for the seven days ending the 17th was in excess by 7¼° daily.

Wylam.—A very fine month. Dull, with occasional gales of wind.

Mean height of barometer 29·866. Mean temperature 39·33, which is 0·7° below the average.

Otterburn.—On sixteen days only throughout 1867 has the thermometer reached 70° in the shade.

Seaham.—A very strong gale of wind from the north sprung up suddenly about 4 P.M. on the 1st December. Up to that time the day had been calm and fair.

Wallington.—A great storm on the 1st. On reviewing the phenomena of the year, it was marked by a late spring, and by abundant agricultural and vegetable crops. Rain came just when it was wanted, and nothing in this locality suffered from drought.

North Shields.—Mean height of barometer for the year 29·92. Yearly range of the barometer 2·261. Mean height of thermometer for the year 46·66. Yearly range of thermometer 59°.

Whitfield.—The thermometer fell to 18° on the 4th. It was below 32° on twenty-one nights. Four inches of snow fell on the 2nd, and also on the 6th.

Snow fell at Otterburn from the 1st to the 10th; at St. John's, Wolsingham, from the 5th to the 7th, and on the 17th and 31st; at Rothbury on the 1st, 4th, and 5th; at Whitley from the 1st to the 3rd, and on the 5th, 7th, and 20th.

Lunar halos were seen at North Shields on the 6th, 8th, 9th, and 14th.

RAINFALL FOR 1867.

TEES DISTRICT.

PLACE.	*Dinsdale Rectory, near Darlington.		Darlington (Southend).	Stobb House, Whorlton.	Egglescliffe, near Yarm.		Durham County Asylum, Sedgefield.	
Height of Guage... Above Sea Level	50 feet.		......	458 feet.	80 feet.		160 feet.	
Height of Guage... Above Ground ...	1½ „		......	9 in.	1 „		5 in.	
MONTH.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.
	Inches.		Inches.	Inches.	Inches.		Inches.	
January	3·56	25	5·50	2·96	3·29	22	3·90	29
February	1·45	10	1·86	1·34	0·81	10	0·92	16
March	2·19	19	4·60	1·92	1·85	20	2·42	24
April	3·36	23	3·92	2·27	2·75	21	2·36	26
May	2·32	16	3·72	2·16	2·42	16	2·27	22
June	1·76	9	2·63	1·80	1·34	9	1·39	12
July	2·95	18	4·11	2·65	2·54	15	3·01	22
August	3·26	11	4·51	2·70	2·71	10	2·69	14
September	1·75	14	2·60	1·25	1·42	14	2·06	20
October	1·26	13	1·85	1·30	1·12	17	1·45	24
November	0·85	7	1·19	......	0·92	7	0·89	11
December	1·95	10	4·30	1·89	2·06	15	2·20	18
Total for 1867	26·66	175	40·79	22·24	23·23	175	25·56	238
Ditto 1866	29·25	...	38·71	29·42	26·67	...	30·27	...
Ditto 1865	22·50	...	27·05	26·73	......	...	25·57	...
Ditto 1864	......	...	22·11	24·26	......	...	......	...
Ditto 1863	......	...	19·26	26·25	......	...	......	...
Ditto 1862	......	...	21·24	25·84	......	...	......	...
Ditto 1861	......	...	32·83	24·54	......	...	......	...
Ditto 1860	......	...	31·86	30·28	......	...	......	...
Ditto 1859	......	...	27·65	26·74	......	...	......	...
Ditto 1858	......	...	......	21·56	......	...	......	...
Ditto 1857	......	...	......	23·93	......	...	......	...
Ditto 1856	......	...	......	27·30	......	...	......	...
Average of Years	26·14	...	29·09	25·75	25·95	...	27·13	...
Difference in 1867 from mean	+0·52 (3 Yrs.)	...	+11·70 (9 Yrs.)	—3·51 (12 Yrs.)	—2·72 (2 Yrs.)	...	—1·57 (3 Yrs.)	...

* These Guages have been tested either by Mr. Symons or Mr. Glaisher.

WEAR DISTRICT.

PLACE.	Stanhope, Castle Gardens.	St. John's, Wolsingham.		*Ushaw College.		*Sunderland, Hendon Hill		Sunderland, The Hall.		Seaham Hall.	
Height of Guage... Above Sea Level	700 feet.	927 feet.		100 feet.		120 feet.		85 feet.		100 feet.	
Height of Guage... Above Ground ...	3½ „	1 ft. 1 in.		10 inches.		6 in.		1 ft. 5 in.		1 „	
MONTH.	Quantity.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.
	Inches.	Inches.		Inches.		Inches.		Inches.		Inches.	
January	4·85	4·78	23	4·16	24	4·24	27	4·77	20	3·65	20
February	2·60	2·41	15	0·96	15	0·54	6	0.60	7	0·70	9
March	4·60	4·94	24	2·29	19	2·14	21	2·32	14	2·13	17
April	3·68	3·60	21	2·28	13	1·44	17	1·09	12	1·50	16
May	2·90	2·19	15	2·66	16	2·27	14	2·56	14	2·51	15
June	0·65	1·01	10	1·51	11	1·74	15	1·66	12	1·77	11
July	3·34	4·58	16	3·77	13	3·04	15	3·69	13	2·99	13
August	1·85	2·79	14	2·37	10	2·46	12	2·19	8	2·98	10
September	2·18	1·76	14	2·06	11	1·86	13	2·24	11	1·67	11
October	1·38	1·71	20	1·25	11	1·00	12	1·14	14	1·18	11
November	1·00	0·57	5	0·58	5	0·78	7	0·62	3	0·76	5
December	3·30	2·19	15	1·96	11	1·83	15	1·62	6	1·77	12
Total for 1867	32·33	32·53	192	25·85	159	23·34	174	24·50	134	23·61	151
Ditto 1866	41·24	36·90	218	31·26	190	27·84	190	......	...	28·32	154
Ditto 1865	......	28·91	199	29·73	168	25·33	168	......	...	26·07	...
Ditto 1864	......	......	...	24·59	...	23·30	136	......	...	22·74	...
Ditto 1863	......	......	...	28·90	...	25·93	...	......	...	26·15	...
Ditto 1862	......	......	...	22·95	...	......	...	......	...	......	...
Ditto 1861	......	......	...	26·03	...	......	...	......	...	......	...
Ditto 1860	......	......	...	......	...	......	...	......	...	......	...
Ditto 1859	......	......	...	......	...	......	...	......	...	......	...
Ditto 1858	......	......	...	......	...	......	...	......	...	......	...
Ditto 1857	......	......	...	......	...	......	...	......	...	......	...
Ditto 1856	......	......	...	......	...	......	...	......	...	......	...
Average of Years	36·78	32·78	...	27·04	...	25·14	...	......	...	25·37	...
Difference in 1867 from mean	—4·45 (2 Yrs.)	—0·25 (3 Yrs.)	...	—1·19 (7 Yrs.)	...	—1·80 (5 Yrs.)	...	......	...	—1·76 (5 Yrs.)	...

* These Guages have been tested either by Mr. Symons or Mr. Glaisher.

TYNE DISTRICT.

PLACE.	Otterburn.		Byrness.	Alston.		Allenheads.		Whitfield.		Park End, Hexham.		Stamfordham.	*Wylam.	
Height of Guage... Above Sea Level	500 feet.		700 feet (?)	1150 feet.		1360 feet.		806 feet.		276 feet.		409 feet.	96 feet.	
Height of Guage... Above Ground ...	1 „		......	3 „		5 in.		1 „		3 in.		1 „	5 „	
MONTH.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Dys. on wh Rain fell.
	Inches.		Inches.	Inches.		Inches.		Inches.		Inches.		Inches.	Inches.	
January	5·07	15	......	3·15	17	6·11	29	3·93	10	5·40	26	6·30	4.08	22
February	2·12	13	......	3 82	19	3·99	19	2·79	17	2·47	19	1·07	0·67	8
March	3·35	13	......	4·88	27	9·09	29	2·14	24	1·51	18	1·32	1·85	18
April	3·23	17	4·03	5·33	23	6·72	27	5·27	24	3·24	21	2·80	1·84	12
May	2·35	15	2·42	2·32	17	2·46	20	1·79	17	2·13	17	2·11	2·22	11
June	1·17	11	1·84	1·65	15	1·28	17	1·43	10	1·31	17	1·10	1·53	8
July	5·58	16	5·18	4·20	19	6·05	20	3·86	17	3·83	18	3·94	2·81	14
August	1·77	13	1·83	2·30	19	2·43	21	2·20	11	2·20	19	1·70	2·00	12
September	1·87	10	2·27	3·40	22	2·65	24	2·47	12	2·36	21	2·30	2·03	15
October	1·51	15	2·30	3·10	25	3·25	24	2·13	19	1·85	22	1·27	0·94	9
November	0·44	7	0·38	1·28	10	1·21	13	0·80	8	0·42	6	0·67	0·59	4
December	3·13	9	3·82	3·84	18	4·18	23	2·53	13	1·71	12	0·95	1·82	11
Total for 1867	31·59	154	24·07 For nine months.	39·27	231	49·45	268	31·34	182	28·53	216	25·53	22·38	144
Ditto 1866	36·02	...		54·76	253	56·84	287	41·71	210	41·83	228	30·09	29·81	173
Ditto 1865	......	...	......	......	...	[illegible]4·42	248	......	...	29·80	...	27·41	29·67	156
Ditto 1864	......	...	......	......	...	[illegible]3·24	259	......	...	29·02	...	26·93	27·57	206
Ditto 1863	......	...	......	......	...	[illegible]4·01	...	......	...	41·71	...	28·60	28·39	185
Ditto 1862	......	...	......	......	...	[illegible]4·20	291	......	...	34·76	...	26·00	24·68	211
Ditto 1861	......	...	......	......	...	[illegible]9·35	282	......	...	31·07	...	26·22	23·54	...
Ditto 1860	......	...	......	......	...	[illegible]9·15	297	......	...	31·04	...	35·26	31·38	...
Ditto 1859	......	...	......	......	...	[illegible]7·70	259	......	...	......	...	27·85	25·15	...
Ditto 1858	......	...	......	......	...	[illegible]7·21	229	......	...	26·00	...	29·19	18·20	...
Ditto 1857	......	...	......	......	...	[illegible]1·79	...	......	...	25·68	...	28·86	24·47	...
Ditto 1856	......	...	......	......	...	[illegible]5·48	...	......	...	45·87	...	35·06	29·25	...
Average of Years	33·80	...	......	47·01	...	[illegible]7·77	...	36·52	...	33·21	...	28·91	26·20	...
Difference in 1867 from mean	—2·21 (2 Yrs.)	...	......	—7·74 (2 Yrs.)	...	[illegible]·68 ([illegible] Yrs.)	...	—5·18 (2 Yrs.)	...	—5·68 (11 Yrs.)	...	—3·38 (12 Yrs.)	—3·82 (12 Yrs.)	...

PLACE.	Whittle Dean Reservoirs.	Hallington Village.	Fawcett.	Woodford.	Camp Hill.	Green Crag.	Valley of North Tyne.	*[illegible]well.	
Height of Guage... Above Sea Level	......	469 feet.	563 feet.	......	676 feet.	800 feet.	......	80 [illegible] 6 in.	
Height of Guage... Above Ground ...	......	6 in.	6 in.	6 in.	6 in.	6 in.	......	[illegible] in.	
MONTH.	Quantity.	Quantity.	Quantity.	Quantity.	Quantity.	Quantity.	Quantity.	Quantity.	Dys. on wh Rain fell.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
January	2·88	2·92	3·14	3·06	3·58	3·35	2·86	4·[illegible]7	28
February	2·25	2·31	2·66	3·56	2·41	2·77	2·59	1·[illegible]	15
March	0·95	0·93	1·55	1·60	1·53	0·93	0·55	3·[illegible]	26
April	2·77	3·67	3·66	5·21	5·27	4·98	5·10	2·[illegible]	24
May	1·68	1·74	1·81	2·18	2·29	2·17	2·10	2·[illegible]	20
June	1·40	1·35	1·24	1·25	1·36	1·18	1·20	1·[illegible]4	13
July	3·13	3·48	3·06	3·40	3·22	3·28	3·05	2·[illegible]3	19
August	2·10	2·32	2·29	2·57	3·27	3·03	3·20	2·[illegible]1	14
September	2·15	2·06	1·92	2·09	2·09	2·25	2·05	2·07	17
October	0·96	1·26	1·20	1·20	1·36	1·55	1·38	1·33	21
November	0·47	0·42	0·38	0·38	0·40	0·42	0·38	0·[illegible]7	9
December	2·65	2·61	2·75	3·15	3·17	2·58	2·51	3·[illegible]1	21
Total for 1867	23·39	25·07	25·66	29·65	29·95	28·49	26·97	27·[illegible]5	227
Ditto 1866	......	33·42	31·35	33·84	34·18	34·28	33·45	29·[illegible]9	230
Ditto 1865	......	......	......	......	......	......	......	29·[illegible]2	186
Ditto 1864	......	......	......	......	......	......	......	28·[illegible]1	188
Ditto 1863	......	......	......	......	......	......	......	28·[illegible]9	198
Ditto 1862	......	......	......	......	......	......	......	26·[illegible]9	199
Ditto 1861	......	......	......	......	......	......	......	23·[illegible]0	213
Ditto 1860	......	......	......	......	......	......	......	38·[illegible]0	259
Ditto 1859	......	......	......	......	......	......	......	27·[illegible]4	182
Ditto 1858	......	......	......	......	......	......	......	21·88	165
Ditto 1857	......	......	......	......	......	......	......	27·[illegible]5	...
Ditto 1856	......	......	......	......	......	......	......	29·82	...
Average of Years	......	29·24	28·50	31·74	32·06	31·28	30·21	28·[illegible]2	...
Difference in 1867 from mean	......	—4·17 (2 Yrs.)	—2·84 (2 Yrs.)	—2·69 (2 Yrs.)	—2·11 (2 Yrs.)	—2·79 (2 Yrs.)	—3·24 (2 Yrs.)	—0·67 (12 Yrs.)	...

PLACE.	*Newcastle Lit. and Phil. Society.		Wallsend.		*North Shields, Rosella Place.		North Shields, Low Lights.	
Height of Guage... Above Sea Level	105 feet.		90 feet.		124 feet.		20 feet.	
Height of Guage... Above Ground ...	1 foot 5 in.		6 in.		1 „		3 feet 1 in.	
MONTH.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.
	Inches.		Inches.		Inches.		Inches.	
January	3·73	...	4·99	14	3·61	20	3·28	18
February	0·56	6	0·85	11	0·82	9	0·70	10
March	1·20	14	2·00	11	1·69	21	1·87	21
April	1·31	16	1·38	15	1·88	15	1·89	15
May	1·67	16	2·45	13	2·32	15	2·12	18
June	1·29	13	1·27	9	1·49	11	1·48	11
July	3·42	15	3·45	14	3·20	14	2·94	13
August	2·41	14	2·14	15	2·35	12	2·27	13
September	2·40	12	2·22	12	1·85	10	1·77	12
October	1·20	14	1·21	16	1·07	13	1·13	18
November	0·64	6	0·76	6	0·98	6	0·99	8
December	2·46	8	2·52	14	2·34	17	2·05	18
Total for 1867	22·29	134	25·24	151	23·61	163	22·49	175
Ditto 1866	22·19	169	26·65	...	26·39	188	26·62	192
Ditto 1865	21·24	124	27·29	...	26·89	130	25·56	142
Ditto 1864	......	...	27·82	...	26·00	...	27·60	...
Ditto 1863	......	...	26·24	...	24·74	...	24·74	224
Ditto 1862	......	...	25·68	...	28·01	...	28·01	260
Ditto 1861	19·58	...	24·62	...	24·76	...	24·76	264
Ditto 1860	27·40	...	34·12	...	32·19	...	32·18	290
Ditto 1859	18·41	...	23·51	...	......	...	......	...
Ditto 1858	13·29	...	......	...	......	...	......	...
Ditto 1857	16·43	...	......	...	......	...	......	...
Ditto 1856	21·22	...	......	...	......	...	......	...
Average of Years	20·22	...	26·68	...	26·57	...	26·49	...
Difference in 1867 from mean	+2·07 (9 Yrs.)	...	—1·44 (9 Yrs.)	...	—2·96 (8 Yrs.)	...	—4·00 (8 Yrs.)	...

*These Guages have been tested either by Mr. Glaisher or Mr. Symons.

COQUET. WANSBECK, AND ALN DISTRICTS,

PLACE.	Wallington.		Cragside, Morpeth.	Lilburn Tower.	Glanton Pike.	Brinckburn.		Milfield, near Wooler.
Height of Guage... Above Sea Level	398 feet 6 in.		400 feet.	300 feet.	534 feet.	200 feet.		200 feet.
Height of Guage... Above Ground ...	1 foot.		......	6 „	7½ in.	5 in.		4 in.
MONTH.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Quantity.	Quantity.	Dys. on wh Rain fell.	Quantity.
	Inches.		Inches.	Inches.	Inches.	Inches.		Inches.
January	4·71	24	......	4·74	5·31	10·89	8	3·33
February	1·56	15	......	0·82	1·06	1·18	6	0·51
March	2·51	21	......	2·33	2·81	2·81	14	2·51
April	2·22	22	......	2·45	2·23	1·79	18	2·27
May	1·97	17	1·85	1·77	2·01	2·35	7	2·26
June	1·88	12	1·75	1·49	1·56	1·35	7	1·61
July	5·10	17	3·81	5·17	4·63	4·48	12	8·16
August	1·96	15	1·56	1·56	1·91	1·67	4	1·56
September	2·16	18	1·93	1·61	1·58	2·33	12	1·58
October	1·56	16	1·51	1·24	1·37	1·64	9	1·14
November	0·51	6	0·49	0·26	0·35	0·37	4	0·30
December	2·85	15	3·35	3·17	3·00	2·82	10	3·22
Total for 1867	28·99	198	16·25 For eight months.	26·61	27·82	33·68	111	28·45
Ditto 1866	......	...		30·02	35·06	33·87	147	32·18
Ditto 1865	......	...	......	30·39	34·26	32·45	133	28·65
Ditto 1864	......	...	......	31·97	28·69	29·54	146	......
Ditto 1863	......	...	......	25·86	30·09	......	...	......
Ditto 1862	......	...	......	30·04	27·12	......	...	......
Ditto 1861	......	...	......	26·17	......	......	...	......
Ditto 1860	......	...	......	......	......	......	...	......
Ditto 1859	......	...	......	25·98	......	......	...	......
Ditto 1858	......	...	......	24·27	......	......	...	......
Ditto 1857	......	...	......	27·11	......	......	...	......
Ditto 1856	......	...	......	32·90	......	......	...	......
Average of Years	......	...	......	28·30	30·50	32·38	...	29·73
Difference in 1867 from mean	......	...	......	—1·79 (11 Yrs.)	—2·68 (5 Yrs.)	+1·30 (4 Yrs.)	...	—1·31 (3 Yrs.)

RAINFALL FOR 1867.

TYNE DISTRICT.

	Whitfield.		Park End, Hexham.		Stamfordham.	* Wylam.		Whittle Dean Reservoirs.	Hallington Village.	Fawcett.	Woodford.	Camp Hill.	Green Crag.
	806 feet.		276 feet.		409 feet.	96 feet.		......	469 feet.	563 feet.	......	676 feet.	300 feet.
	1 „		3 in.		1 „	5 ..		......	6 in.	6 in.	6 in.	6 in.	6 in.
ys. wh ain ll.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Quantity.	Quantity.	Quantity.	Quantity.
	Inches.		Inches.		Inches.	Inches.		Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
29	3·93	10	5·40	26	6·30	4.08	22	2·88	2·92	3·14	3·06	3·58	3·35
19	2·79	17	2·47	19	1·07	0·67	8	2·25	2·31	2·66	3·56	2·41	2·77
29	2·14	24	1·51	18	1·32	1·85	18	0·95	0·93	1·55	1·60	1·53	0·93
27	5·27	24	3·24	21	2·80	1·84	12	2·77	3·67	3·66	5·21	5·27	4·98
20	1·79	17	2·13	17	2·11	2·22	11	1·68	1·74	1·81	2·18	2·29	2·17
17	1·43	10	1·31	17	1·10	1·53	8	1·40	1·35	1·24	1·25	1·36	1·18
20	3·86	17	3·83	18	3·94	2·81	14	3·13	3·48	3·06	3·40	3·22	3·28
21	2·20	11	2·20	19	1·70	2·00	12	2·10	2·32	2·29	2·57	3·27	3·03
24	2·47	12	2·36	21	2·30	2·03	15	2·15	2·06	1·92	2·09	2·09	2·25
24	2·13	19	1·85	22	1·27	0·94	9	0·96	1·26	1·20	1·20	1·36	1·55
13	0·80	8	0·42	6	0·67	0·59	4	0·47	0·42	0·38	0·38	0·40	0·42
25	2·53	13	1·71	12	0·95	1·82	11	2·65	2·61	2·75	3·15	3·17	2·58
268	31·34	182	28·53	216	25·53	22·38	144	23·39	25·07	25·66	29·65	29·95	28·49
287	41·71	210	41·83	228	30·09	29·81	173	......	33·42	31·35	33·84	34·18	34·28
248	......	...	29·80	...	27·41	29·67	156	......	......	......	......	......	......
259	......	...	29·02	...	26·93	27·57	206	......	......	......	......	......	......
...	......	...	41·71	...	28·60	28·39	185	......	......	......	......	......	......
291	......	...	34·76	...	26·00	24·68	211	......	......	......	......	......	......
282	......	...	31·07	...	26·22	23·54	...	......	......	......	......	......	......
297	......	...	31·04	...	35·26	31·38	...	......	......	......	......	......	......
259	......	...	......	...	27·85	25·15	...	......	......	......	......	......	......
229	......	...	26·00	...	29·19	18·20	...	......	......	......	......	......	......
...	......	...	25·68	...	28·86	24·47	...	......	......	......	......	......	......
...	......	...	45·87	...	35·06	29·25	...	......	......	......	......	......	......
...	36·52	...	33·21	...	28·91	26·20	...	......	29·24	28·50	31·74	32·06	31·28
...	—5·18 (2 Yrs.)	...	—5·68 (11 Yrs.)	...	—3·38 (12 Yrs.)	—3·82 (12 Yrs.)	...	......	—4·17 (2 Yrs.)	—2·84 (2 Yrs.)	—2·69 (2 Yrs.)	—2·11 (2 Yrs.)	—2·79 (2 Yrs.)

Valley of North Tyne.	* Bywell.		* Newcastle Lit. and Phil. Society.		Wallsend.		*North Shields, Rosella Place.		North Shields, Low Lights.	
......	86 feet 6 in.		105 feet.		90 feet.		124 feet.		20 feet.	
......	6 in.		1 foot 5 in.		6 in.		1 „		3 feet 1 in.	
Quantity.	Quantity.	Dys on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.	Quantity.	Dys. on wh Rain fell.
Inches.	Inches.		Inches.		Inches.		Inches.		Inches.	
2·86	4·07	28	3·73	...	4·99	14	3·61	20	3·28	18
2·59	1·31	15	0·56	6	0·85	11	0·82	9	0·70	10
0·55	3·26	26	1·20	14	2·00	11	1·69	21	1·87	21
5·10	2·93	24	1·31	16	1·38	15	1·88	15	1·89	15
2·10	2·16	20	1·67	16	2·45	13	2·32	15	2·12	18
1·20	1·44	13	1·29	13	1·27	9	1·49	11	1·48	11
3·05	2·58	19	3·42	15	3·45	14	3·20	14	2·94	13
3·20	2·54	14	2·41	14	2·14	15	2·35	12	2·27	13
2·05	2·07	17	2·40	12	2·22	12	1·85	10	1·77	12
1·38	1·38	21	1·20	14	1·21	16	1·07	13	1·13	18
0·38	0·87	9	0·64	6	0·76	6	0·98	6	0·99	8
2·51	3·04	21	2·46	8	2·52	14	2·34	17	2·05	18
26·97	27·55	227	22·29	134	25·24	151	23·61	163	22·49	175
33·45	29·19	230	22·19	169	26·65	...	26·39	188	26·62	192
......	29·82	186	21·24	124	27·29	...	26·89	130	25·56	142
......	28·81	188	......	...	27·82	...	26·00	...	27·60	...
......	28·49	198	......	...	26·24	...	24·74	...	24·74	224
......	26·49	199	......	..	25·68	...	28·01	...	28·01	260
......	23·80	213	19·58	...	24·62	...	24·76	...	24·76	264
......	38·00	259	27·40	...	34·12	...	32·19	...	32·18	290
......	27·34	182	18·41	...	23·51	...	......	...	......	...
......	21·88	165	13·29	...	......	...	......	...	......	...
......	27·55	...	16·43	...	......	...	......	...	......	...
......	29·82	...	21·22	...	......	...	......	...	......	...
30·21	28·22	...	20·22	...	26·68	...	26·57	...	26·49	...
—3·24 (2 Yrs.)	—0·67 (12 Yrs.)	...	+2·07 (9 Yrs.)	...	—1·44 (9 Yrs.)	...	—2·96 (8 Yrs.)	...	—4·00 (8 Yrs.)	...

*These Guages have been tested either by Mr. Glaisher or Mr. Symons.

COQUET. WANSBECK, AND ALN DISTRICTS, — COAST DISTRICTS.

Wallington.		Cragside, Morpeth.	Lilburn Tower.	lanton Pike.	Brinckburn.		Milfield, near Wooler.	North Sunderland.		Earsdon.	Whitley.	Howick.	
398 feet 6 in.		400 feet.	300 feet.	4 feet.	200 feet.		200 feet.	125 feet.		150 feet (?)	83 feet.	125 feet.	
1 foot.		......	6 „	7½ in.	5 in.		4 in.	1 foot 2 in.		......	11 in.	10 in.	
Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	uantity.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Dys. on wh Rain fell.	Quantity.	Quantity.	Quantity.	Dys. on wh Rain fell.
Inches.		Inches.	Inches.	nches.	Inches.		Inches.	Inches.		Inches.	Inches.	Inches.	
4·71	24	......	4·74	5 31	10·89	8	3·33	4·92	28	4·29	3·21	4·97	8
1·56	15	......	0·82	1 06	1·18	6	0·51	0·42	9	0·72	0·67	0·71	8
2·51	21	......	2·33	2·81	2·81	14	2·51	1·97	16	1·84	1·69	1·75	15
2·22	22	......	2·45	2 23	1·79	18	2·27	1·82	16	1·73	1·93	1·63	20
1·97	17	1·85	1·77	2·01	2·35	7	2.26	1·81	12	2·15	2·36	1·87	16
1·88	12	1·75	1·49	1·56	1·35	7	1·61	1·35	11	1·88	1·64	1·34	12
5·10	17	3·81	5·17	4·63	4·48	12	8·16	4·03	16	2·59	3·38	3·80	17
1·96	15	1·56	1·56	1·91	1·67	4	1·56	2·25	14	1·71	1·84	2·49	17
2·16	18	1·93	1·61	1·58	2·33	12	1·58	1·76	15	0·89	2·30	2·34	14
1·56	16	1·51	1·24	1·37	1·64	9	1·14	1·29	13	1·10	1·23	1·43	15
0·51	6	0·49	0·26	0·35	0·37	4	0·30	0·39	5	0·81	0·93	0·43	5
2·85	15	3·35	3·17	3·00	2·82	10	3·22	2·39	15	2·33	2·27	2·22	12
28·99	198	16·25 For eight months.	26·61	27·82	33·68	111	28·45	24·40	170	22·04	23·45	24·98	159
......	...		30·02	35·06	33·87	147	32·18	25·75	189	26·01	28·35	28·88	168
......	...	......	30·39	34·26	32·45	133	28·65	34·27	...	24 82	26·99	28 64	...
......	...	......	31·97	28·69	29·54	146	......	......	...	......	26·64	22·01	...
......	...	......	25·86	30·09	......	...	......	......	...	......	......	18·34	...
......	...	......	30·04	27·12	......	...	......	......	...	......	......	19·30	...
......	...	......	26·17	......	......	...	......	......	...	......	......	18 30	...
......	...	......	......	......	......	...	......	......	...	......	......	27·48	...
......	...	......	25·98	......	......	...	......	......	...	......	......	18·84	...
......	...	......	24·27	......	......	...	......	......	...	......	......	22·51	...
......	...	......	27·11	......	......	...	......	......	...	......	......	20·77	...
......	...	......	32·90	......	......	...	......	......	...	......	......	22·58	...
......	...	......	28·30	30·50	32·38	...	29·73	28·14	...	24·25	26·35	22·71	...
......	...	......	—1·79 (11 Yrs.)	—2·68 (5 Yrs.)	+1·30 (4 Yrs.)	...	—1·31 (3 Yrs.)	—3·74 (3 Yrs.)	...	—2·21 (3 Yrs.)	—2 90 (4 Yrs.)	—2·27 (12 Yrs.)	...

RAINFALL RETURNS.

The rainfall returns this year are again the most complete and satisfactory of all the returns sent in to the Club.

The importance of an accurate knowledge of the rainfall is becoming gradually to be very generally acknowledged, not merely in its bearing on the water supply to towns and villages, but on the food supply of the country, and that in directions not very apparent on a merely superficial view, *e. g.*—a dry or a wet season at the period when the young salmon are about to make their way down to the sea may make all the difference between a most abundant fishery and a very poor one. Amongst the evidence produced before the Salmon Fishery Commissioners there is a copy of a very interesting diary kept by the late Mr. R. Lovegrove, of Taplow Mills, near Maidenhead. From this diary we find that the take of salmon in Mr. Lovegrove's fishery in the Thames, in the years 1794, 1795, and 1796, averaged about 248lbs. yearly. 1795 was a wet year, and the weight of salmon captured in 1797 was 670lbs. 1797 was also a wet year, and the salmon caught in 1799 weighed 507lbs. The same fact is also borne witness to by the market returns of the fish sold in the London Market. Between 1850 and 1859, 1852 was the year of greatest rainfall; and in 1854, 29,655 boxes of salmon, each weighing 112lbs., were sent from the United Kingdom to London. 1858 was the driest year of the ten, and in 1860 only 20,111 boxes were sent to Billingsgate.

It may interest some readers of the Transactions to know that every inch of rainfall is equivalent to 100 tons, or 22,632 gallons of water for each acre of ground—more than 4½ gallons on every square yard. The sun and wind, it is found from some experiments carried on over a considerable period by the late Mr. Dickenson, on the chalk soils of Hertfordshire (where the average fall is about 24 inches), carry off by evaporation about 14 inches, or 1,400 tons an acre; and 10 inches, or about 1,000 tons sink into the earth, and are discharged by springs or other natural drains. When an unusual fall occurs, say 30 inches during the year, a very different state of affairs takes place. Three thousand tons of water fall, but the evaporation remains the same; and so more than half (1,600 tons out of 3,000 tons) are absorbed into the earth, to be discharged by natural or artificial drainage.

The following approximate mean depths of rain annually at various places in the United Kingdom have been published by Mr. Symons. The places where the least rainfall occurs would seem to be Lincoln, Stamford, and Southwell, where it only amounts to 20 inches; 24 inches at London, Norwich, Thirsk, and Edinburgh; 27 inches at Canterbury, Shields, and Dunrobin; 36 inches at Manchester; 40 inches at Barnstaple, Plymouth, Shetland, and Waterford; 49 inches at Carlisle; 50 inches at Bolton, Settle, and Galway; 59 inches at Keswick; 64 inches at Greenock and Inverary; 78 inches at Ambleside; 85 inches at Coniston; 140 inches at Seathwaite, in Borrowdale; 165 inches at the Stye, in Cumberland, which seems to be the wettest place in the United Kingdom.

Mr. E. I. Lowe has recorded the most rainy months and days at Beeston, near Nottingham, from 1843 to 1857.

MOST RAINY MONTHS.

Year.	Month.	Inches.
1852	November	7·0
1852	September	5·3
1849	September	5·0
1847	May	5·0
1853	June	5·0

HEAVIEST RAINFALL ON ANY ONE DAY AT BEESTON.—1843-1857.

Year.	Day of Month.	Inches.
1843	August 9	1·095
1846	October 19	1·300
1847	May 8	1·645
1848	June 18	1·055
1848	July 21	1·150
1849	September 28	1·335
1850	July 25	1.084
1851	July 24	1·160
1852	July 26	2·063
1852	September 6	2·044

Year.	Day of Month.	Inches.
1853	August 17	1·502
1855	July 14	1·060
1857	June 30	1·590
1857	August 15	3·010

Mr. Symons remarks that the monthly rainfall for the year 1867, throughout the kingdom, may be grouped thus:—

January, March, April, July, October	Rather above the mean.
February, May, September, December	Near the average.
June, August, November	Below the average.

The total rainfall for 1867 is very remarkable for its singularly close approach to the mean of a series of years, and this not only by grouping large districts, but at individual stations. This is abundantly evident from a close comparision of the fall at no less than seventy carefully selected stations in England, Scotland, and Ireland.

	Average of 1850–9.	Average of 1860–5.	Depth in 1867.	Difference from Depth.
England (omitting Seathwaite, in Cumberland)	29·44	30·98	30·86	—·12
Scotland	30·19	33·73	32·84	—·89
Ireland	32·73	38·88	37·52	—1·36
Mean of the whole	30·79	34·53	33·74	—·79

The amount of water in the air, from an average of seven years observation at the Greenwich Observatory during each month of the year, has been given by Mr. Bellville in his "Manual of the Thermometer:"—

Column I.—Gives mean height in grains of vapour in a cubic foot of air at ... 9 A.M.

Column II.—Gives mean height in grains of vapour in a cubic foot of air at ... 3 P.M.

,, III.—The mean addition of vapour required for complete saturation of a cubic foot of air, at ... 9 A.M.

,, IV.—Ditto ditto ditto ditto ditto ...3 P.M.

	9 A.M.	3 P.M.	Deficiency.	
			9 A.M.	3 P.M.
January	2·70	2·84	0·17	0·30
February	2·58	2·72	0·25	0·62
March	2·77	2·85	0·40	1·05
April	3·26	3·37	0·68	1·41
May	4·02	4·06	1·10	2·04
June	4·71	4·78	1·45	2·42
July	5·07	5·26	1·50	2·27
August	5·00	5·07	1·18	2·27
September	4·66	4·77	0·73	1·93
October	3·96	4·01	0·35	1·08
November	3·27	3·42	0·22	0·55
December	2·78	2·89	0·17	0·37

The amount of water which the air contains increases with its temperature. The mean relative humidity of the air is greater at 9 A.M. than at 3 P.M. The mean quantity of vapour in this time actually increases; but as the increase is not in proportion to the increase of temperature in the same interval, the air is drier.

AVERAGE RAINFALL OF THE VARIOUS STATIONS IN THE ACCOMPANYING TABLE.

	1866.	1867.
In the Coast District	27·34	23·71
,, Tees District	31·01	27·69
,, Wear District	31·77	27·19
,, Coquetdale and Wansbeck District	32·78	29·11
,, Tyne District	33·50	29·10

DEPTH OF WATER IN THE TYNE.

The observations made by Mr. G. Clayton Atkinson for some years past of the depths of the Tyne at Wylam Bridge has been again kindly communicated to the Club.

	1866.	1867.
	Feet.	Feet.
January	4·80	4·9
February	3·60	3·6
March	3·36	3·2
April	3·14	3·5
May	1·67	2·8
June	1·38	1·8
July	1·65	1·9
August	3·00	1·6
September	3·94	2·1
October	4·14	2·1
November	3·87	1·7
December	3·62	4·1
Average	3·18	2·8

BAROMETER.

The returns of the average readings of the barometer furnished by some of our careful observers are more numerous this year than last. The printed forms which have been issued by the Club will, it is hoped, enable those who help us, at no small cost of time and trouble, with these returns, to do so more easily to themselves and in a form more readily and uniformly available for publication.

BAROMETER, 1867.—MEAN READINGS.

MONTHS.	ALSTON.		ALLENHEADS.		BYWELL.		WYLAM.	NORTH SHIELDS.		SEDGEFIELD.	
	Mean Readings.	Range.	Mean Readings.	Range.	Mean Readings.	Range.	Pressure at 9 A.M.*	Mean Readings.	Range.	Mean Readings.	Range.
January	29·617	1·635	28·136	1·422	29·501	1·516	29·504	29·557	1·269	29·608	1·510
February	29·962	2·055	28·415	1·844	29·774	1·956	29·907	29·833	1·934	29·896	2·045
March	29·867	2·020	28·332	1·828	29·711	1·940	29·713	29·787	1·898	29·814	1·829
April	29·656	1·485	28·170	1·236	29·508	1·274	......	29·561	1·270	29·963	1·356
May	29·964	0·760	28·441	0·706	29·808	0·776	......	29·865	0·732	29·916	0·755
June	30·125	1·200	28·598	1·126	29·948	1·150	30·004	29·989	1·149	30·056	1·138
July	29·882	1·070	28·386	1·031	29·728	1·092	29·768	29·797	1·059	29·838	1·053
August	29·946	0·600	28·454	0·597	......	......	29·707	29·848	0·678	29·961	0·643
September	30·041	1·020	28·517	0·910	29·865	0·974	29·851	29·907	0·989	29·981	0·969
October	29·849	1·310	28·348	1·163	29·702	1·268	29·717	29·747	1·178	29·799	1·172
November	30·309	1·545	29·770	1·018	30·145	1·070	30·181	30·199	1·187	30·235	1·321
December	30·004	1·375	29·458	1·402	29·833	1·474	29·866	29·868	1·528	29·932	1·340

* This is properly corrected, except for height above sea—100 feet.

TABLE OF TEMPERATURE.—1867.

Height above Sea	ALLENHEADS. 1360 feet. Max.	Min.	Mean.	Dew Point.	Elastic Force of Vapour.	Humidity Saturation =100.	BYWELL. 86½ feet. Max.	Min.	Mean.	Dew Point.	Elastic Force of Vapour.	Humidity Saturation =100.
January	34·2	23·3	28·7	18·0°	·098	63	39·1	25·5	32·4	29·9°	·166	90
February	44·5	34·1	38·5	36·1°	·213	92	49·5	37·3	43·2	39·1°	·238	85
March	38·2	26·2	30·6	22·6°	·121	71	45·2	28·8	33·8	29·5°	·163	84
April	49·3	37·5	41·0	38·5°	·233	91	55·2	40·9	46·2	40·5°	·252	82
May	54·2	40·3	45·1	40·8°	·255	85	58·4	43·4	42·7	42·7°	·277	81
June	60·4	46·1	50·5	46·0°	·311	85	65·7	50·1	55·1	48·1°	·336	78
July	60·8	47·5	51·9	47·2°	·325	85	66·3	51·4	56·5	49·8°	·355	78
August	63·6	50·1	55·0	49·0°	·348	78	......	......	......	......	......	......
September	58·3	46·4	50·2	46·5°	·317	88	64·8	49·2	55·4	48·8°	·345	79
October	50·2	38·4	43·3	40·7°	·254	90	57·2	40·0	47·5	42·3°	·270	83
November	43·3	32·9	37·5	34·7°	·201	90	50·6	35·0	42·0	35·7°	·209	79
December	40·9	17·2	35·6	33·1°	·188	91	45·5	33·0	39·3	34·5°	·199	83
Average for 1867	49 65	36·66	43·15	37·5°	·238	84	......	......	......	......	......	......
Ditto 1866	50·70	37·70	44·20	......	......	......	......	......	......	......	......	......

Months.	WYLAM. 96 feet. Max.	Min.	Mean.	NORTH SHIELDS. 124 feet. Max.	Min.	Mean.	Dew Point.	Elastic Force of Vapour.	Humidity Saturation =100.
January	38·3	26·1	32·2	36·9	29·4	33·0	30·0°	·167	89
February	48·8	37·2	43·0	47·1	37·8	42·1	38·1°	·230	80
March	42·6	29·7	36·2	41·4	31·8	35·1	33·3°	·190	93
April	54·9	41·1	48·0	52·6	41·1	44·6	41·0°	·257	87
May	56·8	42·1	49·4	53·7	42·8	46·0	42·8°	·275	89
June	64·1	48·7	56·4	60·4	48·7	51·9	48·0°	·335	86
July	65·6	49·3	57·5	61·3	51·1	54·0	48·1°	·336	80
August	68·9	49·4	59·1	65·1	51·8	56·8	50·8°	·371	80
September	62·4	47·9	55·1	59·8	49·8	53·3	48·3°	·339	82
October	55·3	39·1	47·2	53·1	42·2	46·8	42·4°	·271	85
November	48·1	36·0	42·0	46·6	38·1	42·1	37·0°	·220	83
December	45·7	32·9	39·3	43·2	34·5	38·9	35·2°	·205	87
Average for 1867	54·32	39·99	47·15	51·77	41·59	46·68	41·2°	·266	85
Ditto 1866	55·20	40·40	47·80	51·88	41·80	46·80	......	......	......

Months.	WALLINGTON. 396½ feet. Max.	Min.	Mean.	WHITFIELD. 860 feet. Max.	Min.	Mean.	ALSTON. 1150 feet. Max.	Min.	Mean.
January	37·8	24·7	31·2	47·0	6·5	26·5	37·0	19·8	28·4
February	45·6	35·0	40·3	54·0	17·0	35·5	47·2	32·0	39·6
March	43·0	27·7	35·3	54·0	10·0	32·0	47·1	24·4	35·8
April	50·4	38·6	44·5	56·0	30·0	43·0	54·1	35·1	44·6
May	55·0	39·4	47·2	73·0	28·0	50·5	63·5	35·6	49·6
June	62·3	45·3	53·8	70·0	37·0	53·5	70·6	42·5	56·5
July	64·1	46·2	55·1	74·0	36·0	55·0	71·2	44·7	57·9
August	65·8	46·7	56·2	74·0	40·0	57·0	73·9	46·5	60·2
September	58·7	42·4	50·5	65·0	37·0	51·0	64·9	41·9	53·4
October	51·8	36·4	44·1	57·0	27·0	42·0	54·7	35·2	44·9
November	44·0	34·1	39·0	48·0	24·0	36·0	45·4	30·5	37·8
December	39·3	33·9	36·6	48·0	19·0	33·5	42·4	28·3	33·2
Average for 1867	51·41	37·53	44·47	60·00	25·91	45 45	56·00	34·74	45·37
Ditto 1866	......	......	......	......	......	......	55·93	34·42	45·17

Months.	SEDGEFIELD. 160 feet. Max.	Min.	Mean.	Dry Bulb.	Wet Bulb.	Dew Point.	Elastic Force of Vapour.	Humidity Saturation =100.
January	35·4	28·1	31·8	32·5°	32·0°	31·0°	·174	94
February	45·4	35·9	40·7	41·6°	39·7°	37·3°	·223	84
March	39·2	31·0	35·7	34·6°	34·1°	33·3°	·190	95
April	51·3	40·8	46·1	45·9°	43·5°	40·5°	·255	82
May	54·2	43·1	48·7	48·5°	45·5°	42·3°	·270	79
June	61·1	48·2	54·7	54·5°	51·1°	47·9°	·334	78
July	62·7	49·4	56·0	55·9°	52·6°	49·5°	·335	79
August	66·7	51·3	59·0	59·0°	55·6°	52·6°	·397	79
September	59·2	48·2	53·9	54·2°	51·5°	48·9°	·347	82
October	51·1	41·3	46·2	46·5°	45·0°	43·4°	·282	88
November	45·5	35·9	40·7	40·6°	39·1°	37·2°	·222	87
December	40·6	33 0	36·8	36·9°	36·3°	35·5°	·208	94
Average for 1867	51·03	40·51	45·77	45·8°	43·8°	41·6°	·269	85
Ditto 1866	......	......	......	......	......	......	......	......

Months.	SEAHAM. 100 feet. Max.	Min.	Mean.	CRAGSIDE, MORPETH. 400 feet. Max.	Min.	Mean.	Dry Bulb.	Wet Bulb.
January	39·2	27·7	33·4	......	......	......	......	......
February	49·2	35·1	42·1	......	......	......	......	......
March	43·4	28·2	35·8	......	......	......	......	......
April	54·2	39·3	46·7	......	......	......	......	......
May	57·1	36·1	46·6	56·4	40·1	52·2	44·5°	42·5°
June	63·8	42·1	52·9	64·1	45·2	54·6	56·5°	54·5°
July	63·1	43·1	53·1	65·3	44·0	54·6	56·8°	55·3°
August	68·1	45·8	56·9	68·1	49·6	58·8	58·1°	56·7°
September	62·2	42·2	52·2	61·1	45·7	53·4	54·0°	52·2°
October	56·2	40·7	47·9	54·4	37·0	45·7	45·6°	42·7°
November	49·1	35·1	42·1	48·7	33·1	40·9	41·5°	41·6°
December	44·2	33·1	38·6	43·6	32·7	38·1	37·6°	36·0°
Average for 1867	54·15	37·38	45·76	......	......	......	......	......
Ditto 1866	53·30	39·40	46·30	......	......	......	......	......

TEMPERATURE.

There is again an increase in the number of observations furnished to the Club this year, and a few hygrometrical returns are also appended. But it is hoped that the next Report will be more full and ample in this department.

Wylam.—On glancing at the subjoined table, showing the difference of the monthly temperature for the year from that of the average of the monthly temperature for twelve years, one cannot but be struck with the violent fluctuations of the mean monthly temperature of the four first months of this year from the normal temperature. January was 4·7° below, February 4·4° above, March 2·4° below, and April 2·2° above the average.

As change of temperature is at the root of all meteorological movements there must be some great significance in this, if only we could discover what it is.

	Mean Max. Temperature, 1867.	Mean for 12 Years, Including 1867	Deviation of 1867 from Mean.
January	32·20	36·92	—4·7°
February	43·02	38·60	+4·4°
March	36·21	40·39	—4·2°
April	48·00	45·82	+2·2°
May	49·48	51·11	—1·6°
June	56·45	56·97	—0 5°
July	57·51	58·60	—1·2°
August	59·19	58·70	+0·4°
September	55·15	54·54	+0·6°
October	47·23	48·29	—1·0°
November	42·07	41·22	+0 8°
December	39·33	40·05	—0·7°
Average for Year	47·15	47·16°	—0·46°

WIND.

It will perhaps be interesting to some persons to compare the returns of the prevailing directions of the wind in the accompanying table with the results obtained by ten years careful observation in the neighbourhood of London. From these observations it appears that in that locality the wind blew on an average from the north on sixteen days, the south on eighteen days, the east on twenty-six days, the west on fifty-three days, the south-west on one hundred and twelve days, the north-west on fifty days, the south-east on thirty-two days, and north-east on fifty-eight days.

The following table shows the direction of the wind as recorded at each of the places whence returns have been furnished to the Club.

	N.	N.E.	N.W.	S.	S.E.	S.W.	W.	E.	Calm
	Days	Days	Days	Days	Days	Days	Days	Days	Days
Wallington	19	56	67	15	31	52	96	29	...
Rothbury (Cragside for 7 months—June to Dec.)	18	5	52	5	19	10	87	17	...
Alston	29	9	28	31	24	30	148	55	11
Whitley	45	17	33	91	8	45	82	44	...
Wylam	12	39	14	1	28	20	210	58	..
Seaham	60	41	28	52	8	27	112	37	...

RESULTANTS.

	Equivalent direction for whole period.	Equivalent duration of whole period.
Wallington	W., 20° N.	35 days.
Cragside, Rothbury, seven months, June—December	W., 18½° N.	102 days.
Alston	W., 7° S.	112 days.
Whitley	W., 32¼° S.	89¼ days.
Seaham	W., 22° N.	85½ days.

RESULTANTS.—WYLAM.

	Amount.	Direction.
January	7	N., 11° W.
February	22	W., 1° S.
March	9	N., 38° E.
April	10	W., 11° S.
May	17	E., 14° S.
June	18	W., 33° N.
July	1	W., 33° N.
August	21	W., 11° S.
September	14	W., 4° S.
October	23	W., 4° S.
November	23	W., 2° N.
December	16	W., 4° S.
	$181 = \frac{181}{105}$ W.	

PREVAILING WINDS.

	NO. SHIELDS.	HOWICK.
January	S.E. & N.W.	N. & N.E.
February	S.W. & N.W.	S.W.
March	N.E. & S.E.	N.E.
April	N.W. & S.W.	S.W.
May	N.E. & S.E.	S.E. & N.
June	N.W. & S.W.	S.W.
July	S.W. & N.E.	N.W. & N.E.
August	S.W. & N.W.	S.W.
September	S.W. & N.W.	S.W.
October	S.W. & N.W.	S.W. & N.W.
November	N.W.	N.W.
December	N.W.	N.W.

CLIMATOLOGICAL TABLES RELATIVE TO THE FLOWERING OF PLANTS.

The hope expressed in last year's report, that additional assistance might be obtained in supplying the information required to make these returns more generally useful, has been realised. As time goes on, it may be well expected that the interest in this subject will increase, and yet more numerous and accurate returns will be furnished.

NOTES ON THE FLOWERING OF PLANTS, &c.

Wylam.—On March 24th, apricots in blossom on a cold wall. The white thorn was in bloom on May 24th. Berberis on May 29th, and peas on May 25th. On June 1st Gloire-de-Dijon rose in flower. June 25th grapes cut for first time. On July 5th, hay cut, good crop.

Acklam, near Middlesbro'.—The severe weather at the beginning of the year did great damage. The Sweet Bays, the Laurestinus, and the Cotoneaster were killed to the roots, as were also most of the tender roses—hardier kinds to the snow-line.

A Wellingtonia gigantea, about ten years old, escaped uninjured, while two specimens of Cedrus deodara, and a Cedar of Lebanon of the same age were much injured. The harvest was general in this neighbourhood on August 28th.

Seaham Hall.—The trees put on their autumn tints very suddenly this year. On October 1st the foliage was quite green, but by the 17th most trees were stripped of their leaves; and by the 31st October nearly every tree was bare. A few miles inland the case was different. The two kinds of potatoes which were least diseased here were the Milky White, an early potato, and Paterson's Victoria amongst the late kinds. The Fluke was next best.

The first signs of the swelling of the buds of forest trees, more especially the elm, beech, and poplar, were to be seen at the beginning of November, 1867, and the buds have continued to increase up to the present time (January 17th, 1868). This seems clearly to show that the sap of trees is in action even during the winter months. Another instance pointing in the same direction was observed during some alterations in the garden in December, 1867. A small piece of bark was taken off a broad-leafed maple; on the second day after the sap had spread round the wounded part, as if water had been poured on, and this continued for several days.

The following list of dates of the flowering of plants within a short distance of Tynemouth has been again kindly furnished by John Coppin, Esq.

WILD PLANTS GROWING WITHIN THREE MILES OF TYNEMOUTH.

Tussilago farfara	Feb. 11	Ribes grossularia	April 6
Ranunculus ficaria	Feb. 18	Primula vulgaris........	April 8
Lamium purpureum ...	Feb. 19	Viola canina	April 11
Lamium album	Feb. 20	Primula veris	April 17
Taraxacum officinale ...	Feb. 26	Prunus spinosus	April 25
Veronica hederifolia ...	Mar. 21	Ranunculus arvensis ...	May 3
Glechoma hederacea ...	April 1		

FOREST TREES, S…R

	SEAHAM.				STANHOPE CASTLE GARDENS.			LILBURN TOWER.				WALLINGTON.			
	In Bud.	In Leaf.	In Blossom	Divested of Leaves.	In Bud.	In Leaf.	In Blossom	In Bud.	In Leaf.	In Blossom	Divested of Leaves.	In Bud.	In Leaf.	In Blossom	Divested of Leaves.
Alder	April 6	May 4	......	Oct. 31	......	April 21	......	April 16	May 8	......	Nov. 5	April 2	April 24	......	Oct. 30
Ash	May 29	June 5	May 6	Oct. 31	......	......	......	April 28	May 16	......	Oct. 27	May 4	June 1	......	Oct. 26
Beech	May 4	May 9	......	Oct. 30	April 18	......	......	April 15	April 29	......	Oct. 23	April 12	May 3	......	Oct. 24
Birch	May 4	May 12	......	Oct. 31	......	......	......	April 4	April 30	......	Nov. 1	April 16	May 4	......	Nov. 6
Black Thorn	......	May 6	April 20	Oct. 31	......	......	......	......	......	May 1	......	......	......	April 29	......
Bramble	......	May 4	July 22	......	......	......	......	......	......	July 10	......	......	......	Aug. 2	......
Broom	......	......	......	Oct. 31	......	......	......	......	......	May 8	......	......	......	May 20	......
Elder	April 1	April 29	July 3	Oct. 31	......	......	July 1	......	......	June 28	......	......	......	June 29	......
Elm	April 1	May 6	......	Oct. 17	May 1	......	......	April 17	May 4	......	Oct. 10	April 8	May 6	......	Nov. 22
Flowering Currant	......	......	April 10	Oct. 12	......	......	April 21	......	......	Mar. 27	......	......	......	April 17	......
Hawthorn	......	May 6	......	Oct. 31	......	......	May 29	......	......	June 12	......	......	......	May 30	......
Hazel	......	May 4	March 1	Oct. 17	......	......	......	......	......	Mar. 15	......	......	......	Mar. 4	......
Honeysuckle	......	May 4	......	......	......	......	July 12	......	......	July 1	......	......	......	May 30	......
Laburnum	......	May 6	May 23	Oct. 17	......	......	......	......	......	June 20	......	......	......	June 1	......
Larch	......	April 11	......	Oct. 17	April 8	......	......	Mar. 18	April 20	......	Oct. 18	Feb. 25	April 13	......	Nov. 15
Lilac	......	May 1	May 10	Oct. 17	......	......	June 1	......	......	May 10	......	......	......	May 30	......
Lime	......	May 4	......	Oct. 17	......	......	......	......	......	......	......	......	......	......	......
Mountain Ash	......	May 2	May 23	Oct. 31	......	......	......	......	......	June 29	......	......	......	May 29	......
Oak	May 7	May 10	......	Nov. 1	......	......	......	May 1	May 13	......	Nov. 14	May 1	May 28	......	Dec. 10
Poplar	......	April 4	March 8	Oct. 31	April 10	April 20	......	Mar. 15	April 7	......	Oct. 22	Feb. 20	April 13	......	Oct. 18
Privet	......	......	......	......	......	......	......	......	......	June 18	......	......	......	July 2	......
Rose (Wild)	......	......	June 18	......	......	......	......	......	......	June 2	......	......	......	June 28	......
Sallow	......	......	......	Oct. 17	......	......	......	......	......	April 25	......	......	......	April 4	......
Sycamore	March.	April 6	May 9	Oct. 17	April 18	May 6	......	April 13	May 3	......	Oct. 26	April 6	April 25	......	Oct. 28
Whin	......	......	April 4	......	......	......	......	......	......	April 26	......	......	......	April 18	......

STANDARD FRUIT TREES, &c.

	ACKLAM HALL, MIDDLESBRO'.		SEAHAM HALL.		STANHOPE CASTLE.		WYLAM.		LILBURN TOWER.		CRAGSIDE, ROTHB…	
	In Blossom	Yield.	In Blossom	Yield.	In Blossom	Yield.	In Blossom	Yield.	In Blossom	Yield.	In Blossom.	Yield.
Apple	May 6	Much bloom; not much fruit.........	May 6	Scarce	May 20	....	May 6	....	May 6	Failure	......	....
Cherry	April 26	Good crop	April 25	....	May 16	....	......	....	April 26	Good	My. 3 (Wild)	....
Pear	April 26	Abundant bloom, fair crop of fruit	April 25	Good	......	....	......	....	April 28	Abundance of fruit but small and badly ripened...	May 2	....
Plum	April 20	Good crop	April 16	Scarce	May 18	....	......	....	April 24	Poor yield	May 6	....
Currant	April 21	Good crop	April 16	Good	May 19	Much blight on the currant & gooseberry bushes......	......	....	My. 3 Black	....	Apl. 27 Blck.	The Blosso… stroyed by …
Gooseberry	April 10	Good crop on the whole	April 10	Good	......	....	......	....	April 3	....	April 16	Plentiful ...
Raspberry	......	....	......	Good	......	....	......	....	......	....	......	....
Strawberry	May 7	Abundant crop	May 8	Good	......	....	......	Gathered June 30	May 9	....	May 7	....

GRAIN, &c., CROPS.

	ACKLAM, NEAR MIDDLESBRO'.			SEAHAM HALL.	LILBURN TOWER.			WALLINGTON.			…	…
	When sown.	When cut.	Remarks.	Remarks.	When sown.	When cut.	Remarks.	When sown.	When cut.	Remarks.	Wh… sown	W…
Barley	April 19	Sept. 7	Very good crops	Good crop, but yield less than at first expected	April 18	Aug. 31	Much straw; yield light ...	......	......	....	April	Aug
Beans	April 3	Sept. 27	Very good crops	Yield various, chiefly owing to the ravages of the fly	Feb. 5	Oct. 8	Good crop	......	......	....	......	
Oats	April 12	Sept. 7	Very good crops	Good crop; yield not so good as expected	Mar. 28	Sept. 5	Heavy crop; quality good	April 10	Sept. 25	Good crop, and plenty of straw...	Mar.	Sept
Peas	April 5	Aug. 20	....	Generally good	Feb. 8	Oct. 6	Very good	......	......	....	......	
Wheat	April 10	Sept. 23	Spring sown wheats yielded well	Good crop	Feb. 6	Sept. 24	Large crop; grain light ...	......	......	....	Nov. 1	Aug.
Hay	......	July 1	Good crops	Good crop	......	July 12	Heavy crop; much damaged by wet	......	July 15	Heavy crop, and well got in	......	June
Potatoes	May 10	......	Yield large, but much diseased..............	Much diseased; out of 20 varieties grown here most were bad	May 11	Oct. 18	Middling crop, small in size	May 14	Oct. 18	Good crop; about one-fourth disease	April	Oct.
Turnips	June 1	......	Generally good crop ...	Good crop	May 23	Nov. 17	Splendid crop	Jun. 8-2…	......	Good crop	May	Nov.

[...]UBS, &c.

[...]AM HALL, NEAR MIDDLESBRO'. In Leaf.	In Blossom.	Divested of Leaves.	WHORLTON. In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	CRAGSIDE, ROTHBURY. In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	ST. JOHN'S, WOLSINGHAM. In Bud.	In Leaf.	In Blossom.	WYLAM. In Leaf.	[...]
April 30	......	Nov. 8	......	......	......	......	April 24	April 30	......	Nov. ...	April 21	May 17	......	......	
May 31	......	Oct. 21	May 4	......	......	Oct. 26	May 9	June 3	......	October	May 18	......	......	May 26	
May 17	......	Oct. 30	Mar. 2	May 7	......	......	April 26	May 10	......	......	......	May 6	......	......	
May 6	......	Nov. 20	April 30	May 3	......	......	April 4	April 28	......	Nov. ...	April 21	May 5	......	......	
......	April 18	......	......	......	April 25	......	......	......	May 6	......	......	......	......	......	
......	June 20	......	......	......	......	......	......	......	July 8	......	......	......	......	......	Apri[...]
......	May 5	......	......	......	May 10	......	......	......	May 11	......	......	......	......	......	
......	June 10	......	......	......	April 14	......	......	......	......	......	......	......	......	......	
April 30	......	Oct. 31	......	......	......	......	April 26	May 8	......	Sept. 30	......	......	......	......	
......	Mar. 20	......	......	......	April 14	......	......	......	April 10	......	......	......	......	......	Apl[...]
......	May 14	......	......	......	May 28	......	......	......	May 7	......	......	......	......	......	
......	Feb. 1	......	......	......	......	......	......	......	......	......	......	......	June 21	......	
......	June 24	......	......	......	July 6	......	......	......	......	......	......	......	......	......	
......	May 9	......	......	......	June 1	......	......	......	......	......	......	......	......	......	
April 24	......	Nov. 20	April 27	May 2	......	......	April 1	April 30	......	Oct. 20	April 18	May 2	......	......	
......	May 7	......	......	......	May 26	......	......	......	......	......	......	......	......	......	
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	
......	May 13	......	......	......	June 1	......	......	......	June 10	......	......	......	......	......	
May 9	......	Nov. 23	May 3	June 2	......	......	May 3	May 17	......	Nov. 14	......	......	......	......	
May 2	......	Oct. 18	April 10	......	......	......	April 25	May 4	......	......	......	......	......	......	
......	June 24	......	......	......	......	......	......	......	......	......	......	......	......	......	
......	June 10	......	......	......	June 20	......	......	......	June ...	......	......	......	......	......	
......	April 4	......	......	......	......	......	......	......	......	......	......	......	April 18	......	
May 1	......	Oct. 29	April 17	April 30	......	......	Mar. 28	April 24	......	Oct. 10	......	May 18	......	......	
......	Mar. 23	......	......	......	May 2	......	......	......	April 27	......	......	......	......	......	

WALLINGTON.

In Blossom.	Yield.
May 8	Blossom destroyed by frost on May 25
May 3	Fruit plentiful.
May 6	A fair crop.
April 28	Below an average; ripened well.
Apl. 22 Blck.	Heavy crop.
April 15	Heavy crop.
......	....
May 9	Heavy crop.

WHITLEY.

[...]	Remarks.
[...] 18	30 bolls per acre; well got
...	....
[...] 26	35 bolls an acre, in good condition.
...	....
[...] 30	22 bolls an acre, in good condition.
[...] 29	3 tons an acre, well got.
[...] 10	7 tons an acre, good quality.
[...] 10	Good crop.

WILD FLOWERS.

	WHORLTON. In Blossom.	ACKLAM HALL, MIDDLESBRO'. In Blossom.	ST. JOHN'S, WOLSINGHAM. In Blossom.	SEAHAM HALL. In Blossom.	STANHOPE CASTLE. In Blossom.	STAMFORDHAM. In Blossom.	NORTH SHIELDS. R. Spence Esq. In Blossom.	NORTH SHIELDS. J. Coppin Esq. In Blossom.	WYLAM. In Blossom.	LILBURN. In Blossom.	CRAGSIDE, ROTHBURY. In Blossom.	[...]
Anemone	Apr. 1[illegible]	May 1	Feb. 17 (Garden)	May 10	......	......	May 11	......	......	Mar. 9	May 1	Ap[...]
Blue Bell	May [illegible]	July 20?	......	......	......	......	......	......	......	May 10	......	Jul[...]
Coltsfoot	......	Feb. 22	Feb. 20	Feb. 20	......	Feb. 19	......	Feb. 11	......	......	......	Ma[...]
Cowslip	......	......	......	Apr. 29	......	......	......	......	......	......	......	
Crowfoot	......	......	......	Apr. 20	......	......	......	......	......	......	......	
Dandelion	Apr. 19	Mar. 16	......	Feb. 20	......	Feb. 18	......	Feb. 26	......	Apr. 18	May 2	Apr. 15
Forget-me-not ...	......	......	......	......	......	......	......	......	......	......	......	......
Garlic...............	......	June 14	......	May 6	......	......	......	......	......	......	......	Sept. 12
Lily of the Valley	May 20	May 13	......	May 20	......	......	May 23	......	......	May 6	......	May 18
Marsh Marigold..	......	......	......	Apr. 10	......	......	......	......	......	......	......	......
Pilewort............	......	......	......	Feb. 20	......	......	......	Feb. 18	......	......	......	......
Primrose	Apr. 2	Mar. 16	Apr. 19	Mar. 11	Apr. 16	......	......	Apr. 8	Feb. 10	May 10	Mar. 20	Feb. 1[...]
Stitchwort	......	......	......	May 20	......	......	......	......	......	......	......	......
Strawberry, Garden	May 20	May 7	......	May 18	May 18	......	......	......	......	May 9	May 7	May
Ditto Wood	......	May 20	......	......	Apr. 18 on shelt'red banks.	......	......	......	......	June 5	Apr. 19	Apr.
Snowdrop	Feb. 10	Feb. 1	Feb. 17	Feb. 3	Feb. 1	Feb. 12	Feb. ...	......	Feb. 1	Jan. 25	......	Feb.
Violet, Dog	......	......	......	Mar. 7	......	......	......	Apr. 11	......	......	Feb. 24	......

GROWING IN GARDENS, NEAR NORTH SHIELDS.

Snowdrop	Feb. 10	Gooseberry	April 7
Crocus (yellow)	Feb. 16	Red Currant	April 9
Red Flowering Currant (against wall)	Feb. 21	Pear (Jargonelle)	April 22
Ditto ditto Standard	April 4	Black Currant	April 23
Crocus (purple)	Feb. 21	Strawberry	April 27
Daffodil	Mar. 31	Blue Hyacinth	May 4
Auricula (yellow)	April 5	Apple	May 6

Some very interesting and instructive particulars as to the blossoming and ripening of fruit trees in the gardens at Pierremont, Darlington, have been kindly forwarded by Henry Pease, Esq., extending over twelve years, and relating to the same trees. These returns are very suggestive.

MAGNUM BONUM PLUM.—EAST ASPECT.

	In Bloom.	Ripe.
1854	April 20	October 3.
1855	May 1	October 6.
1856	April 21	October 8.
1857	April 20	September 11.
1858	April 20	September 6.
1859	March 21	September 1.
1860	May 5	September 24.
1862	April 23	September 18.
1863	April 3	August 27.
1864	No bloom	....
1865	No bloom	....
1866	April 6	September 10.
1867	April 16	....

FOREST TREES, SHRUBS, &c.

	Seaham.				Stanhope Castle Gardens.			Lilburn Tower.			
	In Bud.	In Leaf.	In Blossom	Divested of Leaves.	In Bud.	In Leaf.	In Blossom	In Bud.	In Leaf.	In Blossom	Divested of Leaves.
Alder	April 6	May 4	......	Oct. 31	......	April 21	......	April 16	May 8	......	Nov. 5
Ash	May 29	June 5	May 6	Oct. 31	......	......	......	April 28	May 16	......	Oct. 27
Beech	May 4	May 9	......	Oct. 30	April 18	......	......	April 15	April 29	......	Oct. 23
Birch	May 4	May 12	......	Oct. 31	......	......	......	April 4	April 30	......	Nov. 1
Black Thorn	......	May 6	April 20	Oct. 31	......	......	......	......	......	May 1	......
Bramble	......	May 4	July 22	......	......	......	......	......	......	July 10	......
Broom	......	......	......	Oct. 31	......	......	......	......	......	May 8	......
Elder	April 1	April 29	July 3	Oct. 31	......	......	July 1	......	......	June 28	......
Elm	April 1	May 6	......	Oct. 17	May 1	......	......	April 17	May 4	......	Oct. 10
Flowering Currant	......	......	April 10	Oct. 12	......	......	April 21	......	......	Mar. 27	......
Hawthorn	......	May 6	......	Oct. 31	......	......	May 29	......	......	June 12	......
Hazel	......	May 4	March 1	Oct. 17	......	......	......	......	......	Mar. 15	......
Honeysuckle	......	May 4	......	......	......	......	July 12	......	......	July 1	......
Laburnum	......	May 6	May 23	Oct. 17	......	......	......	......	......	June 20	......
Larch	......	April 11	......	Oct. 17	April 8	......	......	Mar. 18	April 20	......	Oct. 18
Lilac	......	May 1	May 10	Oct. 17	......	......	June 1	......	......	May 10	......
Lime	......	May 4	......	Oct. 17	......	......	......	......	......	......	......
Mountain Ash	......	May 2	May 23	Oct. 31	......	......	......	......	......	June 29	......
Oak	May 7	May 10	......	Nov. 1	......	......	......	May 1	May 13	......	Nov. 14
Poplar	......	April 4	March 3	Oct. 31	April 10	April 20	......	Mar. 15	April 7	......	Oct. 22
Privet	......	......	......	......	......	......	......	......	......	June 18	......
Rose (Wild)	......	......	June 18	......	......	......	......	......	......	June 2	......
Sallow	......	......	......	Oct. 17	......	......	......	......	......	April 25	......
Sycamore	March.	April 6	May 9	Oct. 17	April 18	May 6	......	April 13	May 3	......	Oct. 26
Whin	......	......	April 4	......	......	......	......	......	......	April 26	......

	Wallington.				Acklam Hall, near Middlesbro'.				Whorlton.			
	In Bud.	In Leaf.	In Blossom	Divested of Leaves.	In Bud.	In Leaf.	In Blossom	Divested of Leaves.	In Bud.	In Leaf.	In Blossom	Divested of Leaves.
Alder	April 2	April 24	......	Oct. 30	April 1	April 30	......	Nov. 8	......	......	......	......
Ash	May 4	June 1	......	Oct. 26	May 1	May 31	......	Oct. 21	May 4	......	......	Oct. 26
Beech	April 12	May 3	......	Oct. 24	May 1	May 17	......	Oct. 30	Mar. 2	May 7	......	......
Birch	April 16	May 4	......	Nov. 6	April 26	May 6	......	Nov. 20	April 30	May 3	......	......
Black Thorn	......	......	April 29	......	......	......	April 18	......	......	......	April	......
Bramble	......	......	Aug. 2	......	......	......	June 20	......	......	......	......	......
Broom	......	......	May 20	......	......	......	May 5	......	......	......	May	......
Elder	......	......	June 29	......	......	......	June 10	......	......	......	April	......
Elm	April 8	May 6	......	Nov. 22	April 9	April 30	......	Oct. 31	......	......	......	......
Flowering Currant	......	......	April 17	......	......	......	Mar. 20	......	......	......	April	......
Hawthorn	......	......	May 30	......	......	......	May 14	......	......	......	May	......
Hazel	......	......	Mar. 4	......	......	......	Feb. 1	......	......	......	......	......
Honeysuckle	......	......	May 30	......	......	......	June 24	......	......	......	July	......
Laburnum	......	......	June 1	......	......	......	May 9	......	......	......	June	......
Larch	Feb. 25	April 13	......	Nov. 15	Mar. 25	April 24	......	Nov. 20	April 27	May 2	......	......
Lilac	......	......	May 30	......	......	......	May 7	......	......	......	May	......
Lime	......	......	......	......	......	......	......	......	......	......	......	......
Mountain Ash	......	......	May 29	......	......	......	May 13	......	......	......	June	......
Oak	May 1	May 28	......	Dec. 10	April 24	May 9	......	Nov. 23	May 3	June 2	......	......
Poplar	Feb. 20	April 13	......	Oct. 18	April 10	May 2	......	Oct. 18	April 10	......	......	......
Privet	......	......	July 2	......	......	......	June 24	......	......	......	......	......
Rose (Wild)	......	......	June 28	......	......	......	June 10	......	......	......	June	......
Sallow	......	......	April 4	......	......	......	April 4	......	......	......	......	......
Sycamore	April 6	April 25	......	Oct. 28	April 10	May 1	......	Oct. 29	April 17	April 30	......	......
Whin	......	......	April 18	......	......	......	Mar. 23	......	......	......	May	......

	Cragside, Rothbury.				St. John's, Wolsingham.			Wylam.	
	In Bud.	In Leaf.	In Blossom	Divested of Leaves.	In Bud.	In Leaf.	In Blossom	In Leaf.	In Blossom
Alder	April 24	April 30	......	Nov. ...	April 21	May 17	......	......	......
Ash	May 9	June 3	......	October	May 18	......	......	May 26	......
Beech	April 26	May 10	......	......	......	May 6	......	......	......
Birch	April 4	April 28	......	Nov. ...	April 21	May 5	......	......	......
Black Thorn	......	......	May 6	......	......	......	......	......	April 20
Bramble	......	......	July 8	......	......	......	......	......	......
Broom	......	......	May 11	......	......	......	......	......	......
Elder	......	......	......	......	......	......	......	......	......
Elm	April 26	May 8	......	Sept. 30	......	......	......	......	......
Flowering Currant	......	......	April 10	......	......	......	......	......	April 1
Hawthorn	......	......	May 7	......	......	......	June 21	......	......
Hazel	......	......	......	......	......	......	......	......	......
Honeysuckle	......	......	......	......	......	......	......	......	......
Laburnum	......	......	......	......	......	......	......	......	......
Larch	April 1	April 30	......	Oct. 20	April 18	May 2	......	......	......
Lilac	......	......	......	......	......	......	......	......	......
Lime	......	......	......	......	......	......	......	......	......
Mountain Ash	......	......	June 10	......	......	......	......	......	......
Oak	May 3	May 17	......	Nov. 14	......	......	......	......	......
Poplar	April 25	May 4	......	......	......	......	......	......	......
Privet	......	......	......	......	......	......	......	......	......
Rose (Wild)	......	......	June ...	......	......	......	......	......	......
Sallow	......	......	......	......	......	......	April 18	......	......
Sycamore	Mar. 28	April 24	......	Oct. 10	......	May 18	......	......	......
Whin	......	......	April 27	......	......	......	......	......	......

STANDARD FRUIT TREES, &c.

	Acklam Hall, Middlesbro'.		Seaham Hall.		Stanhope Castle.		Wylam.		Lilburn Tower.		Cragside, Rothbury.		Wallington.	
	In Blossom	Yield.	In Blossom	Yield.	In Blossom	Yield.	In Blossom	Yield.	In Blossom	Yield.	In Blossom.	Yield.	In Blossom.	Yield.
Apple	May 6	Much bloom; not much fruit	May 6	Scarce	May 20	....	May 6	....	May 6	Failure	......	....	May 8	Blossom destroyed by frost on May 25
Cherry	April 26	Good crop	April 25	....	May 16	....	......	....	April 26	Good	My. 3 (Wild)	....	May 3	Fruit plentiful.
Pear	April 26	Abundant bloom, fair crop of fruit	April 25	Good	......	....	......	....	April 28	Abundance of fruit but small and badly ripened...	May 2	....	May 6	A fair crop.
Plum	April 20	Good crop	April 16	Scarce	May 18	....	......	....	April 24	Poor yield	May 6	....	April 28	Below an average; ripened well.
Currant	April 21	Good crop	April 16	Good	May 19	Much blight on the currant & gooseberry bushes......	......	....	My. 3 Black	....	Apl. 27 Blck.	The Blossom destroyed by frost	Apl. 22 Blck.	Heavy crop.
Gooseberry	April 10	Good crop on the whole	April 10	Good	......	....	......	....	April 3	....	April 16	Plentiful	April 15	Heavy crop.
Raspberry	......	....	......	Good	......	....	......	....	......	....	......	....	......	....
Strawberry	May 7	Abundant crop	May 8	Good	......	....	......	Gathered June 30	May 9	....	May 7	....	May 9	Heavy crop.

GRAIN, &c., CROPS.

	Acklam, near Middlesbro'.			Seaham Hall.	Lilburn Tower.			Wallington.			Whitley.		
	When sown.	When cut.	Remarks.	Remarks.	When sown.	When cut.	Remarks.	When sown.	When cut.	Remarks.	When sown.	When cut.	Remarks.
Barley	April 19	Sept. 7	Very good crops	Good crop, but yield less than at first expected	April 18	Aug. 31	Much straw; yield light ...	......	......	....	April 5	Aug. 18	30 bolls per acre; well got
Beans	April 3	Sept. 27	Very good crops	Yield various, chiefly owing to the ravages of the fly	Feb. 5	Oct. 8	Good crop	......	......	....	......	......	....
Oats	April 12	Sept. 7	Very good crops	Good crop; yield not so good as expected	Mar. 28	Sept. 5	Heavy crop; quality good	April 10	Sept. 25	Good crop, and plenty of straw...	Mar. 28	Sept. 26	35 bolls an acre, in good condition.
Peas	April 5	Aug. 20	....	Generally good	Feb. 8	Oct. 6	Very good	......	......	....	......	......	....
Wheat	April 10	Sept. 23	Spring sown wheats yielded well	Good crop	Feb. 6	Sept. 24	Large crop; grain light ...	......	......	....	Nov. 1 '66	Aug. 30	22 bolls an acre, in good condition.
Hay	......	July 1	Good crops	Good crop	......	July 12	Heavy crop; much damaged by wet	......	July 15	Heavy crop, and well got in	......	June 29	3 tons an acre, well got.
Potatoes	May 10	......	Yield large, but much diseased	Much diseased; out of 20 varieties grown here most were bad	May 11	Oct. 18	Middling crop, small in size	May 14	Oct. 18	Good crop; about one-fourth disease	April 18	Oct. 10	7 tons an acre, good quality.
Turnips	June 1	......	Generally good crop	Good crop	May 23	Nov. 17	Splendid crop	Jun. 8-26	......	Good crop	May 4	Nov. 10	Good crop.

WILD FLOWERS.

	Whorlton.	Acklam Hall, Middlesbro'.	St. John's, Wolsingham.	Seaham Hall.	Stanhope Castle.	Stamfordham	North Shields. R. Spence Esq.	North Shields. J. Coppin Esq.	Wylam.	Lilburn.	Cragside, Rothbury.	Wallington.
	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.
Anemone	[illegible] 10	May 1	Feb. 17 (Garden)	May 10	......	......	May 11	......	......	Mar. 9	May 1	Apr. 12
Blue Bell	[illegible] 2	July 20?	......	......	......	......	......	......	......	May 10	......	July 10
Coltsfoot	......	Feb. 22	Feb. 20	Feb. 20	......	Feb. 19	......	Feb. 11	......	......	......	Mar. 2
Cowslip	......	......	......	Apr. 29	......	......	......	......	......	......	......	......
Crowfoot	......	......	......	Apr. 20	......	......	......	......	......	......	......	......
Dandelion	[illegible] 19	Mar. 16	......	Feb. 20	......	Feb. 18	......	Feb. 26	......	Apr. 18	May 2	Apr. 15
Forget-me-not	......	......	......	......	......	......	......	......	......	......	......	......
Garlic	......	June 14	......	May 6	......	......	......	......	......	......	......	Sept. 12
Lily of the Valley	[illegible] 20	May 13	......	May 20	......	......	May 23	......	......	May 6	......	May 13
Marsh Marigold	......	......	......	Apr. 10	......	......	......	......	......	......	......	......
Pilewort	......	......	......	Feb. 20	......	......	......	Feb. 18	......	......	......	......
Primrose	[illegible] 2	Mar. 16	Apr. 19	Mar. 11	Apr. 16	......	......	Apr. 8	Feb. 10	May 10	Mar. 20	Feb.
Stitchwort	......	......	......	May 20	......	......	......	......	......	......	......	......
Strawberry, Garden	[illegible] 20	May 7	......	May 18	May 18	......	......	......	......	May 9	May 7	May
Ditto Wood	......	May 20	......	......	Apr. 13 on shelt'red banks.	......	......	......	......	June 5	Apr. 19	Apr.
Snowdrop	[illegible] 10	Feb. 1	Feb. 17	Feb. 3	Feb. 1	Feb. 12	Feb. ...	......	Feb. 1	Jan. 25	......	Feb.
Violet, Dog	......	......	......	Mar. 7	......	......	......	Apr. 11	......	......	Feb. 24	...

TRE

WALLINGT AM.

n Leaf.	In	In Blossom
pril 24		......
une 1		......
ay 3		......
ay 4		......
......	A	April 20
......	A	......
......	M	......
......	J	......
ay 6		......
......	A	April 1
......	M	......
......	M	......
......	M	......
......	J	......
ril 13		......
......		......
......		......
......		......
y 28		......
ril 13		......

8

9

GROWING IN GARDENS, NEAR NORTH SHIELDS.

Snowdrop	Feb. 10	Gooseberry	April 7
Crocus (yellow)	Feb. 16	Red Currant	April 9
Red Flowering Currant (against wall)	Feb. 21	Pear (Jargonelle)	April 22
Ditto ditto Standard	April 4	Black Currant	April 23
Crocus (purple)	Feb. 21	Strawberry	April 27
Daffodil	Mar. 31	Blue Hyacinth	May 4
Auricula (yellow)	April 5	Apple	May 6

Some very interesting and instructive particulars as to the blossoming and ripening of fruit trees in the gardens at Pierremont, Darlington, have been kindly forwarded by Henry Pease, Esq., extending over twelve years, and relating to the same trees. These returns are very suggestive.

MAGNUM BONUM PLUM.—EAST ASPECT.

	In Bloom.	Ripe.
1854	April 20	October 3.
1855	May 1	October 6.
1856	April 21	October 8.
1857	April 20	September 11.
1858	April 20	September 6.
1859	March 21	September 1.
1860	May 5	September 24.
1862	April 23	September 18.
1863	April 3	August 27.
1864	No bloom	………………
1865	No bloom	………………
1866	April 8	September 10.
1867	April 16	………………

COE'S GOLDEN DROP PLUM.

	South Aspect.		South-East Aspect.	
	In Bloom.	Ripe.	In Bloom.	Ripe.
1854	April 16	October 1......	March 28	October 10.
1855	April 25	October 1......	April 21	October 2.
1856	April 15	October 6......	April 8	October 15.
1857	April 20	September 20.	April 20	October 1.
1858	April 15	September 10.	April 10	September 5.
1859	March 24	September 5...	March 24	September 25.
1860	....	....	April 12	October 12.
1861	April 6	September 1...	April 3	Destroy'd by frost
1862	April 23	September 12.	April 20	September 18.
1863	March 30	September 18.	March 24	August 30.
1864	April 11	September 10.	April 11	September 2.
1865	April 11	September 6...	April 10	August 10.
1866	April 20	September 11.	April 11	September 10.
1867	April 10	....	....	....

MARIE LOUISE PEAR.—SOUTH ASPECT.

	In Bloom.	Ripe.
1854	April 7	October 18.
1855	April 20	October 20.
1856	....	....
1857	April 22	October 21.
1858	April 23	October 10.
1859	April 20	October 5.
1860	May 5..............................	October 17.
1861	April 22	October 27.
1862	April 20	October 27.
1863	April 10	September 30.
1864	April 20	September 30.
1865	April 27	September 24.
1866	April 10	October 10.

JEFFERSON PLUM.—SOUTH-EAST ASPECT.

	In Bloom.	Ripe.
1854	March 24	September 2.
1855	April 21	September 20.
1856	April 8	September 19.
1857	....	....
1858	March 26	August 27.
1859	March 21	August 20.
1860	April 11	September 18.
1861	March 27	Destroyed by frost.
1862	April 10	September 2.
1863	March 24	August 4.
1864	March 30	August 27.
1865	April 10	August 10.
1866	April 11	August 12.

MOOR PARK APRICOT.—SOUTH-EAST ASPECT.

	In Bloom.	Ripe.
1853	March 20	September 19.
1854	March 13	September 4.
1855	Blossom destroyed by frost	....
1856	March 20	August 31.
1857	March 26	August 19.
1858	March 30	August 14.
1859	March 2	August 10.
1860	April 3	September 28.
1861	March 27	Fruit destroyed by frost.
1862	March 26	September 13.
1863	March 7	August 18.
1864	March 30	Destroyed by frost.
1865	April 4	August 16.
1866	March 15	September 4.

GREEN GAGE PLUM.—SOUTH ASPECT.

	In Bloom.	Ripe.
1853	April 16	September 12.
1854	March 31	September 2.
1855	April 25	September 25.
1856	April 15	September 15.
1857	April 20	September 11.
1858	April 15	August 27.
1859	March 24	August 18.
1860	....	....
1861	April 6	August 18.
1862	April 20	September 10.
1863	March 30	August 12.
1864	April 9	August 20.
1865	April 14	August 24.
1866	April 16	August 9.

NOTES ON BIRDS AND INSECTS.

Wallington.—Rook shooting began on May the 24th; three weeks later than in an early season, and a fortnight later than the general average of seasons. On December 24th many hive bees were seen flying about; also three tortoise-shell butterflies.

Lilburn Tower.—Owing to the cold dull weather which characterised the year generally but few of the rare birds were seen.

Wylam.—March 13th, rooks had eggs. September 8th, a great number of white butterflies suddenly appeared, and were gone again on the 9th. October 25th, humming bird hawk-moth seen on some stocks. Black-cap birds were very numerous this year.

Stamfordham.—Thrush heard to sing on January 28th. The lark on February 14th. Wood pigeons heard on February 15th. Swallows arrived April 17th; last seen October 2nd.

Alston.—Cuckoo heard April 28th.

MIGRATORY BIRDS.

	ACKLAM HALL, MIDDLESBRO'.			SEAHAM.			STANHOPE CASTLE.	STAMFORDHAM.	LILBURN TOWER.		CRAGSIDE, ROTHBURY.			WALLINGTON.		NORTH SHIELDS.
	Arrival.	Departure.	Remarks.	Arrival.	Departure.	Remarks.	Arrival.	Arrival.	Arrival.	Departure.	Arrival.	Departure.	Remarks.	Arrival.	Departure.	Arrival.
Black-cap	April 16	Aug. 4	Only one pair seen	May 10	......	Not common this season..	......	......	......	......	......	......	....	April 18	....	......
Chiff-chaff	.....	......	....	April 1	......	Numerous	......	......	......	......	......	......	....	......	....	......
Corncrake	May 8	July 1	....	May 23	Oct. 10	Numerous	May 9	......	May 5	Aug. 18	May 6	......	Very numerous...	May 8	....	May 5
Cuckoo	April 29	June 21	Seldom heard ...	April 27	......	Rare this year ...	April 26	May 2	May 15	Aug. 3	April 28	......	Very numerous...	April 26	June 24	April 25
Fieldfare	......	April 2	....	Nov. 6	May 11	Numerous	......	......	......	......	......	......	....	Nov. 14	April 1	......
Redstart............	......	......	....	April 18	......	Rare	......	......	May 14	Aug. 16	......	......	....	May 2	....	......
Redwing	......	......	....	......	......	....	......	......	......	......	......	......	....	......	....	Sept. 25
Starling............	Feb. 2	July 20	Large flocks seen	......	......	....	......	......	Feb. 12	Nov. 15	May 4	......	....	Feb. 1	Nov. 21	......
Swift	......	......	....	May 31	Sept. 12	....	......	......	May 18	......	May 1	October.	....	May 14	....	......
Swallow............	April 19	Sept. 15	Very numerous...	April 28	Oct. 21	Not numerous ...	April 20	Apr. 17; last seen Oct. 2.	April 18	Nov. 4	April 27	Sept. ...	Very numerous...	April 20	Oct. 11	April 28
Weatear............	......	......	....	April 20	Sept. 10	....	......	......	......	......	......	......	....	April 20	....	......
Whitethroat	April 30	Sept. 24	Not numerous ...	......	......	....	......	......	......	......	......	......	....	......	....	......
Willow Wren......	......	......	....	Mar. 27	Sept. 24	....	......	......	......	......	......	......	....	April 19	....	......
Woodcock	......	......	....	Sept. 12	April 1	....	......	......	......	......	......	......	....	Oct. 26	Feb. 1; two seen after the snow in Jan.	......

INSECTS.

	ACKLAM HALL, MIDDLESBRO'.		SEAHAM HALL.		STAMFORDHAM.	LILBURN TOWER.		CRAGSIDE, ROTHBURY.		WALLINGTON.	
	First seen.	Remarks.	First seen.	Remarks.	First seen.	First seen.	Remarks.	First seen.	Remarks.	First seen.	Remarks.
Small White Butterfly	....	....	April 23	Not common	....	April 20	....	May 10	Numerous	May 5	....
Orange Tip ditto	June 1	Not numerous ...	....	....	....	Mar. 28	....	....	....	May 29	....
Tortoiseshell ditto	April 16	Not numerous ...	....	....	....	....	....	April 30	Scarce	Mar. 24	One seen; not again till May 19, plentiful; last seen Nov. 28.
Holly Blue ditto	....	....	....	....	July 9	....	....	....	....	July 6	....
Brimstone Moth	....	....	June 28	....	....	....	....	....	....	June 5	....
Currant ditto	....	....	....	....	....	....	....	....	....	July 15	....
Ghost ditto	....	....	....	....	....	....	....	....	....	June 18	....
Small Dagger ditto	....	....	....	....	....	....	....	....	....	May 5	Only one seen–a female.
Cockchafer	....	....	April 12	....	....	....	....	....	....	....	None in this locality.
Hive Bees	Mar. 24	....	....	Swarm on June the 24th; bad honey season	Feb.	June 29?	....	....	....	Feb. 12	June 17th first swarm.
Humble Bees....................	April 4	Very scarce	April 15	....	April 24	April 20	....	....	....	April 17	....
Wasps	May 1	....	May 9	Numerous	April 27	May 6	Very numerous in August and Sept.	May 9	Very numerous...	May 4	Very numerous and very destructive in Aug. and Sept.

Stanhope.—In the autumn of 1866, and in the months of November and December, a number of Bohemian chatterers were shot in this neighbourhood. In Bernard's "History of British Birds" it is stated that they visited the Northern Counties in 1796 and 1798.

Acklam, near Middlesbro'.—A fine specimen of the night-jar was shot in the spring, also two North American cross-beaks in May.

Seaham.—On the 1st, 2nd, and 3rd of January, great numbers of larks passed over here, flying southward. At the same time many snow-buntings and mountain finches were seen about the corn stacks; they disappeared with the snow. The same remark applies to blackbirds and thrushes; they were unusually scarce during the summer. The green and black aphides were very troublesome this season; some crops were entirely destroyed by them. There was much honey dew in June and July. Garden slugs *(Limax agrestis* and *Arion hortensis)* were very destructive. Wasps were more numerous than they had been for years. Butterflies were very scarce.

North Shields.—Woodcocks arrived April 4th. Humble bees seen April 12th. Small white butterfly seen April 22nd. Beetles (Geotropes ?) April 12th.

In drawing this year's Report to a close, the editor ventures to repeat a suggestion of Sir John Herschel's, and to say that he will be extremely thankful to any one, whether a regular observer or not, who will be so obliging as to furnish him with any memoranda they may make in reference to it. He "strongly recommends those whose occupation leads them to attend to the signs of the weather, and who from hearing a particular weather adage often repeated, and from noticing themselves a few remarkable instances of its verification, have 'begun to put faith in it,' to commence keeping a note-book, and to set down without bias all the instances which occur to them of the recognised antecedent, and the occurence or non-occurence of the expected consequent, not omitting to put down those cases in which it is left undecided; and after so collecting a considerable number of instances (not less than a hundred) proceed to form a judgment on a fair comparison of the favourable, the unfavourable, and the undecided cases, remembering always that the *absence of a majority one way or the other would be, in itself, an improbability:* and that, therefore, to have any weight, the majority should be a very decided one, and *that* not only in itself, but in reference to neutral instances."

Again—It has been stated, apparently on good ground, that a persistent steadiness and frequently repeated uniformity of monthly mean temperatures precede extremes of cold or heat, according to the season of the year. In summer they are said to precede a severe winter, and in winter to precede a great summer heat. Also, that when the means from December to March inclusive, are above or about the average, the succeeding summer is almost always above the average; when the means from November to March inclusive are all above the average (except January) the succeeding summer is always above the average also; when the difference between the means of May and June is about 1° or 1½° the remainder of the summer is generally very cold. Again, when the mean temperature of December is more than 2° above that of November, the winter quarter (January, February and March) will always have a mean temperature considerably above the average.

Can any of the friends of the Tyneside Club furnish information bearing in any way upon the theory here propounded?

The editor will feel very grateful for any weather proverbs (even one or two, common or uncommon) which any of the readers of this Report may kindly send him. Such weather proverbs and sayings will form capital pegs on which to hang observations of the kind meant by Sir John Herschel.

Did space permit, there are many other suggestions which the editor would throw out for the consideration of his fellow observers. There cannot be any doubt that meteorology is rapidly advancing to be one of the foremost branches of science; and, based as it must be, on the collection and classification of countless and widely spread observations, continued over a long series of years, every one who contributes even a few accurately observed facts renders good service to the cause. A recent writer on the subject of meteorology remarks that "to doubt that a science of weather is possible would be to doubt that atmospheric disturbances are governed by fixed laws. But, indeed, a wonderful change has taken place in this matter of late years. Formerly most *savants* scoffed at the idea of predicting the weather; and Arago, the French astronomer, said that no scientific man, anxious for his reputation, would venture on such a thing, even for the space of a single day. But now it is just the reverse. Those most acquainted with meteorology are the staunchest believers in the ultimate probability of 'doing the thing' to the world's great satisfaction. Indeed, had one half the time and research devoted to Sideral Astronomy been spent in observing and registering changes, which any one may notice, but no one has succeeded in predicting and interpreting, meteorology would not be 'still in its infancy,' after a birth thousands of years ago —nay, coeval with the first appearance of man on earth, to observe the 'signs which are in the firmament of the heavens.'"

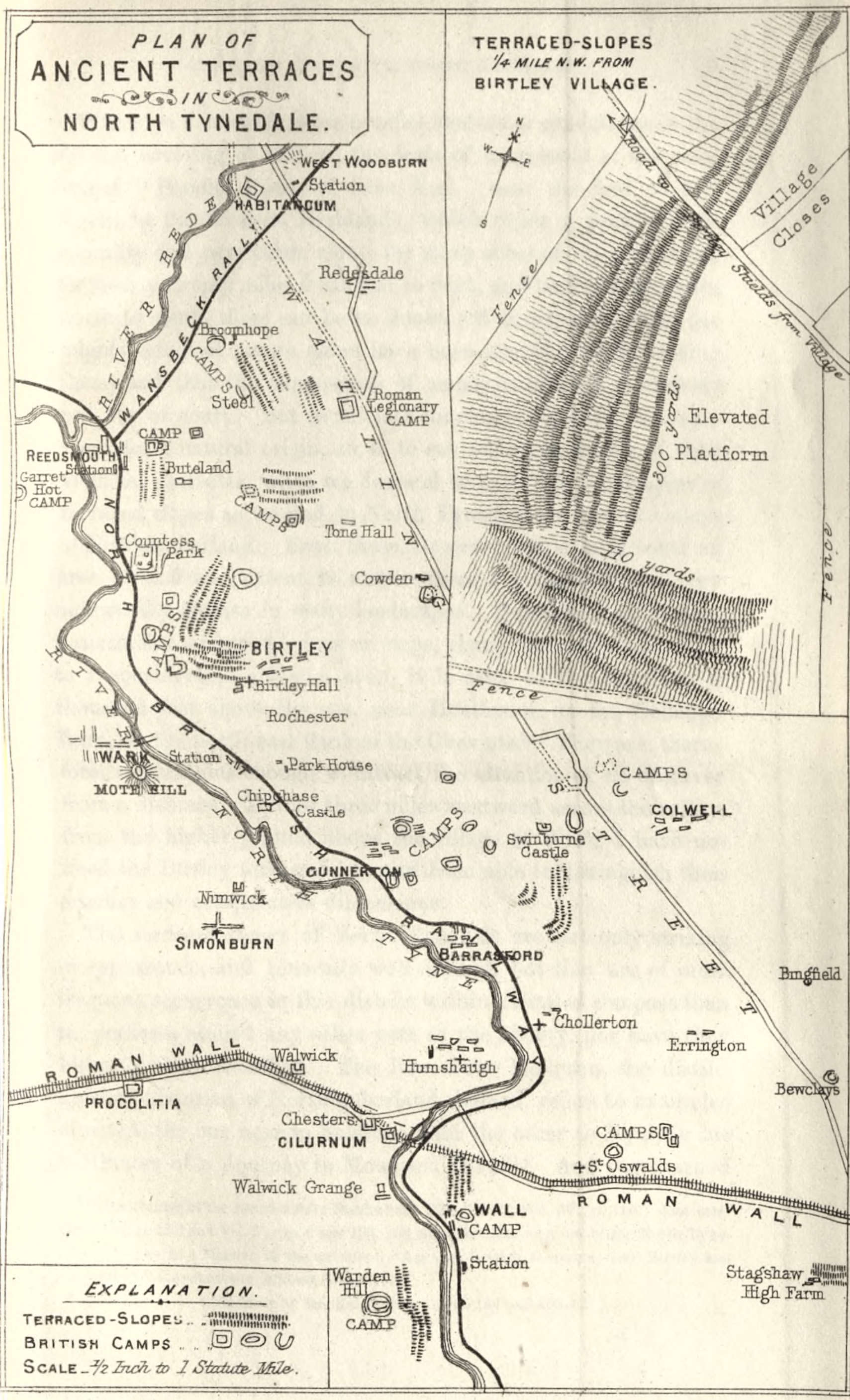
The observations recorded in the Meteorological Report and Climatological Tables have this year been forwarded by the following contributors:—

Allenheads and Bywell	Mr. M. Varty, Haydon Bridge.
Alston	F. H. Dickenson, Esq., Alston.
Howick (Earl Grey) Lilburn Tower (E. J. Collingwood, Esq.) Roddam Hall (Wm. Roddam, Esq.) Glanton Pike (F. W. Collingwood, Esq.	Communicated by the Rev. J. F. Bigge.
Brinkburn	C. H. Cadogan, Esq.
Darlington	H. Pease, Esq., Pierremont. Mr. John Richardson, Southend.
Dinsdale Rectory, near Darlington	Rev. J. W. Smith, M.A.
Durham	Rev. Dr. Gillow, Ushaw College.
Eaglescliffe, near Yarm	Rev. J. Hull, M.A.
Earsdon	John Taylor, Esq.
Horsley	Mr. John Bew.

Middlesbro', Acklam Hall	Mr. Hebblewhite.
Millfield, near Wooler	G. A. Grey, Esq.
Newcastle	G. Lyall, Esq., Lit. and Phil. Society.
North Shields	Robert Spence, Esq. John Coppin, Esq.
Otterburn	Rev. T. Wearing.
Park End	M. A. Ridley, Esq.
North Sunderland	Rev. F. R. Simpson.
Rothbury	Sir W. G. Armstrong.
Seaham	Mr. R. Draper, Seaham Hall Gardens.
Sedgefield, Durham	J. Smith, Esq.
South Shields.............................	Rev. R. E. Hooppell, M.A.
Stamfordham	Rev. J. F. Bigge, M.A.
Stanhope	Mr. Thos. Surtees, Stanhope Castle.
Sunderland	J. W. Mounsey, Esq., Hendon Hill. Rev. George Iliff, The Hall.
Wallington................................	Mr. Hedley, Wallington Hall Gardens.
Wallsend..................................	J. W. Dees, Esq.
Whitfield..................................	Rev. J. M. Mason, M.A.
Whitley	Rev. R. F. Wheeler, M.A.
Whittle Dean Company's Reservoirs.	D. D. Main, Esq.
Whorlton, in Teesdale	T. Dodgson, Esq.
Wolsingham	W. Backhouse, Esq.
Wylam	G. C. Atkinson, Esq., Wylam Hall.

II.—*An Enquiry into the Origin of certain Terraced Slopes in North Tynedale.* By the Rev. G. Rome Hall.

The subject of our present enquiry is one of considerable interest, and, at the same time, of no little difficulty. What may have been the origin of those remarkable terrace-lines which occasionally appear on the declivities of our upland valleys or lower river-basins, forms a problem which cannot as yet be said to be positively and satisfactorily solved. Different observers—the geologist, the military engineer, the practical agriculturalist, and the archæologist, have reviewed them from their own particular stand-point, and, as might be expected, have traced their formation to various and widely different agencies.



PLAN OF
ANCIENT TERRACES
IN
NORTH TYNEDALE.
TERRACED-SLOPES
1/4 MILE N.W. FROM
BIRTLEY VILLAGE.
Road to Birtley Shields from Village
Village Closes
Fence
300 yards
110 yards
Elevated Platform
WEST WOODBURN
Station
HABITANCUM
RIVER REDE
WANSBECK RAILWAY
Redesdale
Broomhope
CAMPS
Steel
Roman Legionary CAMP
CAMP
REEDSMOUTH Station
Garret Hot CAMP
Buteland
Tone Hall
Countess Park
Cowden
BIRTLEY
Birtley Hall
Rochester
WARK
Station
Park House
MOTE HILL
Chipchase Castle
CAMPS
COLWELL
Swinburne Castle
GUNNERTON
Nunwick
SIMONBURN
BARRASFORD
NORTH TYNE
RIVER
BORDER COUNTIES RAILWAY
WATLING STREET
Bingfield
Chollerton
Errington
ROMAN WALL
Walwick
Humshaugh
Bewclays
PROCOLITIA
Chesters
CILURNUM
CAMPS
St. Oswalds
Walwick Grange
WALL
CAMP
Station
Warden Hill
CAMP
Stagshaw High Farm
EXPLANATION.
TERRACED-SLOPES
BRITISH CAMPS
SCALE – 1/2 Inch to 1 Statute Mile.

When we meet with these parallel shelves or gradations in the alluvial covering of hills on the scale of magnitude of the celebrated "Parallel Roads of Glen Roy," near the foot of Ben Nevis, in the Western Highlands, which retain a perfect horizontality and parallelism along the steep sides of the mountains for nearly twenty miles from east to west, and twelve miles from north to south, there can be no doubt left in any mind that the mighty forces of nature alone have been operative in producing them, and that the supposition of man's handiwork is entirely put out of court. But much less conclusive must be the argument for a natural origin, so as to set aside *any* theory of their artificial character, when we descend to such minor examples of terraced slopes as we find in North Tynedale, and other valleys of Northumberland. Even these, however, are seen to cover an area of sufficient extent to render them a prominent and very noteworthy feature in many landscapes. Sometimes they form a succession of broad ledges or steps, rising one above the other to a considerable altitude, even, it is said, to the height of a thousand feet above the sea, near Heathpool, on the Colledge Burn, on the north-east flank of the Cheviots.* They are, therefore, conspicuous enough to attract the attention of an observer from a distance. Two or three miles westward across the valley, from the higher ground above the village of Wark, I have noticed the Birtley terrace-lines, and been able to distinguish their number and comparative dimensions.

The terraced-slopes of North Tynedale are not only striking in appearance, and generally well defined, but they are of more frequent occurrence in this district within a limited compass than in, perhaps, almost any other part of the county, nor have they hitherto been described. The Rev. John Hodgson, the distinguished historian of Northumberland, indeed, refers to examples situated, the one near to Falstone, and the other to Ryal, in his "Minutes of a Journey to Mounces, 1814."† And our learned

* "Proceedings of the Berwickshire Naturalists' Club," 1862, Vol. IV., p. 448. Also compare Ibid, p. 160, and Vol. V., pp. 6 and 190, and some remarks on a few of the North Tynedale examples in a Memoir by the writer on "Ancient British Remains, near Birtley and Barrasford,"—*Archæologia Æliana*, Vol. VII.

† "Memoir by Dr. Raine, Vol. I., pp. 142 and 150–1."

Vice-President, the Rev. Dr. Bruce, in his "Roman Wall," * has also had occasion to mention incidentally the series of similar "entrenchments," as they are sometimes called, which he observed at Wall and High Warden. But these observers contented themselves with a simple reference to these singular works. The *locale* of the terrace-lines (which I now venture to describe more at large, before proceeding to mention some of the best-ascertained theories respecting their origin, and my own conclusions on that intricate question) may, for convenience, be separated into two groups, centring around the villages of Birtley and Wall respectively. Both groups lie in the southern portion of the vale of North Tyne, below the junction of the River Rede, and with a single exception are found on the left or eastern bank of the North Tyne, at some little elevation on the sunny slope of the river basin.

BIRTLEY GROUP.

In a lateral opening from the vale of the Rede to the south, through which runs the Steel Burn, are numerous terraces, the longest lines being nearly four hundred yards, narrowing as they ascend towards the Watling Street, in conformity to the irregular triangular shape of the escarpment. The site is now covered with heather, and strewn with boulders and ancient slag-heaps from early iron-workings under the limestone higher up the hill. The excavations of Sir W. Armstrong for iron ore and limestone on the same declivity have recently encroached on these terrace-lines, as well as on a more distinctly-marked series at a greater elevation, and more to the south, where ten different ledges can be counted from a distance, about one hundred and fifty yards in length. Both of these terraced slopes face the west, with a point to the south. Across the adjoining Buteland ridge, about a mile-and-a-half distant, is a *second* series of at least seven or eight distinct terraces, several yards broad, and from five to seven feet high. Their aspect is due south towards Low Shields Green.

* P. 166, 3rd Edition.

A *third* series, but less distinctly marked, is met with on the western declivity of the same ridge, immediately below Buteland House, about one mile distant. Here facing due west, towards the North Tyne, as it encircles Countess Park, the whole slope is covered with "rig and rean" cultivation, intermingled with which, where the descent is more abrupt, are six or seven terrace-lines, averaging three feet in height and many yards in breadth.

The *fourth* and last series of the Birtley group is that remarkable example, half-a-mile to the west of the village, the lines of which run nearly at a right angle to each other. As these singular terraces are exceedingly well defined, and may be taken as typical of all the rest in the district, I have made a more careful examination of this than of any of the other series; in which I have been aided by a tracing from the Ordnance Survey, kindly given me by Lieutenant H. Helsham Jones, R.E. The western side of the incomplete rectangle is over three hundred yards in extreme length, the southern face being one hundred and ten yards. The former is cut into six terrace-lines or ledges of unequal length, having a shorter one inserted about mid-way; and the lowest projects outwards in a convex manner from the usual horizontal straight line. Making allowance for the gradual detrition, or wearing down of the soil, the terraces average three, five, six, seven, one-and-a-half, and five feet in height, reckoning from the base; and the platforms are fourteen, eight, and the three uppermost, nine yards in breadth. Other lines of small relative elevations exist at the summit, intermingled as in the west Buteland example, with the broad furrows of comparatively recent cultivation. About mid-way in the length of this west face the escarpment reaches its greatest height above the river, and from that point has a gentle inclination to north and south. The terraces themselves, towards the north, now begin to lessen considerably in altitude, but usually retaining their previous breadth; until crossing the road to Birtley Shields, the three uppermost ledges, for more than a hundred yards, do not rise above two or even one foot above each other. They then are seen to coalesce gradually into the level surface of the ground towards the Mill Knock Camp. Between the southern and western faces is a broad slope about six yards wide, separating between them at the angle, and preventing their junction in horizontal parallels. The five terraces cut into the southern escarpment are of nearly equal length; but a shorter ledge is again inserted, this time at each end of the second from the top, measuring about one-third of the whole terrace-line, or forty yards. There is also a segmental break in the direct course of the lowest bank, at the west end, of a similar length. The comparative roughness of its surface, so different from the smoothly-cut slopes and levels of the other terraces, may denote an outburst of the freestone strata. Those lines abruptly terminate, probably from the same cause, at their eastern extremity in apparently artificial excavations. In this face also there is a decided dip of the ground towards the angle; the various heights of the ledges, measured as before, are six, ten, seven-and-a-half, seven, and five-and-a-half feet. The level spaces widen as they ascend gently towards the east, but about mid-way are seven, eleven, ten, and fifteen yards respectively in breadth.

WALL GROUP.

There is an interval of four or five miles between the last example and the first of the present group. Proceeding down the valley to the park of Swinburne Castle, we come upon a long freestone escarpment which is cut, at intervals, throughout its length into two series of well-marked terrace-lines, with smaller banks or ledges on the summit, running at right angles away from the sloping ground. The first shelves are about two hundred yards long, and curve inwards at their southern extremity almost like seats in an amphitheatre. There are five very distinct ledges, besides others in the more level space beneath, two of them five feet, one three feet, another six, and the uppermost ten feet high; whilst in breadth they measure, two of them ten yards, one eight, and the remaining one twelve yards. These terraces are scooped out, as if artificially, at their northern end; and beyond them, separated by an out-crop of the strata, and broad cross-lines of culture, running at right angles down the gentle declivity, another and second terraced slope, as continuation of the same escarpment, occurs, of an equally defined character, and about the same length. In height, the ledges average five, three, eight, and the uppermost nearly twenty feet, being in breadth about fourteen, twenty, and twelve yards. These all face due west. One more example, at least, may also be seen about fifty yards nearer to the castle, where the carriage drive skirts a rounded hill of small elevation, the western face of which has two terraces, ten and six feet high, and twelve and eight yards broad. The different series of terraces at Swinburne are very remarkable.

Almost as singular is the *second* example of this group, half-a-mile north of Wall village, and between it and the line of the great Roman barrier. It lies facing the west, with an inclination to the north, on a lower slope of the steep declivity of Wall Camp Hill, and consists of four or five terraces, overhanging a precipitous descent of nearly forty feet. The ridges breast the brow of the undulating escarpment, and neither retain their horizontality nor their parallelism during their course of more than two hundred and fifty yards, four of them scooped out at the northern end, as in the last example. They rise five, seven, twelve, and four-and-a-half feet above each other, and are nine, six, four, and five yards wide. The upper are much shorter than the lower terraces, being adapted to the nature of the ground, like the Steel series. On the gentle slope above, and in the level space beneath, the whole surface is furrowed with traces of late cultivation.

The *third* and remaining series of terrace-lines of this group may be distinctly seen from the Wall Camp Hill on the opposite side of the valley. They lie on the slope of Warden Hill, beneath the great British Fort, facing nearly due east, near High Warden House, and consist of three or four ledges, all more or less distinct, from six to twelve feet high, and of a proportionate width. The uppermost shelf, after running about sixty yards, suddenly dips to a lower level, and continues for seventy or eighty yards further, whilst two shorter terraces towards the opposite or northern extremity, and at a lower elevation, pass along the declivity.

Such are the terraced slopes of North Tynedale which I have seen for myself; some of them bearing a very marked character, and all of them deserving, perhaps, more than the incidental reference which has been hitherto given to a few examples. The difficult question of their origin, whether natural or artificial, or partaking of both of these characters, now faces us, and I confess to considerable diffidence in endeavouring to state fairly the various theories that science and observation have put forward to account for them, and the conclusions at which I have myself arrived.

Natural Origin.—Here we enter on the domain of the geologist, and retire into the dim mysterious ages of the far-distant past, which witnessed the gradual preparation of the earth's surface by Divine power and wisdom for the requirements of human existence. Above the present beach or sea-margin of our own country, and along the shores of nearly all Western Europe, following the bays and recesses of the land, are, it is well known, various ancient or raised beaches. It is supposed that these terraces on our coasts and on the banks of estuaries prove either an elevation of the land or a depression of the ocean, and the former presence of tides and waves at these successive levels. Sometimes a mere shelf or line on a hill side, of no greater magnitude than the terraces of North Tynedale, attests the change of relative height between former and existing sea-margins. With respect, however, to these beaches or terraces, which are found belting the slopes of *inland* valleys, unless we have reason to consider them as estuaries in the seas of geological times, another but similar agency has been suggested. They are held to give evidence of previous water-levels, and seem to "point to a time when the valley was occupied by a lake at that height, or when the plain stood at that level, and before the river had worn its channel down to its present depth." These long horizontal terraces or ledges of sand or gravel and silt have attracted much attention during late years. Sir Chas. Lyell, it will be remembered, speaking of the "changes of surface during and since the emergence of the Newer Pliocene strata," gives a striking instance ot this configuration in connection with the same mountain limestone formation which prevails here; and he further illustrates his subject by an engraving. He says, "In the limestone districts of the Val di Noto (in Sicily) the strata are for the most part horizontal, and on each side of the valley form a succession of ledges or small terraces, instead of descending in a gradual slope towards the river plain in the manner of the argillaceous formations. When there is a bend in the valley the exact appearance of an amphitheatre, with a range of marble seats, is produced."* Something slightly similar to this picturesque appearance has been remarked in connection with the Swinburne terraces in this valley. When these long level escarpments occur near to the present channel of rivers, of which every one has seen an example, it is easily perceived how they denote changes, often recurring in the river bed itself by the disintegrating action of winds and rain, and the erosive force of floods. It is, however, in cases like those now under consideration, where the terrace-lines are found on the higher slopes of a valley or glen, that we pass from a simple to a more complicated phase of the subject, and from comparatively modern times to the indefinite remoteness of the later geological periods. This has been especially the case with the wonderful terraces or "Parallel Roads of Glen Roy." Sir C. Lyell, in his "Antiquity of Man," † treats them at considerable length, and concludes that these and the terrace-lines of some neighbouring valleys "were formed on the borders of glacier lakes," that the vales themselves then formed shallow lakes, whose level is marked by the uppermost shelves, the escape of water over any "col," or parting ridge of lower level between the glens, being prevented by the protrusion of a glacier from above so as to rest like a barrier on the flank of the hill; and the lower shelves or terraces would afterwards be formed by the shrinking of the ice into less dimensions, and the escape of the waters of the lakes over and

* "Principles of Geology," 4th Edition, Vol. IV., p. 7.

† 2nd Edition, Class XIII., pp. 252 to 264.

through the mountain passes, as the blockage by glaciers or icebergs was removed from time to time. This theory for the formation of the Glen Roy terraces, and of some others on a much smaller scale, seems now to be generally followed. And, indeed, there are in this district of Western Northumberland some traces of glacial action, which might, to a certain extent, account for similar phenomena, and influence us so far as to assign, perhaps, a portion of the terraced slopes of North Tynedale to that efficient cause. If we go in imagination back to the strange epoch of the "Drift formation," as it is usually termed, when an Arctic climate rested on these islands, we see only a few summits of our present mountains and hills appearing above the great sea, like islets, beneath which lie submerged the pleasant valleys and fertile plains that we now behold. This valley and its tributary vales would then form a series of lakes—a chain of "loughs," of various degrees of depth, of which there are a few minor representatives along the line of the Roman Wall still remaining in what we call our "Northumbrian lakes." Above the present junction of the North Tyne and Rede there would be, at that remote period, such a lake, until the softer strata between the Garrett Holt Hill and the Buteland ridge were worn through by the eroding pressure from above. Another lake must have engulphed the now open space of the valley between this barrier and the hard free-stone strata which crossed from the Chipchase Park House quarry to the southern bank of Wark Burn. A still more extensive tract must have lain under water (perhaps divided off for a time into two lakes by the great basaltic ridge cropping out at Gunnerton) between the barrier at Chipchase and another high free-stone ridge, once closing up the narrow pass between the Wall and Warden Hills. From many a vantage-ground, such as the Gunnerton Crags, the ancient outline of this inland lake is very marked, with the hilly slopes so perfectly encircling it, that it would not be possible for the spectator, if a stranger, to tell where the long-imprisoned waters had at length burst their primeval barrier, and escaped through the estuary of the Tyne valley into the great glacial sea. We are not left merely to our imaginations in picturing this scene. Undoubtedly there would be originally many traces of the successive levels at which these inland lakes had stood at different times, excavated on the slopes of the valley and its transverse openings on similar sites to those whereon we now find the parallel terrace-lines. But what vestiges, if any, remained subsequent to the far more powerful action of the descending ice-bergs and ice-floes of the "drift period," is the difficult question to decide. There are evidences yet to be discerned of the passage of glaciers down North Tynedale, when it was either a firth or arm of the sea, or a chain of inland lakes. What are these proofs of glacial action, then, to which with good reason the formation of the Glen Roy terraces, and to some extent our own parallel ridges might be ascribed? They are found in the general physical characteristics of the valley; in the fact that glacial currents from the colder north to the warmer south, in the short summer of that pleistocene, or boulder drift period, have worn and denuded the crags and hills on its eastern bank, whilst the rugged strata of the opposite slopes are marked with thick accumulations of clay, sand, and gravel. The direction of the stream is the ordinary one of that period, nearly from north-west to south-west; and by its agency have been laid bare such bold head-lands as the Mill Knock, near Birtley, and the basaltic range between Gunnerton and Barrasford, which confront the west or north-west. Then, again, the same tremendous transporting power could alone account for the moraines of sand, and gravel, and boulders, found, for example, along the great escarpment above the Steel Burn, and on the platform above the Birtley terraces—the debris of huge water-worn blocks, especially, brought down and detached from the under surface of the brief summer avalanches or slowly melting ice-bergs.* As these gradually forced their ponderous masses along the valley, they have further left their unmistakeable traces here and there in the smoothing and grooving, and scratching of the rock surfaces, which were of too enduring a nature to be displaced; and this,

* Near to the top of the Wark Mote Hill, on the north side, Mr. Hodgson noticed on his visit to Mounces in 1814 "an alluvial block of granite, about a ton in weight.—*Memoir*. Vol. I., p. 140.

too, in one direction only, parallel with the valley itself. One of the best sites for observing this is in the neighbourhood of the last great barrier through which the ice-bergs must have forced their way, that is, near Wall village. The Rev. W. Greenwell, in his address in 1863,* as President of our Society, remarks—"In a cutting, through which the railway is carried, were seen instructive sections of the glacial drift; and many specimens of polished and striated pieces of limestone were observed in the clay of which the drift consists, showing unmistakable evidence of their having been set, so to speak, in ice, and subjected whilst so imbedded to a lengthened course of attrition, which had given them almost the polish of glass, and then scored deep lines on the polished surface." †

Seeing, then, that the same natural agencies have been at work here as elsewhere, to which the most experienced geologists have attributed the formation of terraced slopes (as at Glen Roy and in the Val di Noto, in Sicily), it would be too much to presume to say that no portion of these parallel ridges in North Tynedale is owing to natural forces,—fully competent, as we have perceived them to be, to produce such phenomena. My own opinion is that, so to say, the *framework* of *some* of the terrace-lines probably originated in the denuding operation of water, and the abrading action of the glacial currents; but that man afterwards, when ages had elapsed, came upon the scene, and made these rude escarpments of nature's work subserve his own purpose, by altering and adapting them, and, it may be, forming others after their pattern, but better fitted for the precise object he had in view, on the same or similar sites.

Artificial Origin.—Some observers (and I could mention more than one excellent geologist, among them, for example, Mr. G. Tate, F.G.S., Secretary of the Berwickshire Naturalists' Field Club, as to those near Heathpool, before referred to) have given it as their firm belief that to man's handiwork *alone* should

* "Transactions," Vol. IV., p. 12.

† Similar traces of glacial action in a limestone boulder were lately noticed by Mr. Greenwell and the writer in the railway cutting under the Buteland ridge.

these parallel ledges be attributed—that they are wholly artificial, and not natural in their origin.* They would remark that the terraces of the kind now under consideration are unlike those of the Glen Roy and the Fluviatile terraces of gravel, as in the Somme valley, and elsewhere; the results being too small for such mighty efficient causes. They would point to the physical features of this district of Western Northumberland as marked by all the peculiarities of the carboniferous or mountain limestone formations, its alternations of harder and softer strata, its protruded basaltic crags and conical heights, and freestone or limestone headlands and escarpments, superimposed upon or underlying its coals, shales, ironstones, and clays. And they would ask us to account for the comparatively *small* number of the terraces under such favourable conditions—why *both* sides of the valley and of the transverse dales had not been furrowed in more places, and along a greater extent of the hill-sides than we find them, as at Warden Hill and Buteland ridge. They might reasonably desire to know how in each lake of the North Tynedale chain in the glacial period the various series of terraces are at *different relative levels* from each other. And above all, why we find the separate ledges dipping out of the horizontal line so much as they do, as in the Birtley example; and, not only ceasing to retain their parallelism, but actually inosculating and running into each other, which is the case in almost every instance. Such arguments must necessarily have great force. Looking at the most striking series of these ledges, that near Birtley, no one could avoid being struck with *its very artificial character.* It is manifest at a glance. Why, then, were they formed by man's

* Compare, however, Mr. Tate's remarks on the Humbledon Heugh terraces (Proceedings of Ber. Nat. Club, Vol. IV., p. 160) which I have seen since writing the above. In this particular case he says,—"Such places near the heugh have been further levelled and trimmed by art and used by the early inhabitants of the district for the purposes of cultivation." The reference is to the terraces formed on gravel at the base of the porphyry hills along the shores of the valley of the Till, which appeared as the land emerged from the waters of that estuary. It is, perhaps, probable that in a few instances of this kind a natural origin of terraced ledges may be found, as a friend has suggested to me, in a sudden fall, or succession of falls, or depressions of the face of an escarpment from the percolation of water beneath the soil, or underlying strata. On a small scale, the action of such quicksands is often observable on the slopes of railway cuttings and embankments.

labour solely in most instances, or, as I think, in a few cases, specially *adapted* to his purposes and uses?

Many ingenious theories have been proposed, some, no doubt, very improbable. Hutchinson conjectures that these terraces have been formed by art, for the purpose of marshalling the militia of the county, and showing them to advantage. Pennant inclines to a similar notion.* One of the most ingenious, but at the same time, most fanciful ideas respecting their object I met with in the upper part of the vale of the river Gelt, near Castle Carrock, in Cumberland. There, along the southern face of a high escarpment, is a series of terrace-lines of extraordinary length, and great variety of dimensions and appearance. My guide informed me that a local antiquary considered that these ledges, which curve into the hill slope towards its base, were formed by the Romans during their occupation of the country (it is about four miles south of the Roman Wall), and they made them serve as a kind of natural amphitheatre; so that, seated on these terrace-ledges, all the cohorts of the neighbouring stations and the native spectators could more easily observe the movements of the Roman galleys in the naval reviews and regattas, which, he conceived, must have often taken place on the bosom of the broad lake beneath, which is now a depression of the dry land by the river margin!

The most feasible of these problematic opinions, however, is, that such terraces were originally intended as lines of entrenchment—field earthworks—thrown up for defence where the enemy might be supposed to be at hand, and in great force. We know that it was the custom of the Romans thus to entrench themselves in their legionary camps (one of which may be seen a little

*Mr. Tate (see *antea.*) observes:—"This, however, is a mere fancy, destitute even of probability." And Pennant, himself, elsewhere conjectures rather inconsistently that the terraces are similar to those made for husbandry in Palestine described by Josephus. Mr. MacLauchlan considers that certain parallel terraces in connection with the Kipple Hill tumulus and the ancient remains of the Camp-field, near Cornhill, on the Tweed, which have between them in some cases natural or artificial depressions for water, are not of an early date, and have been made as "a garden of pleasure," probably in peaceful times—*Notes on Camps in Northumberland*, p. 31–2. See also, for a discussion concerning the "Lynchets," or Shelves of Wiltshire, *Notes and Queries*, Third Series, Vol. VII., pp. 241, 301, 330, 362, 422, 463, and Vol. VIII., p. 59.

to the south of the Steel terraces, and west of the Watling Street, near Four Laws Inn); and this on every successive evening of their march. It has been remarked that, "till the employment of fire-arms in war, it is probable that the manner of occupying ground for military purposes which had been adopted by the Romans continued to be used by the nations formed on the ruins of that empire." The natural obstacles of a country, such as escarpments, were undoubtedly made available in ancient times; and just as the Scottish army occupied the British camp on the Otterburn ridge, before the battle of Chevy Chase, so an army at various times may have entrenched themselves on the wide platform surrounded on two sides by the Birtley terraces, if these terrace-lines existed previously, as I think they undoubtedly did. Though they have not followed the precise Roman pattern of a continuous line of parapet around the site of encampment, we know that as recently as in the wars of the last century, strong defensive works were thrown up in the Austro-Prussian campaigns of the Great Frederick. And again, in the late campaigns of Northerners and Southerners in the United States, the spade was almost as important a military adjunct as the sword itself. As to the Birtley series of terraces, my own first impression, as it would be that of many observers, was in favour of their origin as military defences of an army in the field. When I was asked for my opinion in connection with the Ordnance Survey of the district, a few years' since, I mentioned a probable date, also, for such occupation. That is, the first warlike expedition of the youthful King Edward III., in 1327, whose army crossed over the Tyne, as Froissart informs us,* and remained for some time in a strong position about *twenty-six miles* from Newcastle (an estimate of distance very nearly accurate in this case), hoping to intercept the invading forces under Murray and Douglas on their return into Scotland. I found afterwards, from a conversation with a woodman in one of the glades of Countess Park, that popular tradition endorses the opinion of their military origin. My informant mentioned that his father had a book, now

* Chroniques, Liv. IV., chap. 19. See also Joshua Barnes' "Account of the Reign of Edward III.;" and Rymer's "Foedera," Tom. IV., p. 300 f.f.

unfortunately passed into other hands and lost (it was not the first History of Northumberland, by Wallis, the Curate of Simonburn, as I believed for a time), which told of a great battle having been fought on and near to this terraced escarpment, one army being stationed there, flanking and protecting Birtley (anciently *Birkley*) Castle, the ruins of which are still visible, and the other army occupying the British fort in Countess Park, beneath which we then stood. He added the report that it was at the time when Welsh soldiers garrisoned the castle, and Northumbrians were transferred to the Welsh marches in their stead:—a local reminiscence, perhaps, of the rebellion of the valiant Hotspur, his alliance with the princes of Wales, and his possession of estates at Walwick Grange, and elsewhere, in North Tynedale.* When Lieut. Sitwell, R.E., came to make his final corrections for the Ordnance Survey, I had the opportunity of consulting a competent authority. Though he, like others, decidedly inclined at first to the supposition of their being lines of entrenchment, he soon pointed out many objections to it from a military point of view; the chief of which were the trivial heights, comparatively, of the western terrace-lines for one-third of their length, which would make them useless as a defensive precaution, and especially the broad inclined approach or descending slope at the angle of junction with the southern face, which would never have served as a *redan*, or advanced position, either to aid in the defence or to annoy besiegers in flank. If this supposition (held, too, by our historian, Hodgson,† in regard to such terraces) of their being

*See "Feudal and Military Antiquities," Chap. XIII., p. 261, by Rev. C. H. Hartshorne.

†"History of Northumberland," Part II., Vol. III., p. 402. It may be remarked here that terraces in direct connection with, and immediate proximity to, ancient camps are met with in the valley; but they are of quite a different character from those now under discussion, occurring *as part of the defences* of British forts, and strengthening the ramparts and ditches in such a manner as to prove they were an intentional portion of the original castrametation, in the examples in which they are found.—See Mr. MacLauchlan's Notes, &c., respecting several instances near Keilder, pp. 58, 61, 65, and 68. Dr. Bruce perhaps refers to such a terrace partly encircling the camp on Wall Hill, beneath the rampart on the west and south, which is very marked; though the adjoining *series* of similar ledges, many hundred yards distant, seem also to be alluded to in the following passage:—"Lines of entrenchment may be seen near the summit of Warden Hill, which lies upon the fork of the two rivers, and upon the hill behind the village of Wall, which is seated upon the left bank of the North Tyne. These are probably ancient British Works."—"Roman Wall," 3rd Edition, p. 166.

military earthworks does not hold good of the Birtley terraces, whose rectangular area (completed by an imaginary line on the east and north) would have included nearly eight acres of ground, it must be *a fortiori* much more improbable in the case of any of the other terraced slopes of North Tynedale.

From independent investigation, therefore, I am shut in to the conclusion that they have a different origin from any of these already suggested. That is, *we find in them the early attempts at cereal cultivation of the ancient British inhabitants of the valley.*

Most of us have seen instances of terrace cultivation, if not in our own country, at least in foreign lands. The traveller by the Calais or Boulogne route to Paris is struck by the appearance of the northern declivity of the Somme valley, near Abbeville and Amiens, where the peasants still cultivate the ancient river margins, which are in places parallel to each other, being level terraces of gravel, in patches chiefly of wheat and the vine. These, no doubt, are natural or fluviatile ledges;* but they illustrate the advantage of using such sites, which are more secure from the wasting effects of sudden rains, and more sheltered than sloping soils could be, that, bearing with them the seeds or young plants, might be washed away, and the labour of the cultivators rendered vain. The terraced vineyards on the banks of the Rhine, in Provence, and in Switzerland, as on the southern slopes of the *Jorat*, between Lausanne and Vevay, will also be recalled to mind, as having been expressly formed or made available for culture. Dr. Hooker has described some parallel terraces, more analogous, indeed, to those of Glen Roy, in the upper valleys of the Himalaya mountains.† But elsewhere in India, as in the picturesque district of the Aravulli, in Raj-pootana, Colonel Tod and others have noticed the series of terraces rising

* Compare Sir J. Lubbock's "Prehistoric Times," p. 310.

† "Antiquities of Man," 2nd Edition, p. 261. In the "Proceedings of the Society of Antiquaries of Scotland," Vol. I., p. 127, I find that Mr. R. Chambers illustrates the terraces of Peeblesshire by a reference to similar works, not only in England, France, and Germany, but also in Hungary, Peru, and Palestine. My attention has also been drawn to such instances in the island of Madeira, and in the valley of the Mississippi, by travellers who had observed them. In the latter case the so-called "Ancient garden beds," or Indian corn-hills, may be meant.

up from the mountain's base, sometimes on each side of a valley, if the aspect is favourable, with their rich crops of sugar-cane, cotton, and rice, and their simple but ingenious plans of irrigation. Further eastward, in China, too, such terrace cultivation is spoken of by Du Halde as carried to great perfection; and Dr. Abel, accompanying Lord Amherst's embassy, describes them as occupying the precise position of the North Tynedale culture lines, being confined in a great measure to their ravines, undulations, and gentlest declivities. And here, I may remark, how well their sites coincide with the instructions of Columella, Cato, Varro, Pliny, and Palladius, all the Roman writers, *de re rustica*, agreeing as to the best situation for culture, which has been unconsciously followed by the common-sense instinct of our remote British ancestors. The Rev. Adam Dickson, in his rare book, "The Husbandry of the Ancients,"* translates the remarks of Palladius thus:—"The best situation of lands is not so much on a level as to make the waters stagnate, nor so steep as to make it run off with violence, nor so low as to be buried in the bottom of a valley, nor so exposed as to feel the violence of storms and heats, but that in all these a mediocrity is always best:—champaign lands exposed, and whose declivity affords the rain a free passage, or a hill whose sides gently decline, or a valley not too much confined, and into which the air has easy access, or a mountain defended by a higher top, and thereby secured from the winds that are most pernicious, or, if high and rugged, at the same time covered with trees and grass."† Similar sites to those recommended by their best writers, the Roman conquerors of Britain seem to have used in the neighbourhood of their great towns along the Wall. Speaking of Borcovicus, the "Tadmor of Britain," Dr. Bruce observes, "A little to the south of it, and stretching westward, the ground has been thrown up in long terraced lines, a mode of cultivation much practiced in Italy and in the east. Similar terraces, more feebly developed, appear at Bradley. I have seen them very distinctly marked on the banks

* Vol. I., p. 138, f.f.

† Compare Smith's "Dictionary of Greek and Roman Antiquities," 2nd Edition, p. 45, Art. "Agricultura."

of Rede Water, at Old Carlisle, and other places."* Within late years also much attention has been paid to the terraced slopes of Palestine (built upon parallel ledges on the limestone hills and their escarpments) as a proof of the ancient fertility of the Holy Land, according to the Biblical description, and as a means of future climatal as well as social improvement. After noticing the encircling ledges of the limestone strata, making the hills on the upland plateau between Jerusalem and Hebron to resemble so many "straw bee-hives," and lamenting their present utter barrenness, Dr. Norman McLeod, in "Eastward," adds:—"Yet it is obvious, as has been remarked by every traveller, that an industrious population could very soon transform these barren hills into terraces rich with 'corn and wine.' Were these limestone ridges once more provided with walls to prevent the soil being washed down into the valley by the rain floods, and were fresh soil carried up from the hollows, where it must lie fathoms deep, magnificent crops would very soon be produced. It is well known also," he observes, "how soon the moisture of the climate would be affected by the restoration of the orchards."†

Thus we see that such terrace-cultivation, as we suppose either wholly originated or greatly modified the parallel ledges on the hill slopes of North Tynedale, has been no unusual or peculiar method of securing the "kindly fruits of the earth." Sometimes, as in an example at the junction of the two sources of the River Gelt, in Cumberland (to the east of the terraces I before referred to), we meet with parallel ledges, apparently built up like those of Palestine and other countries, where this mode of culture is

* "Roman Wall," 2nd Edition, p. 192. In the 3rd Edition, p. 191.

† Dean Stanley ("Sinai and Palestine," Chap. II., p. 120) quotes a passage from Dr. Olin's Travels, which clearly shows the necessity of terraces for cereal cultivation where the rainfall is abundant, as it would be in Northumberland, and especially on the flanks of the Cheviot range, when primeval forests, in which the cultivated spots were *mere clearings*, covered the face of the land. "The entire destruction of the woods which once covered the mountains, and the utter neglect of the terraces which supported the soil on steep declivities, have given full scope to the rains, which have left many tracts of bare rock where formerly were vineyards and corn-fields." In Smith's "Dictionary of the Bible," Vol. I., p. 28, Art. "Agriculture," it is said, "The lightness of agricultural labour in the plains set free an abundance of hands for the task of terracing and watering, and the result gave the highest stimulus to industry."

still employed, with low stone ramparts for the more careful preservation of the soil. There appear to be traces of this in the Birtley series, though I would not rest much upon its occurrence. A section of the terrace face in various places would alone make sure of this peculiarity. But wherever those unhewn supporting walls appear, they prove beyond a shadow of doubt the presence of man's handiwork in the origin of such terraced slopes. In the other case, where it was possible for nature to be made subservient, it must be concluded, as Dean Stanley remarks of many instances in the Holy Land, that the sides of the hills have themselves been formed by natural agencies into horizontal, or, as in the Holy Land, "concentric rings of rock," and that these rock ledges must have served in ancient times as supports to the terraces when they were under cultivation.*

The only reasonable objections to the conclusion that our North Tynedale terraced slopes were early culture-plots of a primitive people are these two, and they are not very difficult to meet. One is, that some of the terrace-lines have a frontage which a practical agriculturist of the present day would consider unfavourable, namely, that their aspect is too northerly, so that the cereals would not receive the full benefit of the sun's rays, and that the primitive cultivators could as readily have chosen sites in the immediate vicinity for their excavation, which would not have been open to this objection. The prolonged front of the Birtley series was taken as an instance. But on examining the Ordnance tracing, or larger map of the district, it will be seen that the terrace-lines run with their faces almost west by north, and not north-west, or nearly due north, as supposed by the objector (an authority on such matters); so that even these slopes would bask in the rays of the afternoon sun.† And as all the other terraces have their slopes varying from due south to due west (and most of them have been actually under tillage within the last hundred years) it will be seen that the early agriculturists

* "Sinai and Palestine," Chap. II., p. 138, 3rd Edition.

† The Rev. Mr. Greenwell informs me he has noticed on the Yorkshire Wolds, near Malton, instances of terraces on a great scale, with a northerly aspect, clearly, as he believes, for cultivation.

were at least fair judges, not only of the best elevation midway up the hill slopes, but also of the most favourable aspects for their simple husbandry.

The other objection has been suggested in connection with the smallness of the portion of cultivated ground on the level platforms of the terraces, in comparison with the supposed requirements of the ancient people who formed them. And, indeed, if we were to judge from the data afforded by the social habits and necessities of the inhabitants of the valley in the present day, or even in mediæval times, it would be so valid as to be insuperable. But we must remember that the rude population whom we consider to have used this terrace-culture, though perhaps more numerous than at the present day, were probably only emerging from a state of comparative barbarism. There is every reason to believe that the cleared banks or terraces, then closely surrounded by dense natural woods, represent the whole area of soil devoted to the growth of cereals by the pre-Roman occupants of the rude encampments, the hill forts, and the lowland fastnesses, of which so many vestiges yet remain in the district. Probably they were Celts, not of the earlier but of the later migration—not the Gadhelic but the Cymric branch—who left only occasionally the fishing in the meres and "loughs," or forsook the hunting-field (where they pursued the elk, the deer, the bear, the wolf, and the wild ox—whose remote descendants still exist at Chillingham—in the primeval forests which once clothed these valley slopes and uplands under the Cheviot range) to till these very ledges with such inefficient implements, made, it may be, of stags' horns and crooked branches of trees, as were used by the inhabitants of the lake-dwellings of Switzerland in contemporary times, previous to or in the beginning of the Christian era. Several querns (hand-mills of a primitive form, in one instance of red granite, but usually of hard freestone, for crushing and grinding the corn) have been found on the sites of early British forts in the immediate vicinity of the terrace lines, as in the Warden Hill camp, which encircles about three acres with its triple rampart; and in the High Shield Green camp, opposite to the culture-ledges on Buteland ridge. A most instructive fact is that each group of these terraced slopes, both near Birtley and Wall, is found where the aboriginal, or Celtic vale dwellers, have been most numerous. Broomhope camp-field, and the smaller forts at the Orchard and above the Steel Burn, are near the Steel terraces. The High Shield Green, Countess Park, and Buteland camps enclose two series of such culture-ledges. Around the Birtley terrace-lines are the Mill Knock, the Dene, Carry House, and West Farm forts closely adjoining. Between the last named camp, which lies to the south, and that series of terraces the farmer informs me he discovered, when draining a few years since in the low-lying intervening hollow, a kind of broad road or pavement of stones, about six yards wide, evidently leading from one to the other through what must have been once a very marshy spot. Again, the Swinburne terrace-lines are overlooked by the chain of forts on the Gunnarton Crags, at no great distance; and those near Wall are immediately beneath the brow of the freestone headlands on which a strong British fortress has stood. Within these "camps," as they are usually called, are still to be seen the circular huts or dwellings of those primitive tribes, who lived more by hunting and fishing, like the rest of the inland people of Britain, whom Cæsar describes,* than by cultivating the ground. Here and there, as in the family barrow opened not long since near Warkshaugh, and noticed on a former occasion, we find tangible relics, such as flint knives, and rudely baked and scored pottery, which teach us something

* "De Bello Gallico," Lib. V., Chap. 14. Compare Lyson's remarks, "Our British Ancestors," p. 41, f.f. During the Roman occupation no doubt a much larger area was brought under cultivation by the native tribes dwelling near the Wall and the Watling Street. Mr. Wright, in "The Celt, the Roman, and the Saxon," thinks it probable that the Emperor Julian's corn ships came for their cargoes to the Tyne or the Humber."—Chap. 4, p. 206. On heather-clad wastes, long given up to pasturage, are traces of early cultivation, not in terraces, but in broad furrows. Between the Gunnerton Money Hill foot and Camp Hill (see "Nat. Hist. Transactions," Vol. I., p. 152) I have noticed such vestiges, which local tradition refers, as a farmer whom I met near the spot informed me, to some period "when the Pope of Rome put all the ploughed land in England under his curse, and people then went farther up the slopes of the hills, where the ground had never been under the plough, that they might still get a crop, and be no worse for it!" This curious legend unmistakeably points to the Papal interdict in King John's reign; and it is elsewhere met with, as I find it mentioned by Mr. Wright, and Mr. Sullivan in "Cumberland and Westmorland," p. 245. This ancient tillage of land, which has lain fallow for ages, is more likely to be the work of Roman or subject-British ploughmen.

further of the social life of these pre-historic dalesmen, who seem also to have been in the habit of depositing a portion of the corn grown on these terraces within the burial cist itself (to judge from the pulverised contents of an urn found therein) for the use of their departed friends in their journey to the "unseen land of *Annwn*"—the "happy hunting grounds" of the yet unchristianised Briton.

In conclusion I would wish merely to sum up the process and results of the present enquiry in a few words. We have seen how comparatively numerous are the examples of these singular and much contested terraced-slopes in this southern district of North Tynedale; that, though the era of the glacial drift has left traces of erosive action in the valley, it is very questionable whether such traces are exemplified to any appreciable extent in the parallel ledges now existing; that, moreover, certain peculiarities in their present form militate against the suppositions, equally of their purely natural origin, and of their artifical formamation as military lines of entrenchment. And that, passing by various untenable notions on the subject, we are led to adopt, as the sole remaining alternative, the theory which views them as examples of that terrace cultivation seen to have been in use among many different nations, and well adapted to meet the meagre requirements of the semi-savage tribes who inhabited the neighbouring hill forts and valley fastnesses, probably both in the Neo-lithic or later Stone Age, and in times verging on the dawn of recorded history, as well as afterwards in the Roman-British period. In this inference drawn from separate and independent data, as to its salient points at all events, it is satisfactory to have the strongly-expressed opinions in agreement therewith of several well-known and experienced archæologists,* among whom may be specially mentioned the Rev. W. Greenwell, Mr. Geo. Tate, F.G.S., and Mr. H. MacLauchlan, F.G.S., who have accompanied the writer in an examination of the chief prehistoric vestiges yet existing in the district.

* See the remarks of Sir R. Colt Hoare on this subject, quoted in "The Celt, the Roman, and the Saxon," Cap. 2, p. 88.

III.—*Notes on various Species of Ctenodus obtained from the Shales of the Northumberland Coal Field.* By ALBANY HANCOCK, F.L.S., and THOMAS ATTHEY.

THE curious genus *Ctenodus* was founded by Agassiz on a single specimen of a palatal tooth procured from the compact coal of Tong, and preserved in the Leeds Museum. It was named *C. cristatus*, and was described in his "Recherches sur les Poissons Fossiles," where it is tolerably well figured. He mentions two other species, under the respective names of *C. alatus* and *C. Robertsoni*—the former from Ardwick, the latter from Burdie House; but we can find no specific description of either,* though there is an account and figure of the microscopic structure of *C. Robertsoni*; but these do not assist us at all in determining its specific identity. So far as we are able to ascertain, *C. cristatus* is, then, the only described species of this genus belonging to the Carboniferous system. We are, therefore, gratified to find ourselves in a position to add several new species of *Ctenodus* to the fauna of our Coal-Measures.

During a long-continued examination of the shales in the neighbourhood of Newcastle we have not only procured divers specimens of Agassiz's species, but have also obtained five or six others, all of which are distinguished by well-marked characters. It is our intention to give in this communication short descriptions of the whole of them, reserving for some future occasion more lengthened details of their characteristic features. In the first place, however, a few remarks may be made respecting the fishes to which this beautiful armature belonged.

Agassiz thought they were Placoids; and so they were deemed to be for several years, until Hugh Miller† obtained and described similar palatal plates attached to the roof of the mouth of a small fish belonging to the Old Red Sandstone, which had previously been described under the generic appellation of *Dipterus* by

* From a remark in Agassiz's "Monogr. des Poiss. Foss du Vieux Grèsrcuge," it appears that both species are inedited.

† See "Footprints of the Creator," p. 62.

Sedgwick and Murchison;* thus at once removing *Ctenodus* from among the Sharks and Rays, and placing it in the order Ganoidei. Since that time *Ctenodus* and *Dipterus* have been considered synonymous, and have recently been transferred to a distinct family named Ctenododipterini—*Ceratodus* and *Tristichopterus* being provisionally associated with them.†

There is, nevertheless, some doubt as to the propriety of merging the genus *Ctenodus* in that of *Dipterus*. In the early part of this year (1867) we were fortunate enough to meet with a small fish in the shale at Newsham, which, though in a very imperfect condition, exhibited some features that perhaps should make us pause before we lay aside altogether the generic appellation *Ctenodus*.

The specimen alluded to is proved to belong to this genus by the presence of four dental plates (two palatal, two mandibular), three of which are distinctly displayed in the crushed head, and the fourth is inferentially recognisable. Now the scales of our specimen, which are in a disturbed state, seem to differ considerably from those of *Dipterus*, in which they are described to be perfectly cycloidal; that is, that they are circular and imbricated.‡ In the Newsham species, which is named in the sequel *C. elegans*, though they must be considered also of the cycloidal type, yet they are not truly so, notwithstanding that they are imbricated. When detached they are seen to be parallelogrammatic in form, with the posterior or exposed end well rounded, the anterior only slightly arched; the sides are nearly parallel, being a little inclined inwards or hollowed; in length they are nearly twice their breadth. Some few, however, differ very much from the above description, being shaped like a battledore. These have the posterior half greatly enlarged and rounded, the anterior portion being much narrowed and truncated. They are all thin and delicate, but large for the size of the fish, and are minutely grooved or plaited from end to end, the ridges being

* "Transactions Geological Society," Ser. 2, Vol. III. (1835).

† " Huxley, "Memoirs of the Geological Survey," Decade 10, p. 24.

‡ Fred. M'Coy, "Synopsis of British Palæozoic Fossils," p. 591.

very finely denticulated and curved towards the centre of the rounded extremity, where they become confused and irregularly nodose. Thus in the centre of the exposed portion there is a sort of rosette, which is defined posteriorly by incomplete concentric wrinkles; a few similar wrinkles or marks of growth extend to the anterior extremity. The whole surface is covered with a coating of enamel, which considerably obscures the markings. On the exposed extremity the enamel is thickened and is very finely granulated, but here it is never perfect, the greater portion of the ornamentation being always exposed; or, at least it is so in our specimen. The under surface of the scale is also grooved lengthwise, but with great inequality, and the grooves are so strongly and irregularly pitted that the ridges which bound them are distinct only at the margins.

On the whole, then, it is evident that the scales of our fish differ considerably from those of *Dipterus*, in which they are described as nearly circular when detached; the sculpture or ornamentation of the surface also seems to vary. There is likewise another and perhaps more important difference found in the dental plates. In *Ctenodus* these plates are what the name implies—solid expansions of dense matter apparently composed of dentine and bone; and the ridges are equally solid outgrowths of the surface of the plates, bearing tubercles or denticles; or, in other words, the plates are covered with denticulated ridges. In *Dipterus*, on the contrary, the dental organs are uniformly spoken of by Hugh Miller as "patches of palatal teeth;"* and Agassiz describes the ridges or "carinæ" of specimens obtained in the Old Red Sandstone of Russia as "composed of series of imbricated and articulated teeth;"† and the figures representing them entirely confirm the description. In the *Ctenodi* this arrangement cannot be said to exist, though there are in a few of the species slight traces of something of the kind, particularly in *C. elegans*.

It may, however, be doubted how far such characters should

* *Op. cit.*

† "Monographie des Poissons Fossiles du Vieux Grès-rouge," troisième livraison, p. 123, Tab. XXIII.

be considered of generic importance. They point out, nevertheless, the propriety of retaining for the present, at least, until more is known respecting them, the generic appellation of *Ctenodus* for our Coal-Measure Ctenododipterini.

The body of the Newsham specimen is not well defined; but as far as the general characters can be determined, they agree with those of *Dipterus*. The head is apparenly round and short, being about one-fourth the length of the entire fish, which is three inches long; and it exhibits in a distinct manner the under side of the basisphenoid and the præsphenoid bones united together. They assume the form of a rhomboidal plate, with a flattened process extending from the anterior and posterior angles; the bones bearing the dental plates have been displaced. The two opercula, which are each formed of a single piece, are equally distinct; they are thick and well-rounded, being only slightly elongated transversely, and have the upper or hinge-margin flattened, the surface irregularly granulated, punctured, and enamelled. The tail is in a confused state; but there can be little doubt that it is heterocercal, of the rhomboidal type. And there are traces of an anal and a ventral fin immediately before the caudal; but it is impossible to say whether or not they are lobed. There are a few slender curved bones scattered about behind the head, which have the appearance of ribs; these, and the bones of the head alone have been ossified; the vertebræ have all disappeared.

Such is the description of the *C. elegans*, so far as it can be determined by the imperfect remains of the specimen in our possession. That it is specifically distinct from the Old Red Sandstone species is evident enough; and it seems quite probable that it even differs from them generically. It is much smaller than most of the *Dipteri*, though it is apparently not full-grown, as the teeth are considerably smaller than the largest specimens of them belonging to this species in our possession; and, on account of its minuteness when compared with the largest species of *Ctenodus* from the Coal-Measures, there is some doubt whether it may not be generically different also from them. It is not more than three inches long, as has been already stated, while three at least of the larger species cannot be less than four or five feet from head to tail. The sphenoid bones previously mentioned of *C. elegans* are together about half-an-inch long; the same bones of the large species alluded to must have been at least eleven inches in length.

From the fragments of a large sphenoid and palatal bones in our possession, it is possible to restore this portion of a skull that probably belonged to *C. cristatus*, which is not the largest species; and we are thus enabled to form an approximate estimate of the size of the head, which must have been upwards of twelve inches long and nine broad. Therefore, assuming the proportions to be similar to those of *C. elegans*, we arrive at the conclusion that these large *Ctenodi* were not less than four or five feet in length.

This estimate of the size of these animals receives some support from the fact that very large opercular plates occur in the same shales in which the palatal armature is found. We have in our possession six or seven different kinds of opercula, all having the essential characters of those found in connexion with the head of *C. elegans*; that is, they agree with them in the roundness of their form, in being composed of a single solid piece, and in the surface-granulation and enamel. So similar are they, indeed, to those of the small species (*C. elegans*) that it is impossible to deny the high probability of their having belonged to species closely allied to it; and at the same time they are readily divisible into species.

The largest of these plates is 5½ inches in diameter; it is almost orbicular, with the hinge-line flattened, and with a rounded process projecting a little at each end limiting its extent: three or four specimens of this large operculum have occurred. The next in size, of which we have two specimens, is four inches across its longest diameter; it is considerably elongated in the transverse direction, being pretty regularly oval; the hinge-line is straight, and strongly defined by two lateral processes. The third operculum is 2½ inches in diameter. It has a finely granulated surface, and the contour is circular and somewhat sinuous; the hinge-line is well defined by two rather acute processes, and is longer than usual. Another orbicular species, about the same size, has the margin less sinuous, and the hinge-line shorter and not so well marked by lateral processes. Besides the above, one or two much smaller but rather obscure kinds have occurred, as well as separate plates of *C. elegans*. And one belonging to *C. obliquus* has been found connected with the palatal teeth and scales. This and the scales will presently be described, along with the oral armature of that species.

Now, should it be denied that these large opercular plates belong to the *Ctenodi*, it may be asked to what other fishes of the Coal-Measures can they be assigned? *Rhizodus*, *Rhomboptychius*, and *Megalichthys* are the only large species that occur to which they could, with our present knowledge, belong. The other large Coal-Measure fishes are all Placoids, and are therefore out of the question. *Rhizodus* and *Rhomboptychius* are, however, apparently closely allied to *Holoptychius*, in which the operculum is composed of more than one piece; and in the former, therefore, the gill-cover is in all probability similarly composed; while in *Megalichthys* the character of the enamel and form of the operculum sufficiently prove that the large opercula above alluded to cannot belong to it.

In the same shales likewise occur strong well-arched ribs, the largest measuring six or eight inches in length. These also probably belong to the larger *Ctenodi*; and this probability becomes almost confirmed when we refer to the fact of the ossification of the ribs in *C. elegans*, and that the proportion they bear in this species to the length of the fish is just about the same that those large ribs bear to the larger *Ctenodi*, which have been already estimated at four or five feet long. These ribs cannot have belonged to any of the other large species of our Coal system, as none of them have, as far as known, ossified ribs; neither can they be assigned to *Campylopleuron*, a new genus recently proposed by Professor Huxley* for some large Coal-Measure fishes found in Ireland, which have not only ossified ribs, but have also large opercula. These opercula, however, being

* "Geological Magazine," Vol. III., p. 166.

"characterized by a raised longitudinal rib," differ from those of *Ctenodus*, which have no such process or "rib."

All the tooth-plates described in the sequel of this communication have such a general resemblance to each other that there can be no doubt of the close relationship of the fishes to which they belong. And, moreover, the bones to which many of them are found attached closely resemble each other. The palatal tooth (or that which has been so designated) is seated on a broadish flattened bone, which, with one exception, is never more than twice the length of the tooth, and is usually considerably shorter; and it is always much expanded at the posterior extremity. This is probably a maxillary bone; and the two branches, when united, have much the appearance of an upper jaw. The propriety, therefore, of calling these palatal plates or teeth may be questioned. The homologies, however, of these parts must be left for the present untouched.* The mandibular tooth is always much narrower than the palatal; and the branch of the mandibulum on which it is placed is not so wide as the bone supporting the palatal tooth, neither is it so much expanded at the posterior end; it is, however, strong and rather massive.

There are two species that have the surface of the teeth with smooth ridges not tuberculated or denticulated, as they are in all the other kinds. These two have consequently some resemblance to the palatal plates of *Ceratodus*, apparently a closely allied form. When further research shall have thrown more light on these obscure species, it will then be time enough to consider the desirableness of dividing this apparently natural group into separate genera.

We shall now conclude this brief communication with concise descriptions of the various dental plates that have come under our observation, retaining the denomination of palatal plates or teeth for the upper pair, though the bones to which they are attached have all the appearance of maxillaries, and so they will be named in the following descriptions.

* This matter is undoubtedly discussed in Professor Pander's "Monograph on the Ctenodipterini;" but we have not seen that important work.

1. Ctenodus cristatus, *Agassiz.*

Poissons Fossiles, Vol. III., p. 137, Pl. XIX., fig. 16.

Tooth plate-like, rather thin, irregularly elliptical, inclining to ovate, $2\frac{1}{4}$ inches long, $1\frac{1}{8}$ inches broad; the upper surface somewhat hollowed or concave; the inner margin well arched, the outer much less so; the whole surface is covered with twelve close-set transverse ridges, which are studded from end to end with closely arranged conical tubercles; the ridges increase in size as they approach the outer margin, and, being inclined towards the anterior and posterior margins, assume a tendency to a radial disposition; the grooves between the ridges are angulated; the tubercles are perfect only at the outer margin, where they are covered with a coat of brilliant enamel, and here they are seen to have the outer face flattened, the base of each tubercle or denticle being subtriangular; elsewhere they are much worn and somewhat compressed at the sides in the direction of the ridges, the whole surface of the tubercles and ridges exhibiting a coarse irregular granulation.

The above description is of a palatal tooth which has the entire right ramus of apparently the maxillary bone attached. The tooth itself is considerably more than half the length of the bone, the posterior extremity of which is very wide and truncate.

Four or five other specimens have occurred, but they are considerably worn, the tubercles in some instances having almost disappeared; two are mandibular, two palatal; the former are very much narrower than the latter.

There can be little doubt that this is Agassiz's species, though our specimens are scarcely so broad as that represented in the "Poissons Fossiles," and they have likewise the posterior margin a little more produced. All the specimens are from the band or dark shale overlying the Low-Main Coal Seam at Newsham.

2. Ctenodus tuberculatus, n. sp.

Tooth plate-like, thick, with an irregular ovate outline, $2\frac{3}{4}$ inches long, $1\frac{6}{8}$ inches broad, the narrow end posterior; the inner margin gibbous or angulated in the centre; the outer margin a little convex; the surface is slightly convex, and is furnished with twelve or thirteen deep, sharp, parallel, approximate ridges, which are strongly tuberculated towards the outer margin, and divided by narrow, deep, angulated grooves; they are arched posteriorly, and enlarged towards the exterior border, but do not at all assume a radial arrangement; the anterior ridge, which is wider than the others, is reflected and prolonged for some distance beyond the outer margin; the tubercles are conical, with obtuse points; those next the external border are coated with shining enamel, and are well produced.

The mandibular tooth differs from the palatal in being narrower, and is so convex as to resemble the longitudinal section of a cylinder; the two or three anterior ridges, too, are much shorter than the rest, the inner margin sloping rather rapidly away in front.

There are half-a-dozen of this species in our collection, all of which were obtained at Newsham; and in the Newcastle Museum there are two others, which were likewise procured from the same locality, and are from the collection of G. B. Forster, Esq. They are all in excellent condition, agree perfectly well in every respect, and can be at once distinguished from *C. cristatus* by the deep and sharp ridges and by the form of the tubercles, which in *C. tuberculatus* are always exactly conical (when they are in a fresh state) at the outer margin. When worn, however, they are flattened at the sides in the direction of the ridges; and then they are wedge-shaped, and they and the whole of the ridges become granulated.

3. Ctenodus corrugatus, n. sp.

Tooth plate-like, thin, subtriangular, three inches long, two inches broad; the surface is slightly convex, and raised into nine stout somewhat irregular rounded ridges or wrinkles, the grooves dividing them being wide and rounded; the ridges die out towards the inner and outer margins, but are enlarged a little as they approach the external border, and are indistinctly and irregularly tuberculated; the inner margin is nearly straight, the outer slightly convex, the anterior slopes forward from the inner margin, and the posterior is produced and rounded. The whole surface is strongly and irregularly punctured.

We have seen only one specimen of this fine large distinct species; it is a palatal tooth, and is in a very good state. It was obtained from the Collingwood Main Pit, and was presented by George Johnson, Esq., to the Newcastle Museum. It is readily distinguished from its allies by the fewness of the ridges, by their roundness and wide separation, as well as by their greater size and general form.

4. Ctenodus obliquus, n. sp.

Tooth depressed, lanceolate, $1\frac{1}{2}$ inches long, $\frac{5}{8}$ths of an inch broad; *the inner margin regularly and much arched*, the outer only slightly curved; the surface with six or seven strong, compressed, sharp-edged ridges, placed transversely in a somewhat radiating manner towards the outer margin, where, being enlarged, they are curved downwards and denticulated; the anterior ridges are very oblique, being much inclined forwards; the denticles or tubercles are much compressed in the direction of the ridges, and are lancet-formed, with sharp points; they are coated with brilliant enamel in finely preserved specimens. The above is the description of the palatal tooth; the mandibular is narrower than the former, and is broadest in front, tapering pretty regularly to the posterior extremity; the anterior ridge is very wide, and much produced beyond the outer extremities of the others, and they are all more curved downwards than those of the palatal tooth.

This is a very distinct form, and cannot be confounded with any of the other species. We have collected between forty and fifty specimens of it, most of which were procured from the Low-Main shale at Newsham; the rest are from Cramlington. Many of them have the jawbone attached in a very perfect condition. The palatal tooth is a little more than half the length of the bone, the posterior extremity of which is much expanded and truncated. The mandibular bone is not much widened posteriorly, and is about half as long again as the tooth.

The specimens vary much in size, the largest being a little over $1\frac{1}{2}$ inches long, while the length of the smallest is not more than $\frac{3}{8}$ths of an inch. The former has seven ridges, the latter six; so that it is evident that age does not make any material change in this respect. This is highly satisfactory, as we can with greater assurance assume that the number of ridges is a good specific character.

The anterior portion of a fish of this species has occurred at Newsham, exhibiting one of the gill-opercles and two of the dental plates with the denticles interlocked; numerous scales are also displayed, but they are in such a mashed-up state that the characters cannot be determined with precision. Enough, however, is seen to show that they agree with those of *C. elegans*, though the ridges or plaits ornamenting the surface are not so numerous, and are considerably coarser; the rosette, too, in the centre of the exposed portion is not so conspicuous, and seems to be smaller. The opercular plate, which is upwards of an inch across its longer diameter, and a little more than $\frac{3}{4}$ths of an inch in the other direction, is thick and irregularly ovate, with the margin sinuous; the hinge-line is long, and has a slight projection in the centre; the surface is strongly punctured and granulated.

5. Ctenodus elegans, n. sp.

Tooth depressed, triangular, upwards of $\frac{3}{8}$ths of an inch long, and $\frac{3}{16}$ths of an inch broad; the inner margin is produced and angulated in the centre, whence it slopes in front and behind towards the outer margin, which is gradually but slightly arched; the surface is provided with eight strongly denticulated ridges, which radiate from the inner marginal angle, where they are very minute, to the outer border; the anterior ridge is a little produced at the outer margin beyond the rest; there are six or seven denticles or tubercles on each ridge; they are much compressed at the sides, are sharp pointed and lancet-like, with the inner limb a little shouldered, where there is occasionally a minute toothlet;

the denticle and ridges are coated with enamel, and shine very brilliantly.

There are sixteen specimens of this minute species in our collection; they were obtained at Newsham and Cramlington.

The mandibular tooth is very similar to the upper one, but is a little narrower; the latter is somewhat more than half the length of the maxillary bone, the posterior extremity of which is not much enlarged, and is diagonally truncated.

This is the tooth before alluded to as having been found in connexion with the head of the entire fish, of which a general description has already been given. It is therefore unnecessary to say more respecting it on the present occasion.

6. Ctenodus imbricatus, n. sp.

Tooth depressed, very thick, hollowed or slightly concave, 2¼ inches long and upwards of an inch broad, with the inner margin well and regularly arched, the anterior slope being much longer than the posterior; the outer margin is nearly straight, but on account of the projection of the surface-ridges is coarsely denticulated; there are six of these ridges or plaits; they enlarge rapidly towards the outer margin; they are strong, smooth, and somewhat distant from each other, and, though mostly inclined forwards, are laid over towards the posterior end, having an imbricated appearance; the grooves dividing the ridges are angulated; the surface is minutely granulated, and the edges are enamelled. The mandibular tooth is very narrow and fusiform; the ridges are not imbricated, and the grooves are scarcely angulated.

This species is not common: we have found only six or seven specimens of it; they were all obtained at Newsham. Two of these, an upper and a lower, are large and in an excellent state of preservation; the others are quite small, but, like the large ones, have six ridges, and agree with them in every particular.

This, and the following species, have some resemblance to

Ceratodus, but correspond in every respect to *Ctenodus*, except in the deficiency of tuburcles or denticles on the ridges.

7. Ctenodus ellipticus, n. sp.

Tooth flattened, thin, elliptical, $1\frac{3}{8}$ inches long, and $\frac{3}{4}$ths of an inch broad; the inner and outer margin irregularly arched; the surface with five transverse, smooth, distant, angular ridges, increasing in size towards the outer margin; the furrows are wide and round, and the anterior and posterior margins of the tooth are extended a little beyond the ridges before and behind; the whole surface, including the ridges, is minutely punctured. The mandibular tooth is narrow with the inner border gibbous; in other respects it agrees with the upper or palatal tooth.

The maxillary bone is considerably more than twice the length of the tooth, and has the posterior extremity greatly expanded and truncated.

Five or six specimens of this tooth have come into our possession. They occurred at Newsham, and are all fully developed and in good condition.

This well-characterized species is not likely to be mistaken for any of those above described. The only one with which it might possibly be confounded is *C. imbricatus*; but the comparative thinness of the plate and the non-imbrication of its ridges sufficiently distinguish it.

IV.—*Notes on the Remains of some Reptiles and Fishes from the Shales of the Northumberland Coal Field.* By Albany Hancock, F.L.S., and Thomas Atthey.* (Plates I., II., III.)

The coal shales of the Low Main Seam at Newsham and Cramlington, near Newcastle-upon-Tyne, so prolific in fish remains, have also yielded some very interesting reptilian fossils, the

* Read at a Meeting of the Natural History Society of Newcastle-upon-Tyne and Tyneside Naturalists' Field Club, March 12, 1868.

J. Basire lith.

largest and most important of which are the posterior and upper portions of two crania that are undoubtedly Labyrinthodont. These are apparently closely related to *Loxomma Allmanni* described by Prof. Huxley in the Proc. Geol. Soc., Vol. XVIII., p. 291 (1862), though apparently generically distinct from that form. Two sets of sternal plates have also been found in the same locality, as well as several ribs, a few vertebræ, two of which have the neural arch complete and most of the processes attached. Several premaxillaries and three or four portions of mandibular bones, with the teeth attached, have also occurred. All these most probably belong to the same large Labyrinthodont Amphibian.

Besides the above interesting remains, an almost entire individual of a new species of *Ophiderpeton*, Huxley, has occurred, as well as several other fragmentary reptilian fossils. And what we now propose is, to give in the following pages more or less detailed descriptions of all these, and likewise of some fish remains that have been found in the same locality.

PTEROPLAX CORNUTA, nobis.

The two cranial fragments of the reptile designated as above are each composed of the two quadrate supra-occiptals, the two parietals, portions of the elongated frontals, the post-frontals, and the epiotic bones, all of which are firmly united into one great pyriform shield by well-knit serrated sutures, which can be traced with sufficient accuracy. This shield corresponds very well in form to the central portion of the fragmentary skull figured in the paper already referred to, by Prof. Huxley; but in the new form it is less angulated. The frontals, too, appear to be longer, though their anterior extremities are broken away; the post-frontals are arcuated in the same manner, but not to the same degree, forming the inner posterior boundary of the large orbits, and their connexions with the parietals and frontals are similar. The parietals widen backwards; and the foramen, which is situated in the line of the median suture, where there is an elongated eminence, is a little behind their centre, and is slightly lengthened in the antero-posterior direction. In the larger specimen it is ¼th of an inch in length; in the other it is a little shorter. The occipital margin is concave, the epiotic bones projecting boldly backwards, and each terminating in a slightly arched, pointed, diverging horn or spine, about an inch long. In neither specimen are these horns (which are very similar to the "postero-internal cornua" of *Keraterpeton**) perfect; but in the smaller individual the upper surface only is wanting.

The external surface of the cranial shield is strongly sculptured in the usual manner observed in Labyrinthodonts; that is, it is covered with anastomosing ridges separating pits and grooves. But this peculiar ornament is not equally distributed; it radiates from the centre of the shield, where it is almost obliterated, and is strongest at the margins. Here the pits and grooves are deep and strongly defined. A rather wide rounded groove extends along the outer margin of the frontals, resembling the mucus grooves of the Labyrinthodonts.

The larger of these shields is seven inches long, including the posterior horns, and 3¾ inches wide. The other is 6¼ inches in length, and nearly three inches wide at the broadest part. Prof. Huxley estimates the width of the skull of *Loxomma Allmanni*, including the lateral portions, which are entirely wanting in our specimens of *Pteroplax cornuta*, at 10¾ inches; and as it appears that the central portion, or that which corresponds to the cranial shields above described, is about one-third the entire width, we are enabled to form an approximate estimate of the width of the skull of the new form, on the assumption that it had similar lateral cranial expansions. On this basis our new Labyrinthodont must have had a skull 11¼ inches wide at the posterior or widest part; and, following up Prof. Huxley's estimate, it could not be less than 15 inches in length. If the body, therefore, was only seven times the length of the cranium, which is about the proportion of these parts in *Keraterpeton Galvani*, a comparatively short species, then *Pteroplax* must have been eight or nine feet long.

This new genus, though it seems, as above stated, to be nearly

* "Transactions" Royal Irish Academy, Vol. XXIV., "Science," p. 351, Plate XXI.

related to *Loxomma*, resembles not a little, in the general form of the skull, as far as it can be determined, *Dasyceps Bucklandi.** The concavity of the occipital margin and the two lateral cornua are very similar in both species; but in the latter, these processes or horns are more robust, and do not look so spine-like as in *Pteroplax cornuta.* The proportions and forms of the component bones, too, are very different; and the parietal foramen in *Dasyceps* is much nearer the occipital margin, as are also the orbits, which are likewise very much smaller. The resemblance, also, of these cranial bones to those of *Keraterpeton* cannot be overlooked, so far as they can be compared. The general form of the crown of the head, with the narrow projecting frontals and concave occipital margin, together with the "postero-釘ernla cornua," are all remarkably alike in the two forms; but, from the deficiency of surface sculpture in that animal, and its comparative smallness, it would seem that they cannot be considered congeneric.

Four left premaxillaries have been obtained; and all of them have a portion of the nasal bone attached, as well as several teeth more or less perfect. The premaxillary is about 2½ inches long, and upwards of half-an-inch wide; it is arched most strongly towards the anterior symphysis, which is oblique and coextensive with the width of the bone; behind it is prolonged, the articular portion being wedge-shaped; the surface is strongly sculptured into elevated anastomosing ridges and depressions; and they all exhibit two strong, wide, round grooves on the external surface, one of which passes from the front, the other from behind, converging and meeting at nearly a right angle, close to the alveolar margin. These grooves are similar to what have been denominated mucus-grooves in the Labyrinthodonts, and are exceedingly like those figured and described by Prof. Owen on the muzzle of *Labyrinthodon leptognathus.*† And in this instance they seem to indicate the boundary of the nasal bone, which is apparently of a lozenge form, probably somewhat prolonged backwards. Half the circumference of an external

* "Memoirs" Geological Survey, 1859, p. 52.

† "Transactions" Geological Society, Ser. 2, Vol. VI., p. 417, Plate XLIII., fig. 1.

nasal orifice is distinctly perceptible in two of the specimens; it is circular, and about $\frac{1}{4}$th of an inch diameter. The two must be placed considerably apart from each other, and not much in advance of the posterior margin of the nasal bone; at least it is only a short way in front of the posterior mucus-groove.

There are five or six conical teeth in each premaxillary; they are stout, grooved, and circular at the base, with the crown compressed in the direction of the length of the jaw; they are provided with wide cutting edges, and are rather abruptly pointed. The largest are upwards of half-an-inch in length, allowing for their lost apices. The three anterior are much larger than the rest, and they are placed at some little distance apart, there being large depressions between them in the alveolar groove, apparently for the reception of the crowns of the mandibular teeth. The two or three posterior teeth are comparatively small, and are placed nearer together than the anterior.

Two specimens of the anterior portion of the left mandible have also occurred, the largest and best preserved of which is four inches long, and about $2\frac{1}{4}$ inches wide. The surface exhibits the same ornamentation as the other bones. The symphysial surface is perfect; it is considerably longer than the width of the ramus, being extended by a process from the inner or lower margin of the bone; there is a trace of a mucus-groove along the inferior border of the ramus. None of the teeth in these specimens are perfect; but enough is left to show that they are similar to those already described. The first tooth is small, and is placed close to the symphsis; the second is very large, and is immediately behind the first; it is half-an-inch in diameter at the base; a large depression $\frac{3}{8}$ths of an inch wide, succeeds this, and then four small teeth placed close together, the two posterior of which are larger than the anterior pair, but one of them is indicated only by a mere fragment of dentine; then comes another large depression, half-an-inch wide; but whether or not this is for the reception of the crown of a maxillary tooth, or is the impression of the base of a tooth belonging to the mandible, it is difficult to say. Close to this depression is the base of another tooth equal in size to the large anterior one. At this point the alveolar groove is broken away; and shortly after, the fragment of the ramus terminates. The aveolar groove is distinctly defined, but widens inwardly to accommodate the bases of the large teeth, which consequently have the appearance of being placed within the smaller ones; they form, however, with the latter, only a single row, and the outer borders of all are placed on the same external line. The other ramus is very imperfect; but, as far as they are traceable, the teeth have the same arrangement.

Besides the above, we have also obtained from the same locality portions of three other mandibles: one belongs to the left ramus, and is in a bad condition; two are in a good state of preservation, but, unfortunately, they both represent the same portion of the right ramus, the anterior part of each being wanting, as also the proximal extremity. They each measure about six inches in length, and widen a little backwards, where they are 2½ inches broad. If we add to the length of these fragments that of the anterior portion before described, and allow for the parts that are wanting, it would appear that the ramus could not be less than 12 or 13 inches long. The internal cartilage having been removed, the lateral bony walls have collapsed and are inclined inwards. The jaw is consequently comparatively thin and flattened. The external surface exhibits the peculiar ornamentation in a very beautiful manner. It is the same as on the other bones, the sculpturing extending over the whole surface in the form of smooth elevated ridges composing an irregular reticulation, with the meshes or depressed spaces deep and of various forms, frequently angular, sometimes rounded, but most commonly elongated; so that the reticulated ridges, on the whole, have a somewhat dendritic appearance. This striking embossed ornament closely resembles that of *Labyrinthodon leptognathus* and *L. pachygnathus;* only it is considerably finer.* The inner surface of the bone is smooth, as well as the external border of the alveolar ridge; and there is a groove along the lower margin extending the whole length of the fragment.

*See Prof. Owen's Paper, "Transactions" Geological Society, Ser. 2, Vol. VI., Plates XLIII., XLVI.

The teeth exhibit very distinctly on the upper portion or crown the wide, compressed, sharp cutting edges, and on the base the strong fluting or grooves. In several, the points are quite perfect, and are decidedly lancet-shaped. The teeth are anchylosed to the bottoms of shallow pits in the not by any means deep alveolar groove.

In one of the fragments there are seven teeth; in the other, four perfect and three imperfect. In the latter the anterior tooth is a little more than half-an-inch long, and the others gradually diminish in size backwards, and are placed considerably apart from each other, the spaces between them being nearly $\frac{3}{8}$ths of an inch wide. In the other fragment the four most perfect teeth appear to be situated at the posterior extremity of the alveolar groove, though the jaw is continued for a considerable distance behind them. The anterior of these four is not quite half-an-inch long, and the others diminish gradually in size posteriorly, the last being not much more than half that length; but its extremity is not quite perfect. The three imperfect anterior teeth are very much larger than the four posterior ones; the largest of them, which is the centre one, cannot have been less than an inch in length, and $\frac{3}{8}$ths of an inch wide at the base. They are all placed considerably apart from each other; but they are not quite so widely separated as those in the other fragment.

We have two other fragments of jawbones of this reptile; but they are in such an unsatisfactory condition that not much can be said about them. One of them, however, is probably a maxillary bone; it is $6\frac{1}{2}$ inches long, and $1\frac{1}{2}$ inches wide; but it is so imperfect that its form is not determinable, and it is much encumbered with other bones. A portion of the alveolar border is nevertheless distinctly displayed, with five close set teeth, the largest of which is upwards of half-an-inch long. Other fragments of teeth are scattered about. We have also a confused mass of apparently cranial bones, which show the peculiar surface sculpture. A portion of a jaw with a tooth or two is mixed up with these fragments.

For some time these portions of mandibles were all supposed to belong to *Rhizodus lanceiformis*, Newberry, as the teeth attached to them are undoubtedly similar to those of that reputed fish. But on considering that the sculpture of the bone surface is exactly like that of the cranial and premaxillary bones, that the teeth of the latter are similar to those of the mandibles, and that the teeth of both exhibit precisely the same Labyrinthodont structure when examined in transverse section, the conclusion that these mandibular fragments really belong to this new Labyrinthodont is quite irresistible. The piscine nature of *R. lanceiformis* is therefore questionable. Certainly the teeth usually so designated belong to this reptile; and unless other evidence be forthcoming this reputed species of *Rhizodus* will have to be erased from the list of Carboniferous fishes.

The two sets of sternal plates are characterized by the same surface ornament which we have found on the other bones; and though neither of them is perfect, sufficient is preserved to enable us, by the aid of both, to form a very good idea of their shape and characters. In the finer and larger specimen all the three plates are present, and by their position exhibit, though considerably displaced, their relation to each other. The posterior ends of the two lateral plates lie in juxtaposition, overlapping the anterior portion of the central plate, and diverging backwards; a portion only of the posterior margin of the central plate is exposed. By removing the matrix, however, from the underside in both specimens, the entire form of this plate is developed. The arrangement and general appearance of the three plates are very similar to those of *Loxomma Allmanni*, figured by Prof. Huxley in the paper already referred to; only the central plate is not so much produced posteriorly, and the lateral ones are much more elongated, agreeing apparently in this latter respect with *Archegosaurus*, in which Prof. Owen remarks that the lateral plates "are shaped like beetles' elytra."* Those of *Pteroplax* certainly resemble in form elongated elytra; but, unfortunately, these plates are not perfect; even in the best preserved specimen only the posterior extremities are entire; they are rounded diagonally, the slope being apparently upwards and outwards. What remains of the most perfect plate measures

* "Palæontology," p. 179.

upwards of seven inches in length, and $\frac{3}{4}$ths of an inch wide. That which seems to be the external margin is thicker than the inner or opposite margin; and here the surface sculpture, which is like that of the other bones, is strongest.

The central plate, which in Labyrinthodonts is usually rhomboidal, is peculiar in form; the two lateral angles are much produced, forming broad rounded lobes or wings (hence the generic appellation); their anterior margins have a sigmodial curve extending to the anterior angle; the posterior margin is almost straight, but is a little produced in the centre, where there is a broad flat process extending backwards; this, however, is not perfect in either specimen. Here the plate is thickest, and on the surface there is a strong sinuous ridge which extends transversely from side to side, just a little in advance of the posterior margin. When the lateral plates are in their proper position, their posterior extremities would, no doubt, rest against this ridge, the anterior extremities converging forwards. The central plate is upwards of four inches long and $6\frac{3}{4}$ wide. The surface is not sculptured in the usual manner, and must be almost entirely overlapped by the lateral plates.

The other set of sternal plates is very imperfect. The characters, however, of the central plate are well developed; and it fortunately happens that while the right lobe of this plate in the former specimen is imperfect, the right lobe of this is quite entire, the other one being injured; so that, by the aid of the two specimens, the form can be perfectly restored.

The two vertebræ with the neural arches complete are in a very good state of preservation. The centrum is quite perfect in one, and almost perfect in the other; and between the two all the processes can be determined more or less completely. They were found at Newsham, but at different times. These very interesting relics closely resemble the figure of the vertebra of *Anthracosaurus* given by Professor Huxley in the "Journal of the Geological Society," 1863, Vol. XIX., p. 63. Our specimens, however, are larger; the neural arch differs a little in form, and there is a very minute notochordal foramen. The body or centrum is biconcave, and appears to be considerably flattened lengthwise. The margins of the articular surfaces are reflected, so that in section the faces of the body would present a sigmoid curve from the centre to the margin. The height is a little more than the breadth, and the circumference at the sides and below is well rounded, though there is here and there a tendency to angularity; but whether this arises from original conformation or from accidental and unequal reflection of the margin, cannot be determined. The upper margin of the anterior face is produced a little in the centre, forming a rounded elevation immediately below the neural arch, and is angulated at the flanks. The same region in the posterior face presents a shallow concavity, exactly similar to that represented in Prof. Huxley's figure referred to.

The sides of the body are somewhat concave, and transversely wrinkled or coarsely striated. The minute notochordal foramen, which is only large enough to admit a stout knitting needle, is difficult to determine, though there can be no doubt of its existence.

The neural arch is comparatively small; it is oval, the long axis being perpendicular. The lips of the arch are produced a little in front; behind they do not appear to be so. The walls of the arch are very stout and pass upwards to form a long high spinous process, which is nearly as high as the centrum, and is thin, being much compressed laterally.

The anterior zygapophyses are large; their articular surfaces are hollow and elongated transversely; their inner borders are confluent.

The posterior pair are much distorted; but they appear to form wide transverse articular surfaces, the faces of which look downwards.

The transverse processes are perfect in neither vertebra, though in one of them the extremities only are lost; they are broad and much compressed from front to back, and originate apparently in the sides of the neural arch and the upper surface of the centrum. They project almost horizontally; but so much of their extremities is wanting that there is no distinct evidence that they are divisible into an upper and a lower portion, corresponding to the head and tubercle of the rib. The upper portion, however, is thicker than the lower.

The measurements of the larger vertebra are as follows:—

	Inches.
Height of the body of the vertebra	1·9
Transverse diameter	1·8
Length	0·8
Height of neural arch	0·4
Height of spinous process	1·7
Length of ditto	1·0
Thickness of ditto	0·2
Width of transverse process	0·7
Thickness of ditto	0·3

Several other well ossified vertebral centra have occurred at Newsham; they have all, however, lost the neural arch and most of the processes. Some, having a minute notochord, probably belong to *Pteroplax*: and two in particular, one of which is 1½ inches high, and about the same wide, agree perfectly well in form with the two above described. These have on the upper surface two peculiar, wide, arched, transverse, sessile processes or lobes, with the anterior faces a little hollowed. There can be no doubt that these belong to this Labyrinthodont, and are probably caudal vertebræ.

There are three or four other vertebræ, quite as large as the above, with a notochord nearly half-an-inch wide, and the remains of lateral processes. These may probably belong to fishes, but we know of no fish in our coal shales to which they can be assigned.

The four or five ribs that have turned up at Newsham are not well preserved. Two are lying in contact with one of the cranial shields, one above, the other below it; but in both instances the extremities are either lost or much injured. The largest is 5½ inches from end to end, and ⅜ths of an inch broad; it is well and regularly arched, and appears to be a little flattened; a wide groove extends along the surface; and one of the extremities, which is crushed flat, exhibits distinct traces of a tuberculum and capitulum, the latter projecting quite ⅜ths of an inch beyond the former, and continues the concavity of the inner margin of the rib. The tuberculum is reflected a little, so as to interrupt the convexity of the opposite margin. In short, this rib, as far as can be determined, agrees very closely with that of *Anthracosaurus* as figured and described by Prof. Huxley (*loc. cit.* p. 63). In another specimen the proximal extremity is better preserved; and in it the head and tubercle are quite in accordance with the above description.

Another rib, which probably belongs to this or to some other equally large Labyrinthodont, differs considerably from those just described. It is not quite four inches long, and near to the proximal end it is upwards of half-an-inch wide; the sides are flattened from before backwards, and exhibit a wide shallow groove from one end to the other. The tuberculum is scarcely distinguishable from the capitulum, except by its projecting boldly outward from the convex margin of the rib; its articular surface is continuous with that of the capitulum, forming with it a wide diagonal termination. Thence the rib tapers rather rapidly to the distal extremity, which is a little recurved.

Two or three limb bones have likewise been found, which, from their size, probably belong to this species. One of these, apparently a femur, is $1\frac{1}{2}$ inches in length and $\frac{5}{8}$ths of an inch wide at the middle of the shaft, which is much compressed from front to back, and is a little arched in the same direction; there is a longitudinal depression extending from end to end. The extremities are much expanded, and they both appear to have double articular surfaces; that which is assumed to be the distal extremity is more expanded on one side than on the other.

From the shortness of this bone it would seem that the limbs of this animal were but feebly developed in comparison with the size of the body.

In concluding this description of the remains of this fine large Labyrinthodont reptile, a few words may be desirable on its relationship with the generic forms previously known. It has been already stated that it is closely allied to *Loxomma*, with which it agrees in having large and probably oblique eyes, placed near together, and in a backward position. It agrees pretty well, too, with it in the general form of that assemblage of bones which we have called the cranial shield, though the curves are more flowing. But the parietals differ considerably in shape: in *Loxomma* they appear to be simply elongated, and scarcely, if at all, enlarged behind;* while in *Pteroplax* they are much enlarged posteriorly, and the frontals seem to be more produced. The sternal plates likewise differ from those of Prof. Huxley's genus, in which the lateral ones are quite short; but in *Pteroplax* they are much elongated, agreeing in this respect with *Archegosaurus*; and the central plate in *Loxomma* is devoid of the remarkable lateral lobes which characterize that of our genus.

We have also seen that this new reptile resembles to some extent *Dasyceps*, particularly in the two occipital horns; but the small eyes, backward position of the parietal foramen and external nostrils, and the difference in the form of the cranial bones, as well as the smallness and different character of the teeth of that genus, sufficiently distinguish it from *Pteroplax*.

This new genus is also related to *Anthracosaurus*, as is apparent by the similarity of the vertebræ, the only difference of importance being that in this new Labyrinthodont there is a minute notochord, while the centrum of *Anthracosaurus* is completely ossified, and the neural arch of the former is oval instead of being triangular as it is in the latter. The occipital region, also, in the two forms is very different: and the teeth disagree both in form and minute structure; indeed, the strongly compressed crown, with its wide cutting edges, seems very characteristic in *Pteroplax cornuta*.

When the tooth is seen in transverse section converging spaces are observed dividing the internal vertical folds or plicæ of dentine: these spaces are widest towards the periphery of the tooth, and are nearly all lost before they reach the pulp cavity, the plicæ having coalesced at their internal extremities.† The plicæ are much undulated or lobulated, and have, extending through

* "Proceedings" Geological Society, Vol. XVIII., p. 292, Plate XI.

† Since the above was in print we have examined other sections of the tooth, and find that the radial spaces dividing the plicæ of dentine are occasionally continuous with the pulp cavity; it would therefore seem that in the minute structure the tooth differs less from that of *Anthracosaurus* than we supposed.

the centre in a radial direction, a double line of granular matter, divided by a thin, clear, homogeneous substance. This compound line takes an undulatory or zigzag course, and sends a simple process from each angle into the lateral lobes or undulations. The two granular lines are continuous with a similar line that follows the sinuosities of the peripheral dentine; and the clear layer between these granular lines appears to be continuous with the clear coating of the tooth, which would seem to be composed of cement, the enamel probably not extending to the base of the tooth. The Labyrinthodont structure of the tooth would therefore appear to be formed by the vertical infolding or plication of the peripheral wall of dentine and its external coating. It is evident, then, that the minute structure of the tooth of *Pteroplax* differs considerably from that of *Anthracosaurus*, in which, according to Prof. Huxley, the radiating plicæ are not formed in this way.

Ophiderpeton nanum, n. sp.

A single individual of a curious serpent-like Labyrinthodont, which apparently belongs to this genus, has been found at Newsham; it is not, however, in a good state of preservation, though the characters are sufficiently distinct to permit of the determination of its specific and generic relations. From the head to the caudal extremity, which appears imperfect, it is $5\frac{1}{2}$ inches long, allowing for the sinuosities: as it lies it is about an inch shorter. The head is so much crushed that none of its characters can be determined. In its disturbed state, however, it is $\frac{3}{10}$ths of an inch long, and nearly $\frac{2}{10}$ths broad. Thirty-three vertebræ can be counted in a pretty continuous series extending from the head; they may, however, be estimated at forty. They do not appear to vary much in size: the largest are $\frac{1}{10}$th of an inch long, and they are decidedly hour-glass shaped. The processes cannot be determined, though it is evident enough that the spinous process is not much elevated, and that it is shorter than the centrum.

Numerous rather long, delicate, slightly curved ribs are scattered along the sides, from the head almost to the caudal extremity. The proximal end is bifid, the capitulum being longer than the tuberculum. The ventral shield is distinctly displayed; it extends from about half-an-inch behind the head almost to the other extremity of the body, in the form of a broad band, and is composed of very numerous, delicate, slightly curved, much elongated scales, with the extremities pointed. They are arranged transversely; and the ends of the parallel rows overlap each other laterally.

The extreme delicacy of these scutes, which are almost filamentous, distinguishes this species from *O. Brownriggii*, described by Prof. Huxley.* Its diminutive size is also characteristic. No trace of sternal plates or of anterior and posterior limbs are observable.

REPTILE, species undetermined.

A single specimen of the central sternal plate of a second large Labyrinthodont was obtained at Newsham some time ago. It is nearly five inches long and about $\frac{3}{4}$ths of an inch wide, and is pretty regularly lozenge-shaped, with the posterior angle produced, forming a wide, depressed, tapering process half-an-inch broad at the termination, which is truncate. The sides thence to the lateral angles are a little concave, and from the lateral angles to the anterior extremity (which is not much produced) are slightly convex; the anterior slopes are much shorter than the posterior ones. The surface is very rugose, with the usual Labyrinthodont structure, which, however, is not so sharply defined as it is in *Pteroplax*. The depressions and ridges have a radial disposition; the plate is about $\frac{1}{8}$th of an inch thick, but diminishes in substance towards the margins.

In this interesting fossil we have evidence of the presence of another large Labyrinthodont in the Northumberland Coal Field, which, judging from the measurements of the plate, cannot be less than the large species previously described. And if we look to the form of the plate and the character of the surface ornament, it would seem probable that it belonged to a reptile not

* "Transactions" Royal Irish Academy, Vol. XXIV., p. 351, "Science," 1867.

only specifically but likewise generically distinct from *Pteroplax cornuta.*

Two or three other different kinds of small sternal plates have likewise been found; but particular allusion will be made only to one species, which appears to be the best characterized. The others must be left for further elucidation.

Of this species there is a set of three plates lying in juxtaposition, apparently not very much disturbed; two are very nearly perfect, the third is partially destroyed. They are rounded and somewhat elongated, particularly one, which is probably a lateral plate; it is upwards of half-an-inch long.

In form and size these plates resemble those of *Keraterpeton*, and in structure they are almost identical. These specimens, as well as those figured of that genus by Professor Huxley in the memoir before quoted, appear to have lost the external surface, and the bone fibres beneath are exposed to view, radiating and anastomosing in a very regular manner from the centre of ossification, which is a little elevated. The appearance is very peculiar, and not a little resembles that of some specimens of *Synocladia* from the Magnesian Limestone. In the species before us the bony reticulation is not quite so fine as it is in *K. Galvani.*

RHIZODUS HIBBERTI, sp., *Agassiz.*

The teeth of this species have not yet been found in the shales of our neighbourhood; but large scales which appear to belong to it are not by any means uncommon at Newsham and Cramlington. They are rarely found perfect; sufficient examples have, however, been obtained to enable us to identify them with the scales of *Rhizodus Hibberti* described by Dr. Young in vol. xxii., p. 599, of the "Journal of the Geological Society." The largest we have seen measures three inches in diameter. They usually appear quite thin, and are of an irregularly rounded form, with the front margin a little flattened, the posterior a little produced, and the sides only slightly arched. The surface is marked with numerous sharp concentric lines of growth, and minute, close, radiating striæ, requiring a good lens to show them. There are also a few distant delicate ridges, extending from the centre to the anterior border.

Such scales are undoubtedly in an imperfect condition. When complete, they are considerably thicker, and the under surface has a smooth bony appearance, exhibiting nevertheless decided concentric lines of growth, a subcentral elongated boss, and numerous small pits, particularly on the posterior portion, which, however, we have never seen in a good condition. On the posterior or exposed area there are a few obscure, irregular, radiating ridges, which are rendered still more indistinct by the granular tubercles that are scattered over the surface. The smaller scales, which are usually about 1¾ inches long and scarcely 1¼ inches wide, have all the characters of the larger scales; but they are generally more elongated in form, and the minute radiating striæ are coarser.

Besides these scales, several bones have occurred at Newsham, which, from the peculiar surface sculpture, most probably also belong to this powerful fish. We were anxious to prove this by comparing them with some authenticated fragment of the bone of *Rhizodus* showing the surface ornament, but have failed in our endeavour. They agree, however, in this respect so well with the descriptions that we cannot hesitate to assign them provisionally to this species.

Of the two most remarkable bones of this collection, one approaches in form to the malar of the Alligator, and reminds one somewhat of the bone in *Asterolepis*, considered by Agassiz to be a premaxillary;* but in our specimen the articular portion is wanting. The other bone is apparently the posterior part of a mandibular ramus with a wide articular process at the hindermost part, not perfect though very distinctly displayed. The former of these bones is quite 4½ inches long, and upwards of one inch wide at the broadest part; it is thin in front, thickens backwards, and bends rather abruptly down at the posterior extremity, which is broken. Along the under margin there is a

* Poissons Fossiles du Vieux Grès Rouge, troisième livraison, p. 95, Table XXXII. figs. 18, 19.

wide, flat, thin, squamous process, probably for the articulation of the maxilla. The opposite margin is not perfect; but in a smaller specimen of the same bone a similar flat articular process extends from the upper margin also.

The bone which we suppose to be the posterior portion of a mandibular ramus is nearly five inches in length and 1½ inches wide, including the lateral squamous expansions; it is thin, flat, and rounded in front; behind it is much thicker. And though the posterior extremity is wanting, the greater portion of the articular process is present; it has a wide oblique glenoidal surface. The lateral squamous expansions will undoubtedly articulate with the dentigerous bone.

Other interesting bones have also occurred, some of which can be identified as jugulars. One distorted and folded mass comprises two large jugulars, apparently the pair of principal plates. A considerable portion of one of them is well displayed, exhibiting in very good condition the surface ornament. Were this plate unfolded it would be about seven inches long and 2½ inches wide. Three or four inches of what seems to be the posterior portion lies flat upon the matrix, and shows the contour quite perfectly. The plate is apparently equally thin throughout; and the outer margin seems, judging from the portion that is displayed, to be pretty regularly arched, and the porterior margin to be rounded and sloped a little forwards towards the inner border.

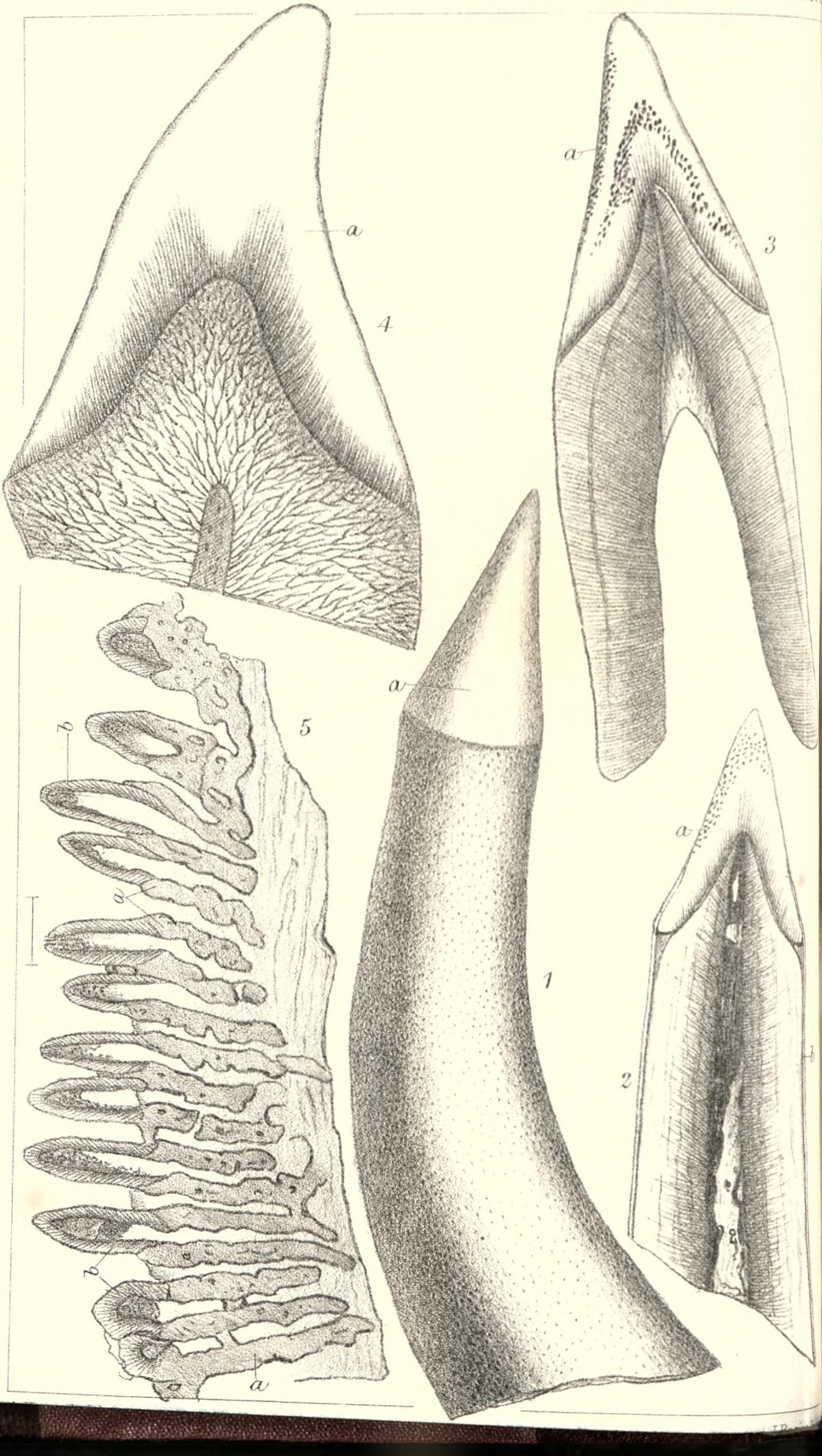
Another bone, probably also a jugular, is worthy of notice. This appears to be an anterior plate; nearly one-half of it can be made out: it is symmetrical, having a stout angular midrib with two lateral wing-like expansions. When entire it would be 4½ inches wide, and 1¾ inches long. It is impossible to overlook the resemblance of this bone to the jugular plate of *Asterolepis*; and, like it, this probably fitted into the top of the arch formed by the junction of the mandibular rami. In *Rhizodus*, however, there appear to be two other plates, as we have already seen; these would lie one on each side of the median line, immediately behind the anterior plate, which is very nearly as wide as the two others put together.

All these bones, as well as several other fragmentary specimens, have the surface covered more or less densely with strong vermicular sculpture composed of hollows and ridges; the latter in some become tubercular, but in others stream over the surface smoothly and regularly, with here and there an occasional bifurcation; in others, again, the vermicular grooves are intricately involved, and sometimes they are broken up to form circular pits. These are the dominant markings in the bones already before us; but the sculpturing on the surface of some opercular plates which we also assign to the same large fish, and which will presently be described, is somewhat modified. In these the vermicular ornament is less developed, and the pitted and tubercular predominate, the ridges being rough and much broken up.

It is on account of these peculiar surface characters that we deem these bones to belong to *Rhizodus*; but this is not the only evidence. On the slab, with the anterior jugular plate, there is a portion of a scale of *Rhizodus*; and on that with the two large jugulars several scales of this fish are found lying in contact with them. If we are right in attributing these scales to *Rhizodus*, we have in the above facts strong corroborative evidence that these bones also belong to it.

The opercular plates above referred to are four in number: three are opercles, one is apparently a præoperculum. They are all crescentic in form, having their anterior margins well hollowed, and both extremities considerably produced. The largest operculum is six inches from point to point, and is upwards of 2½ inches wide; the posterior margin is a little sinuous, and is bordered with several parallel depressed lines, probably indicative of growth; the anterior margin is bounded by a wide, smooth, articular surface, which is divided from the rest of the operculum by a ridge. The præoperculum is similar in form to the operculum, but it is wider in proportion to its length, and there is a single groove following the sinuosities of the posterior border, the anterior margin is concave, with a very narrow articular surface.

NOTE.—It is the intention in this and the following notes to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comment on the value of the various genera and species recently proposed by Prof. Owen in his paper on the "Dental Characters of Genera and Species, chiefly of Fishes, from the Low-Main Seam and Shales of Coal, Northumberland."* It has become necessary to do this, as the anticipated beneficial results from the former "Criticism" of the "Abstract" of the paper as read have not been realized,† though the influence of this criticism is distinctly traceable in the text of the published paper, as well as in the appended foot-notes.

The first genus we have to refer to is that named *Mioganodus* (pl. 8), which is founded on the section of a tooth that in no respect differs from that of the so-called *Rhizodus lanceiformis*, Newberry. We have shown in the former part of this communication that this reputed fish is most probably a Labyrinthodont amphibian; but be this as it may, we have teeth of this species attached to the dentary bone exactly similar in contour to, and not larger than, the figure of the tooth of this so-called new genus: and when a longitudinal section of these teeth is examined under the microscope, there is no perceptible difference in the minute structure from that of the tooth of *Mioganodus*; even the concentric layers of dentine, which are considered characteristic, are equally well marked. Certainly, when the tooth of *R. lanceiformis* is perfect, the base exhibits the Labyrinthodont infolding of the peripheral wall of dentine; but when the tooth is found detached (and that figured by Prof. Owen was so found), the basal portion is rarely if ever present: and then the dentinal walls are observed to thin out from the interior and to terminate below, when seen in section, in sharp wedge-shaped points, just as they are represented in the figure of *Mioganodus laniarius*. The tooth, then, on which this genus is founded is merely the upper portion or crown of a tooth of the so-called *Rhizodus lanceiformis*.

RHIZODOPSIS SAUROIDES, sp., *Williamson*.

Several specimens of the elegant fish upon which Professor

* "Transactions" Odontological Society, 1867.

† "Geological Magazine," Vol. IV., pp. 323 and 378.

Huxley founds the genus *Rhizodopsis** have occurred at Newsham. They are all in a very incomplete state, though, with the aid of the whole series, many of the characters can be determined. The most perfect specimens are between five and six inches in length; the largest is eight inches long, exclusive of the tail, which is wanting; and the smallest is not more than two or three inches in extent. There is proof, however, that this species sometimes attains a considerable size. A crushed head has been found that measures nearly 8½ inches in length; and ossified vertebral rings have occurred that are $\frac{9}{10}$ths of an inch in diameter.

In all respects our specimens agree well with Dr. Young's description of this species in the "Journal" Geological Society. (*loc. cit.*) The scales are usually well preserved; all the fins, as well as the tail, can be determined; and the gill opercles, mandibles, and upper jaws, in a more or less entire state, with the teeth attached, are all displayed.

The scales vary, of course, greatly in size. On the smallest fish they cannot be more than ⅛th of an inch long, while large detached scales measure an inch in length. They are all, however, so perfectly similar that it is impossible to deny their specific identity. The coarseness of the surface sculpture and the thickness of the scale vary, as might be expected, with its size; but no other difference can be detected. It is therefore only left us to follow the prudent caution of Dr. Young, and to wait for further information before doing anything so rash as to divide specifically the thin and delicate from the thick and comparatively coarse scales. There is one character, however, which seems to have escaped the notice of this palæontologist, and which is pretty distinct in one or two of our examples. The dorsal and ventral fins are protected in front by a series of thick enamelled scales, which are brilliantly glossy and minutely punctured, not at all like the body scales, but similar to those in front of the fins in *Megalichthys*. The first or proximal scale is very stout, if not a solid cylinder, and is ¾ths of an inch long, it looks almost like the base of a spine, but is probably composed of two

* "Quarterly Journal" Geological Society, Vol. XXII., p. 596, 1866.

lateral plates. This is succeeded by a double longitudinal series of elongated rectangular pieces, which extend apparently almost to the distal margin of the fin.

The premaxillary bones, which were wanting in Dr. Young's specimens, are present in some of ours; and they, as well as the mandibles, have a large, slightly curved laniary tooth at the distal extremity. This is succeeded by a series of numerous small conical teeth, of the same size and character as those of the maxilla. These, as well as the small mandibular teeth, are placed at pretty regular intervals, though it is not uncommon to observe two or three pressed close together. Traces of two or three additional laniary teeth can be observed in the mandibles, situated on a line a little within the row of smaller teeth.

The premaxillary bone is unusually long. The maxilla is *shorter than the former, and is narrow in front and expanded considerably behind. The mandibles are long, narrow bones, with the margins nearly parallel and the distal extremity rounded.* The surface of all these bones is rugose, with irregular reticulated ridges, or wrinkles and punctures.

All the bones of the jaws frequently occur detached. A large series of such have been procured, many of which are associated with the scales of the fish. The anterior laniary teeth are nearly always present in both the præmaxillæ and mandibles; but the additional large teeth of the latter are seldom present. In four or five instances, however, they are distinctly displayed; and in one specimen there are five laniary teeth, including the anterior one.

In the detached state the form of these bones can be well observed. The maxillaries are usually $\frac{7}{10}$ths of an inch long, and about $\frac{3}{10}$ths of an inch wide at the broadest part. They are flat thin bones, produced and pointed in front, and widened rather suddenly behind, as already stated; the alveolar border is nearly straight; the upper border in front is parallel with the alveolar border for some little distance backwards; it then suddenly ascends to the posterior margin, which slopes backwards and downwards. There is, at a little distance from the anterior extremity, a well-developed narrow articular process, which stretches upwards and forwards. The teeth vary somewhat in number; they are usually about twenty-five, which are arranged along the alveolar margin in regular order. This regularity, however, is frequently disturbed by the approximation of two or more; sometimes three or four are placed close together.

The premaxillaries are long narrow bones, about as long as the maxillaries, being usually $\frac{7}{10}$ths of an inch in length, and nearly $\frac{3}{10}$ths of an inch broad. The alveolar margin is almost straight; the opposite margin gently slopes backwards in a somewhat sinuous course, so that the bone is pretty regularly wedge-shaped, the posterior extremity being pointed. There are about the same number of teeth as in the maxilla, with the addition of a large conical laniary tooth in front, immediately before which is a small tooth or two.

The mandibular bone we have never seen quite perfect: one of the most complete in the series measures $1\frac{4}{10}$th inches in length, and about $\frac{2}{10}$ths of an inch wide near the front; the upper and lower margins are nearly parallel; it is rounded in front, and appears to taper a little at the posterior extremity; the anterior extremity is slightly bent upwards. There are from fifteen to twenty teeth in our fragments; the number must be much greater in the entire ramus. There is likewise a large laniary tooth in front, and three or four others placed along the ramus, in a line within the small teeth; in front of the anterior laniary there is a small tooth or two like those in the præmaxilla. These, however, are not always to be seen; and the posterior laniary teeth are very rarely present, or are perhaps frequently buried in the matrix. They are placed at some little distance from each other; and the small external teeth, like those of the upper jaw, frequently exhibit considerable irregularity, though on the whole they are placed apart at pretty regular intervals. The above description of the jaws applies to those of the usual size; but we have a mandibular bone which, if complete, would be upwards of three inches long, and a maxillary or two of corresponding dimensions.

The laniary teeth are grooved at the base, and here the peripheral dentine is a little infolded or plicated; and in fine specimens the surface of the crown exhibits a thin film of enamel. Traces of enamel, too, are occasionally found on the small teeth; but they are most frequently without it, probably in consequence of erosion.

One curious fact in connexion with the occurrence of this species is worth recording. Several of our specimens were found concealed within the stems of reed-like plants, which have somewhat the appearance of Calamites. A single individual occurred in each stem, nearly filling it. How they got into this position, whether accidentally or otherwise, it is impossible to form an opinion; but as out of a score of individuals that have been found four or five have been so placed, it would seem that something more than mere chance has had to do with it.

Note.—*It is apparently on fragments of the jaw bones and on the teeth of Rhizodopsis sauroides* that Prof. Owen has founded his *Dittodus parallelus, Ganolodus Craggesii, Characodus confertus*, and the Batrachian genus *Gastrodus*. The figure of *Dittodus parallelus* (pl. 1) seems to us to represent nothing more than a fragment of either a mandible or maxilla of this fish, with a few pairs of the teeth in juxtaposition, the rest having been removed either before deposition or in making the section.

When two teeth grow up close together, as we have seen is not unfrequently the case in this species, the peripheral dentine of the two is often united at the base, and then we have a "twin tooth" in all respects similar to those figured of this so-called *Dittodus*, and just as well entitled to be compared to the "Siamese twins." We have now before us numerous sections, many of which were made several years ago, demonstrating this fact; and in one or two instances there are even three or four teeth so united.

That which is denominated "osteo-dentine," in the apical part of the pulp cavity, is, we apprehend, a mere film of the inner layer of dentine. A similar substance occurs in many of our sections, exhibiting the general appearance and dotted structure given to it in Prof. Owen's figure; and this is undoubtedly the inner film of dentine, and the dots are the orifices of the calcigerous tubules. When the film is a little thicker the dots become elongated; and in other specimens they gradually assume the regular tubular appearance, in accordance with the increased thickness of the section.

Ganolodus Craggesii is founded on a mandibular bone of the same fish. This fragment is a little distorted, and has the posterior extremity broken off and turned forwards; and all the laniary teeth, with the exception of the anterior one, are lost, as we have already seen is frequently the case in the mandibles of *Rhizodopsis*. The size, form, and surface sculpture of the bone, which latter is well represented in the wood-cut, as well as the character, size, and arrangement of the teeth, all prove this.

There is no difference whatever between this mandibular ramus and several that are now before us of *Rhizodopsis*. *Ganolodus Craggesii*, Owen, will therefore have to give place to *Rhizodopsis sauroides*, sp., Williamson.

Ganolodus sicula (pl. 7) is very intimately related to a very different fish. The tooth on which this species is sought to be established is perhaps the commonest in the shales of the Low-Main seam; it belongs to *Megalichthys*, and is apparently a laniary tooth of a young specimen. There is not the slightest perceptible difference in the form and structure of the tooth, as represented in the figure of this so-called species, and the form and structure of the numerous sections of teeth of *Megalichthys* which we happen to possess. That the specimen figured was grooved and plicated at the base, like the tooth of this fish, is proved by the remnants of the plicæ, as may be seen on referring to fig. 1 *b*, pl. 7. Prof. Owen calls these fragments "part of the parietal dentine." Were this strictly correct, the calcigerous tubules would be seen cut across, producing the appearance of dots more or less elongated, as is well represented by Mr. T. West in pl. 14, fig. 4 (*Gastrodus*). On the contrary, the tubules in the fragments alluded to are all exhibited lengthwise, as they are in the cut edge of the peripheral dentine—proving to demonstration that these fragments are portions of the basal plicæ. To be satisfied of this, it is only necessary to examine a longitudinal section of the tooth of *Megalichthys*, or any other tooth with a plicated base.

The variety *G. undatus* (pl. 7, fig. 7) is most assuredly the tooth of *Strepsodus sauroides*, Huxley: the double bend of the apex and general proportions of the crown put this beyond doubt.

A fragment of a maxillary bone of *Rhizodopsis* has, it is impossible to doubt, served for the establishment of the so-called *Characodus* (pl. 13). Here there is not one tooth left, they are all broken away; but the form of the fragment itself, tapering at one extremity and suddenly expanding at the other, as likewise the columnar structure of the bone for the support of the teeth, prove this to be an imperfect maxillary of *Rhizodopsis sauroides*. These peculiar pillars of bone supporting the teeth are very characteristic of the jaw-bones of this fish; but in the maxilla they are most developed. Some of our specimens (Plate I., fig. 5) are precisely similar to that figured as *Characodus*, the teeth having been all broken away, with the exception of three or four. The display of this curious structure depends much on the plane of the sections; it is possible to cut it nearly all away, leaving merely the external layer of bone on one side; and it is never developed to the same extent in the præmaxilla and mandible.

The præmaxilla is the basis of the genus *Gastrodus* (pls. 14, 15) the supposed Batrachian, as is evinced by the shape of the fragment, the size, form, character, and disposition of the teeth; nor is there any important difference in the minute structure of the teeth in this so-called genus. According to Prof. Owen's measurements, the dentinal tubules in *Dittodus parallelus* have a diameter of $\frac{1}{10000}$ of an inch, in *Characodus* $\frac{1}{12000}$ of an inch, and in *Gastrodus* $\frac{1}{10000}$; while in *Rhizodopsis* we have ascertained that they are likewise about $\frac{1}{10000}$ of an inch in diameter. The teeth of the so-called *Gastrodus* are certainly represented to be without enamel; but we have seen that it is frequently absent in *Rhizodopsis*; and many of the teeth, as exhibited in the figure, are cut diagonally short, so that their form and proportions are destroyed. The appearance thus presented is very common in sections of minute jaws; and, unless clearly understood, may readily lead to error. The diagonal section of a quill illustrates this very well.

The bone-cells of the jaw of *Rhizodopsis* are quite as Batrachian as are those figured of the pseudo-*Gastrodus;* and so are those of *Megalichthys*, and many other sauroidal fishes.

There is, then, no evidence in the paper referred to of a minute air-breathing Batrachian of the age of the lower seams of the Northumberland Coal Field, the so-called genus *Gastrodus* being resolvable into *Rhizodopsis sauroides*, a Ganoid fish.

Ctenodus cristatus.

Since the publication of the paper on *Ctenodus*,* the matrix has been carefully removed from the upper side of the large sphenoid bone of this species by which the size of the fish was estimated. And now this interesting specimen reveals to us the cranial bones of the occipital region in an undisturbed and excellent state of preservation. The whole of the bones of one side are almost perfect, so that there is no difficulty in restoring this portion of the cranium, the constituent bones of which are arranged exactly as they are in the figure of the "cranial buckler" of *Dipterus* given by Hugh Miller in his "Footprints of the Creator."

The bones vary little in size, and, with the exception of the central occipital and parietals, are most irregularly pentagonal. There are three occipitals; the central one is not much larger than the lateral; the former is nearly as wide as it is long, and is seven-sided, with the anterior margin a little pointed in the centre, and the posterior margin nearly straight. The lateral occipitals are connected with the postero-lateral margins of the central occipital, and, diverging in front, admit a bone on each side, which is wedged in between them and the antero-lateral borders of the central occipital and the external margins of the parietals. External to these bones, and in connexion with their

* "Annals and Magazine Natural History," Feb., 1868.

outer margins, are three other bones, which form the lateral borders of the cranium. In all there are five bones on each side of the central occipital and posterior part of the parietals. Only a small portion of the left parietal is preserved; but enough is present to show that this pair of bones are elongated, being widest apparently a little behind their centre, and having their posterior margins slightly divergent to receive the anterior angle of the central occipital.

The surface of the bones is not ornamented with "waved and bent lines," as those of *Dipterus* are described to be by Miller (*ibid* p. 61), but is minutely granulated and punctate, similar to that of the opercles described in the paper on *Ctenodus* already referred to, and here and there are indications of the radial bone structure beneath.

The original estimate of the width of this head was nine inches. It is now evident that it really was $8\frac{1}{2}$ inches across the occipital region, without taking into account the fragmentary bone, probably a portion of an operculum. Were this added to the above measurement, the width would be ten inches.

The external characters of the palatal plates of the various species of *Ctenodus* were described in the paper on that genus mentioned above. Nothing, however, was said of the internal structure, such matters of detail having been reserved for some future occasion. But it is now perhaps desirable to give some account of the microscopical character of these peculiar dental plates.

In sections made across the transverse ridges that cover the whole surface of the plates, a very beautiful structure is presented to view. The entire substance is found to be composed of a minute reticulation of bone-like matter, the meshes or medullary canals being large and much complicated. The ridges stand up from the surface in the form of conical tooth-like processes; and the reticulated matter of which they are composed is perfectly continuous with that of the plate or base; but the meshes or medullary canals in them are a little elongated, and the surface is protected by a compact, rather thin layer, which is only distinguishable from the rest of the tissue by its density and darkness of colour; on this layer there is a thin external coating of enamel.

At the base of the plate there is a stratum of considerable thickness, in which the reticulation becomes somewhat closer, and which is characterized by numerous short elliptical bone-cells, the radiating canaliculi of which are frequently obliterated, but in well-preserved specimens they can be observed distinctly. The net-work of this stratum is continuous with that which lies immediately above it, but is at once distinguishable by its darker colour, greater density, and the presence of radiating cells. The substance forming the reticulation of the upper portion of the plate is, on the contrary, devoid of bone-cells, and is pale and transparent; but it is coated with a thin layer of a darker matter, in which are numerous branched tubules. When the section is made very thin these tubules, however, all disappear, and the substance is then, to all appearance, perfectly homogeneous. These tubules are likewise very frequently invisible, even in comparatively thick sections, probably on account of the state of the fossil; or it may be that the canaliculi have all disappeared under the influence of the balsam used in mounting the specimens.

The peripheral enamel is very often wanting; and even the dense continuous layer of bone-like matter immediately beneath it is frequently entirely worn away; and then the section presents a rugged margin.

The microscopic structure of *Ctenodus* has been figured and described by M. Agassiz, in his "Poissons Fossils" (vol. iii., p. 166, tab. M. f. 3). The figure is very good, so far as it is worked out; but when the author describes the "cellules calciferes" at the base of the plate as without ramifications, it is evident he has been deceived, probably by the use of balsam; or it is just as likely that the canaliculi had not been preserved in the specimen he examined. He is also wrong in his assertion that "la substance qui forme la surface extérieure de la dent est parfaitement homogène, sans trace de structure quelconque." If his sections had been made very thin, this substance would undoubtedly have appeared so. The examination of many specimens is frequently necessary to correct errors of this nature.

NOTE.—It is on the palatal tooth or plate of *Ctenodus*, probably of *Ctenodus obliquus* (or, perhaps, *C. elegans*, or it may be on a minute plate of one of the larger species) that Prof. Owen has founded his genus *Saganodus* (pl. 12). This is one of the genera on which no remark was made in the "Criticism" of the "Abstract;" but a mere glance at the figure in the paper is sufficient to satisfy us that it represents nothing else than a small imperfect palatal plate of this genus. One of the authors of the present communication has had in his cabinet for many years numerous sections of the palatal plates of *C. obliquus*; and on comparing them with the figure of the "teeth and a small portion of the jaw" of the so-called *Saganodus*, no difference of the slightest importance can be perceived. The six wedge-shaped ridges seen in transverse section stand up from the bony network of the plate in the form of conical tooth-like processes, all inclined a little to one side, and increasing in size towards the same side, and having their reticulated substance continuous with that of the plate. In all these respects the resemblance to the figure is so great that no one can doubt for a moment that the so-called jaw and teeth of *Saganodus* are identical with the palatal tooth of one of the *Ctenodi*.

In the example figured by Prof. Owen, as also in many of our specimens, the external enamel and the peripheral walls of continuous matter have been worn away. His section is evidently a little diagonal, as proved by the increased depth of the plate ("jawbone"). And the minute structure, as rendered in fig. 3, is perfectly similar to that of many of our specimens.

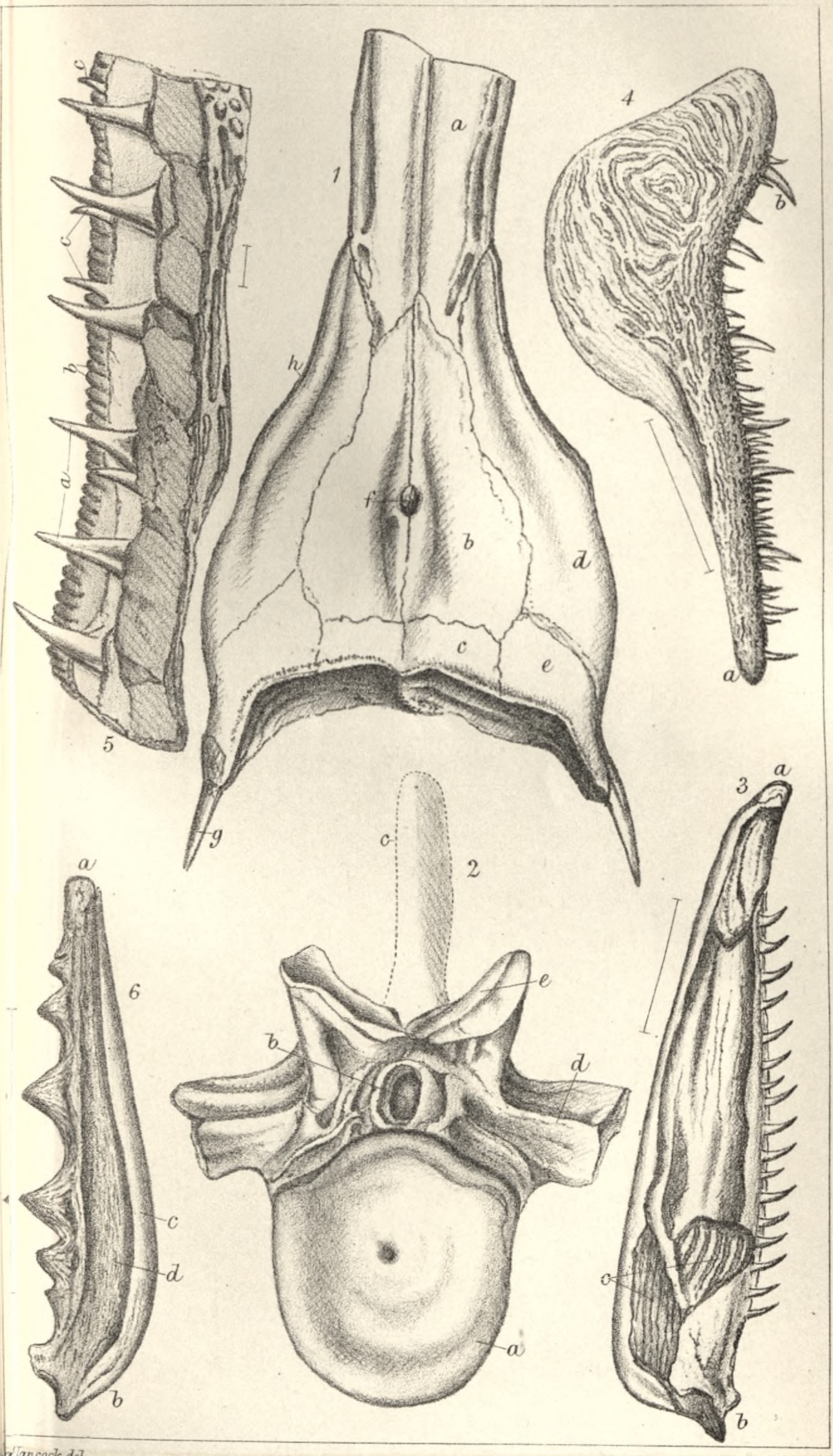
In the so-called *Saganodus* we see a remarkable example of the danger of trusting entirely to sections of minute objects, the planes of which are not understood. The oral armature of *Ctenodus* we have seen is composed of plates having on the surface several transverse wedge-shaped ridges, which are usually denticulated or tuberculated. Had it been understood that the specimen examined was a section cutting such ridges transversely, it never could have been described as a fragment of a "jaw supporting conical teeth."

It has been already stated that the enamel is frequently worn away. It is, however, generally persistent towards the outer margin of the plate; a little further back it is almost invariably removed; and still further back, on the older portion of the plate, the peripheral wall of hard matter is scarcely ever found, having undoubtedly been worn down by the action of the jaws. It is, therefore, clear enough that, in accordance with the line of the section, we might have the margins of the tooth-like processes rough, without any distinct peripheral wall, as in the figure of the so-called teeth of *Saganodus*; or there might be such a wall, without any external enamel; or, again, both the enamel and peripheral wall might be present: and such a series of sections of *Ctenodus* we possess. Were we, then, ignorant that the sections were made from different parts of the same object, we might readily be led to erect three distinct genera on the palatal plate of a single species of *Ctenodus*. And again, were we disposed to create species, various degrees in the obliquity of the section would afford excellent opportunities for so doing, as the tooth-like processes would vary in length and form in each section.

PALÆONISCUS EGERTONI, *Agassiz*.

Two large patches of scales, representing the greater portion of the fish have occurred at Newsham. The scales are in a very good state, and show the characteristic markings of this very pretty species; when examined with the microscope, it is perceived that the surface of enamel is regularly covered with extremely minute punctures or dots. The larger patch is 1⅝ inches long, and upwards of ⅜ths of an inch wide. The fins are not displayed; neither are there any traces of head or tail.

Several other *Palæonisci* have been found in our shales, as well as one or two species of *Amblypterus*. There is also in the collection a specimen or two of what we take to be a species of *Eurylepis*, Newberry. Though these are not in a very perfect condition, they are in a much better state of preservation than the specimens of *P. Egertoni*. In many of them the head is



Hancock del.

J. Basire lith.

present; and both the tail and fins are frequently determinable. Several of them are probably new; but at present we cannot enter more fully on this branch of the subject, and must leave it for some future opportunity. A few words, however, may be said on the dentition of these fishes, particularly as it seems to be little understood; indeed it appears that little or no attention has been given to this matter.

M. Agassiz, in his great work, "Poissons Fossiles," states that the teeth of *Palæoniscus* are "en brosse" (tome ii., pt. 1, p. 42); but the words which immediately precede this expression must be taken to qualify it. They are—"Mais les dents sont si excessivement petites qu'il est très-rare de pouvoir les distinguer." From this it is pretty evident that this distinguished naturalist knew very little about the matter. Succeeding writers, however, appear to have rested satisfied with this description. Mr. Binney, indeed, so long ago as 1841* figured the jaw of *Palæoniscus Egertoni*, showing a row of large, conical, sharp-pointed teeth, as well as a few of the small external ones. He says that the jaw is "armed with sharp conical teeth of a nearly uniform size, inclining from the front." This communication, however, has been unfortunately overlooked.

The teeth of these jaws are not "en brosse," neither are they of that feeble "villiform" structure so much insisted on of late. They are disposed in two distinct rows, one within the other, much in the same fashion as in *Megalichthys* and *Rhizodopsis*, but still much more like that which obtains in *Pygopterus*, in which the teeth are likewise arranged in two rows—one being of large laniary teeth, the other of small external ones. And, according to M. Agassiz, they do not in this genus form "une brosse ou râpe comme les dents du *Polypterus*." The inner row in *Palæoniscus* (Plate II., figs. 3, 4, 5) is composed of a few comparatively large, curved, sharp-pointed, conical teeth, which are placed at some little distance apart from each other. In the outer row the teeth are numerous, small, conical, and pointed, occasionally crowded, and in some species apparently not quite in regular order.

* "Transactions Manchester Geological Society," Vol. I., p. 167, Plate V., fig. 12, 1841.

It is this outer row of comparatively small teeth that appears to have been seen and described by M. Agassiz, the inner row of laniary teeth having escaped his observation. Nor is it any wonder that such a matter of detail should have been overlooked by this naturalist; and, indeed, many such omissions are found in the great work alluded to. But when we consider the novelty and vastness of the matter before him, and especially that the bent of his mind was directed mainly to the larger problems of his subject, the only marvel is that such blunders are not more numerous. The laniary teeth are very frequently concealed in the matrix; and when the jaw is in its natural position, they are liable to be obscured by the external row, which stands up on an elevated ridge of the alveolar margin.

The laniary teeth vary in number in the different species, and probably, in a limited degree, even in the same species; but this is difficult to determine, for it rarely happens that the row is complete, these large teeth being frequently broken off. Nevertheless in several of our specimens they can be observed arranged at pretty regular intervals, evincing that the series, as far as it extends, is complete. In one mandible, in which the row is nearly entire, there are eighteen or nineteen teeth; and in the mandible of another species fourteen or fifteen can be counted. The teeth in the maxillæ appear to be equally numerous.

The teeth themselves (Plate III., figs. 1, 2) are, as we have already said, sharp pointed and conical; they are a little recurved, the bend being usually greatest a short way above the base. Fine large specimens are upwards of $\frac{1}{8}$th of an inch long; but they are generally much less; they vary considerably in this respect in the different species. They are most frequently wide at the base, and contract rather suddenly immediately above; thence the attenuation is very gradual, until within a short distance of the apex, a little below which the crown is slightly swelled; from this point the sides of the tip incline more rapidly towards each other, and unite to form an extremely sharp apex. In some species the apex is much produced and attenuated, in others it is comparatively short; but in all it is characterized by its sharpness. The sharp pointed tip or apex is formed of a thick cap of enamel, and is usually quite smooth and highly polished. Below the cap, in all the species examined, the crown has a subdued lustre, and is fretted in a very beautiful manner with numerous minute, short, close-set, longitudinal depressions, which, being arranged lengthwise, have occasionally a lateral inclination: hence the peculiar fretted appearance of the surface.

On making a longitudinal section (Plate III., fig. 2), the pulp-cavity is seen to conform to the shape of the crown; the cavity is wide below and narrow above, tapering gradually towards the apex, and terminating just within the extremity of the dentine. The tip of enamel fits on to the top of the dentine like a ferrule, and is in the form of an inverted V, with the angle filled up for some distance, and the stout limbs turned out a little below, and mortised, as it were, into the dentine. The enamel-cap varies a little in form in the different species; but it varies still more in accordance with the plane of the section. When the section is made directly through the centre, the solid apical portion of the enamel is seen to be much produced, and very sharp. By making the section a little eccentric, the solid tip is reduced in length and sharpness; and by carrying the process a little further, the enamel-cap becomes a mere thin covering, like a transverse section of a low-pitched roof; and at last it entirely disappears, and is replaced, as it were, by a somewhat obtuse point of dentine.

In the finest specimens, the whole tooth below the enamel-cap is coated with a distinct film of enamel, which is perfectly colourless; in others, traces of it are observed only here and there; but in by far the greater number it is entirely wanting: when this is the case the surface of the tooth is frequently observed to be roughened as if by erosion. And it may be here stated that it is not merely the enamel that is eroded, but it frequently occurs that in the teeth of *Palæoniscus*, as well as in the teeth of other small fishes, the dentine itself is worn away to such an extent that very little of it is left to protect the pulp-cavity. It is, therefore, not unlikely that all the teeth of *Palæoniscus* were originally coated with enamel; or it may be that in some species there is an external coating of enamel, and in others it is wanting. When the tooth is perfect its walls are thick in proportion to the calibre of the pulp-cavity. The calcigerous tubes are very fine and numerous.

NOTE.—After the above description of the tooth of *Palæoniscus*, it is scarcely necessary to say that there is no character by which it can be distinguished from that of the so-called genus *Ganacrodus* of Professor Owen (pl. 6): the teeth of the latter and former agree in size, form, and structure. We have found the enamel tip to exist in *P. comtus* and other species from the Marl-slate, as well as in the species from our Coal-Measures. This we have proved in the most satisfactory manner, not by taking the teeth at random as they are scattered through the matrix, but by taking the jaws from the heads of well authenticated *Palæonisci*, and examining the teeth both externally and in section. After having done this in a great number of specimens, we are enabled to state that the small enamel-tipped teeth found detached in the Cramlington and Newsham shales are exactly the same as those attached to the jaws. They are of the same size and form, with the same bright tip of enamel and finely fretted walls; and in section there is no difference whatever, the general form, the enamel-cap, the pulp-cavity, and dentine are all precisely the same; and all precisely agree with the tooth of the so-called *Ganacrodus*. It is, therefore, hard to understand what is meant by the use of such terms as "the villiform teeth of *Amblypterus* and *Palæoniscus*," "the vague and ill-defined characters of those *en brosse* of *Palæoniscus* and *Amblypterus*:" such expressions may indeed mislead, as they or similar words appear to have misled their author, but they can never for a moment obscure the light derived from a thorough examination of the facts.

The laniary teeth of *Palæoniscus* and *Amblypterus* agree in all essential characters; and the tooth of the former is in every respect similar to that of Professor Owen's "new genus." Consequently this genus can never be adopted by palæontologists.

With regard to the coating of enamel on the crown of the tooth, on which much stress is attempted to be laid, we can only say, in addition to what has been previously stated, that it is most frequently absent from teeth attached to the jaws, and that by far the greater number of our specimens are deprived of it, (as we are inclined to believe) from the effect of erosion. Be this, however, as it may, the fact remains unchanged. Authenticated *Palæoniscus* teeth in connexion with the jaws agree in all respects with the tooth of *Ganacrodus*, even to the absence of enamel on the crown of the tooth.

Palæoniscus, however, is not the only genus in which this beautiful enamel-cap exists. Although Prof. Owen is pleased to ignore what is stated in the previous "Criticism" on the subject, we here venture to assert that the teeth of *Pygopterus*, *Amblypterus*, *Gyrolepis*, and *Cycloptychius* have a perfectly similar tip of enamel. *This we have determined by our own independent research, and can prove the fact by numerous sections of the teeth of all these genera.*

Considerable importance, however, appears to be attached to the supposed novelty of this peculiar tooth structure in the paper so often referred to. Prof. Owen therein states, on this subject, "that he had not before met with any similar tooth in the whole range of his odontological researches."* Betwen twenty and thirty years ago, however, M. Agassiz described and figured the very same structure in the teeth of *Pygopterus*,† *Saurichthys*,‡ *Polypterus*, and *Lepidosteus*,§ the last two being recent sauroid fishes.

After giving a full description of the general characters of the tooth of *Pygopterus*, M. Agassiz says, "Un cône de dentine entoure cette cavité pulpaire de tous côtés; il est plus massif au milieu, là où se voit le renflement extérieur, plus mince vers la base et vers le sommet, et recouvert en haut d'un capuchon en émail, qui occupe à-peu-près le tiers de la dent et forme à lui-seul toute la pointe. En examinant la dent à la loupe, on

* Pamphlet reprinted from the "Transactions of the Odontological Society," p. 29.

† "Poissons Fossiles," Vol. II., Part II., p. 152.

‡ Ibid, Vol. II., Part II., p. 153, tab. H., figs. 2–5.

§ Ibid, Vol. II., Part II., pp. 27, 43, tab. G., figs. 9–12.

reconnaît au plus fort du renflement extérieur une ligne circulaire qui indique la limite du capuchon émaillé et de la dentine. La dentine elle-même n'offre rein de remarquable. Les tubes calcifères . . . . . Ceux du sommet se continuent, comme chez le *Polypterus*, dans l'émail, où ils paraissent plus roides, mais en même temps plus fins et moins régulièrement disposés que dans le dentine."

Of *Polypterus* the same author writes as follows :—" Cette dentine forme la plus grande partie de la dent; elle n'est recouverte qu'au sommet par un petit capuchon *d'émail* trèsdur, et dans lequel je n'ai pu reconnaître ces fibres composées de petits cubes superposés, telles qu'on les a reconnues chez les mammifères. L'émail du *Polypterus* (fig. 12) est transparent comme du cristal, sans trace de structure, et ce n'est que dans sa base que pénètrent les dernières extrémités effilées des canaux calcifères de la dentine," etc.

Respecting *Saurichthys* it is stated :—" Cette différence entre le socle et le sommet est encore plus frappante, lorsqu'on examine leur structure au microscope; le premier est composé de dentine, le dernier d'émail. La cavité pulpaire est un cône creux entouré d'un cône de dentine massive, sur lequel repose le capuchon émaillé comme dans les dents du Polyptère." This description of the structure of the tooth of *Saurichthys* is very different from that given in the "Odontography," p. 170, where the cap of enamel is certainly described, but not recognized as such; the author apparently not being aware of the difference between the base and the summit, pointed out by M. Agassiz. And, indeed, the description seems to be confined to the enamelled or upper portion alone, the basal portion evidently having been deficient in the specimen examined.

Similar passages might be quoted repecting *Lepidosteus*; but perhaps enough has been said on the supposed recent discovery of the "emamel-tipped spear teeth." We have seen that M. Agassiz fully described and accurately figured this form of tooth in four genera (Plate III., figs. 3, 4) between twenty and thirty years ago (1833–1844); and we have determined its existence in four other genera, and have likewise verified the accuracy of

M. Agassiz's observations in *Pygopterus*, *Lepidosteus*, and *Saurichthys*, making in all eight in which a cap of enamel is found. It is therefore highly probable that, when the subject is fully investigated, enamel-tipped teeth may prove to be not at all uncommon. But how has all this escaped the observation of the learned author of the "Odontography?" for escaped him it assuredly has, or he never could have written as he has recently done respecting *Palæoniscus*, *Amblypterus*, *Pygopterus*, *Polypterus*, and *Lepidosteus*.

Acanthodopsis Wardi, sp., *Egerton*.

For some time past one of the authors of this paper has had in his collection several jaws of a fish with large triangular teeth, five or six in number, and appearing like processes of the bone; and of so peculiar a character are they that it was impossible to say even to what family of fishes they belonged. It was not until similar specimens were found associated with other remains that any light could be obtained respecting them. At length a crushed head or two were procured, exhibiting the same peculiar jaws, with the like curious teeth attached, lying in juxtaposition with the spines of one of the *Acanthodei*, partially buried in what appeared to be the broken up skin of the fish, crowded with minute rhomboidal scales. In one specimen the two pectoral spines are placed in their proper position behind the head, and united to it by the continuity of tissue, so as to leave no doubt that they and the head belong to the same fish. The uniting tissue, too, was mainly composed of granule-like scales of a lozenge form. A tail likewise of an Acanthodian has occurred in the same locality, the scales on which agree both in size and character with those found with the heads. It is therefore quite certain that the jaws alluded to belong to the *Acanthodei*, notwithstanding the abnormal character of the teeth, which in this family are usually described as minute and conical.

In the genus *Acanthodes*, indeed, the teeth appear to have been determined only in one species, though M. Agassiz states, in his description of the genus, that fine teeth disposed in a simple range appear to garnish the circumference of the mouth.* The species in which the teeth have been determined is *A. pusillus*; and of this the same author writes that the mouth is "garnie de très-petites dents qui, même sous une très-forte loupe, ne paraissent que comme des petits points noirs." † This is so definite that it is impossible to doubt its accuracy; we are therefore forced to the conclusion that in this genus, as at present understood, there are two very distinct kinds of dentition, so distinct, indeed, that it seems necessary to establish a new genus for the reception of those species, which, like *A. Wardi*, may have large triangular teeth, similar to those alluded to. We therefore propose the generic appellation of *Acanthodopsis* for those *Acanthodei* with this peculiar dentition.

The remains in our possession of such fishes are divisible into two species by the characters of the spines, scales, and teeth. One of these is very much larger than the other. It is the smaller of the two that appears to be identical with *A. Wardi*. The larger species is probably the same as that of which Sir P. Egerton had obtained the head and anterior parts, and which is supposed by him to "have measured two feet six inches in length." ‡ A pectoral spine of this is stated to have been 9½ inches long.

The mandibular ramus of *A. Wardi* (Plate II., fig. 6) is about 1½ inches long and ¼th of an inch wide at the broadest part, which is near the proximal extremity, whence it tapers gradually to the distal end, which is rounded; the proximal end turns upwards, and presents a well-defined concave articular surface. The dentigerous bone is very thin, and its walls are usually pressed close together; the outer wall is irregularly striated longitudinally, the inner wall is smooth; the lower margin is strengthened by a stout styliform process, *c*, which is very liable to detach itself, when it assumes the appearance of a cylindrical spine graduating to a point in front; it is united behind to the

* "Poissons Fossiles" du Vieux Grès Rouge, première livraison, p. 39.

† Ibid, p. 36.

‡ "Quarterly Journal Geological Society," Vol. XXII., p. 470.

articular process, and is probably nothing more than a prolongation of the angular bone.

This styliform process has been described as the entire mandibular ramus in some of the *Acanthodei*, and is seen occasionally attached to the head, the dentigerous bone, with the teeth, having been detached. In Sir P. Egerton's figure of *A. Wardi* these styliform bones, so denuded, are seen still articulated to the head and thrown backwards; the teeth are frequently found attached to the thin-walled dentigerous bone, the styliform process having probably been left so attached to the head.

The teeth are never found separated from the bone. There are five or six in each ramus, two of the larger being in the centre, the smaller ones in front and behind; they are compressed in the direction of the jaw, and when seen in this position they have the shape of as many equilateral triangles with the lateral margins a little hollowed towards the apices, which are recurved; they are expanded at the base, where they become confluent, and are coarsely and irregularly striated from one extremity to the other; and the surface being liable to erosion, the striation is frequently exaggerated.

The upper jaw is co-extensive with the mandible, and is apparently formed of one piece. The teeth are like those of the under jaw, and lock very accurately into them; they are of the same size and character, and are equal in number to those of the mandible. The largest teeth are nearly $\frac{1}{8}$th of an inch in length; they are much wider than they are thick from back to front.

On making a longitudinal section of the teeth in the direction of the jaw, the structure is found to be very peculiar. The jaw itself is composed of very dense bone on the surface, in which the Haversian canals are well defined, and the radiating cells are very numerous and minute; they are elongated fusiform, with the canaliculi (when observable) sufficiently abundant, and arranged for the most part at right angles to the long axis of the cells. In the superficial and denser portions of the tissue the cells and tubules are the most minute; in the deeper portions they are larger and less regular in form, and the bone becomes riddled with medullary cavities, until at length it is entirely reduced to a sort of cellular structure. This curious cellular tissue is continued into the teeth, and forms their central mass, there being apparently no distinct pulp-cavity, or if any, it is confined to the base. This tissue becomes less open as it approaches, and gradually forms a dense layer at the surface of the teeth, in which layer the Haversian canals are as distinct as they are in the bone of the ramus, and the cells, diminished in size, assume their regular elongated form, and at the extreme margin they disappear. This peripheral layer, which represents the dentinal wall of ordinary teeth, is found to be continuous from tooth to tooth; it differs, however, in no respect from the dense external surface of the ramus. Indeed it is quite evident that the bone of the jaw is continued into and forms the teeth; they may, therefore, be looked upon as processes of the jaw. We have failed to detect the least trace of enamel on the surface of the teeth.

A considerable portion of one of the pectoral spines lies near to the crushed head of this species, in which the jaws are distinctly displayed with the teeth interlocked. The spine has lost its distal extremity; the fragment, however, is flattened towards this end; at the basal extremity it is thickened, and assumes a triangular form; a groove extends along the anterior margin. Detached spines have also occurred, agreeing exactly with Sir P. Egerton's description of the pectoral spine of this species.

The scales are minute rhombs, with the upper surface smooth and slightly convex. Some appear to be minutely and irregularly granulated. Perfectly similar scales clothe the heterocercal tail which was procured at Newsham, and which we believe to belong to this fish. It is about $\frac{3}{4}$ths of an inch wide, and, including the pedicle to which it is attached, it is $1\frac{3}{4}$ inches long; the under lobe is not much produced, and the upper is rather obtuse; no rays are perceptible. The scales are well preserved, and are in an undisturbed state. Some of them are brilliantly glossy, and have, towards the posterior angle, a boss-like swelling; others are dull and minutely granular. Which is the true natural surface it is difficult to say, though it seems probable that the latter is. Be this as it may, both kinds of scales are found scattered in the vicinity of the head and spine.

ACANTHODOPSIS EGERTONI, n. sp.

A crushed head, with the pectoral spines attached, a detached jaw or two, a few separate spines, and some scattered scales are all the remains that have occurred of the large species alluded to. The head, which could not have been less than 2¼ inches long, has one of the mandibular rami well displayed, with the teeth attached; but they are, unfortunately, in a very imperfect state. The ramus is very similar in character to that of *A. Wardi*; but the dentigerous bone does not appear to be striated; the styliform process is not much arcuated at the proximal extremity, and tapers gradually to the anterior point. The teeth are arranged in the same manner as in the smaller species, that is, with the larger in the centre, and smaller at the extremities of the jaw; with the aid of a detached mandible we are able to ascertain that there are seven or eight in each ramus; they are not nearly so wide at the base as in the previous species, and they are more regularly and finely striated. Some of the bones of the head are finely and regularly tuberculated; these are probably the orbital plates. The similar plates of the other species appear to be irregularly granular.

The spines attached to the head are upwards of 2½ inches long, though they are not entire; but the largest detached specimen in our possession is quite an inch longer, though in it, too, the point is broken. This must have been longer than the largest mentioned by Sir P. Egerton; it is upwards of ¼th of an inch broad, and is flat and curved like the others, resembling the blade of a scimitar; towards the base the inner margin is thickened and angulated, and a depressed line or groove extends from end to end a little within the anterior or arched margin; a few fine longitudinal lines are seen near to and almost parallel with the opposite margin; the point appears to be rounded, but is not quite perfect in any of our specimens.

The scales which are found associated with the head and spines are very similar to, but they seem to be smaller than, those of the other species, as pointed out by Sir P. Egerton; they also appear to have the surface more elevated and rounded.

From the character of the scales and great size of the pectoral spines, but more particularly from the difference observed in the teeth, we consider ourselves justified in dividing this from the *A. Wardi*, and beg to dedicate it to Sir P. Egerton, who was the first to point out the probability of its specific distinctness. We therefore propose for it the name of *Acanthodopsis Egertoni*.

GYRACANTHUS TUBERCULATUS, *Agassiz*.

The gigantic spines of this little-understood fish occur pretty frequently at Newsham and Cramlington, in a fine state of preservation. In conjunction with Mr. J. W. Kirkby, one of the authors of this paper pointed out in 1863 that these spines were not, as usually thought, dorsal, but were paired spines, most probably pectoral.* We have now before us seventy-one of these formidable weapons; and the first thing that strikes the observer is, that by far the greater number have lost the apical extremity, and that they are not merely bent from front to back, but are also laterally curved. On closer examination it is found that there are as many bent to the right as to the left side, and that of such bent spines there are just twenty-four pairs. Thus twenty-three spines are left unaccounted for; these may be considered straight, being bent only from front to back, and their points are entire. But first respecting the paired spines: we have said that they have all lost their points; they are not fractured, however, but are all worn smoothly down diagonally at a very acute angle; and, what is still more interesting, this wearing always takes place at the side opposite to that of attachment. Assuming, therefore, that these spines are pectoral, and that they were inclined backwards and downwards, as assuredly they would be, then the wearing of the points is exactly such as

* See paper entitled "Fish Remains in the Coal Measures of Durham and Northumberland," by Messrs. T. Atthey and J. W. Kirkby, read in the Geological Section at the Newcastle Meeting of the British Association.

would take place by their coming in contact with the ground. And again, the largest or oldest spines are uniformly the most worn; some, indeed, are reduced to mere stumps. In one such specimen now before us, which is seven inches in circumference, and which must have been one of the largest, only 10½ inches are left. Another example, six inches in circumference, is only seven inches long, including the portion buried beneath the skin.

All this seems to demonstrate, beyond doubt, that these are really paired spines, most probably pectoral. And from this wearing we may fairly assume that *Gyracanthus* was a ground fish, and that the spines assisted its motions at the bottom of the water.

The straight spines, or those which are not laterally bent, are all regularly arched from before backwards; and their distal or pointed extremities are all perfect, not being in the least degree worn. These are apparently dorsal spines; and that there is only one of such in each fish seems probable from the fact that they occur in the ratio of one to two of the paired spines, as shown by our previous division of the seventy-one specimens.

The dorsal spines are considerably smaller than the paired ones; they are more compressed, and the posterior denticulated keel is more strongly developed; the extreme point is smooth, compressed, and rounded in front. The largest are about eleven inches long, and 3¼ inches in circumference at the thickest part. The paired spines are fifteen or sixteen inches in length, and upwards of 6½ inches in circumference.

One or two specimens of the species denominated *G. formosus* have likewise occurred; and as the same spine of *G. tuberculatus* is occasionally found with both tuberculated and smooth ridges, the former can scarcely be considered a good species. M. Agassiz's figure of *G. formosus*,* like *G. tuberculatus*, is laterally bent.

Large flat triangular bones are frequently found associated with the spines, measuring sometimes 8½ inches long, and 6½ inches broad at the widest part. Their structure is very open; and as they are seldom well preserved, they are probably only imperfectly ossified, the bone fibre radiates from the apex to the

* "Poissons Fossiles," vol. iii., tab. V., figs. 4, 5, 6.

expanded base. There can be little doubt that these are carpal bones, similar to those in connexion with the pectoral fins in the sharks and dogfishes. This bone is thickest at the apex, which is rounded, and thins out towards the distal expanded margin or base. The large longitudinal groove at the root of the spine probably corresponds to the lower or anterior margin of this bone; or it may be that it was fitted to a lower carpal which was coadjusted to this bone, but, being entirely cartilaginous, has disappeared. However this may be, it can scarcely be doubted that this triangular bone supported, directly or indirectly, the great pectoral spines.

There are found also frequently associated with the remains of *Gyracanthus* large thin layers or patches of matter, almost entirely composed of minute compressed bodies, of which there are two kinds. One, much smaller than the other, and by far the more numerous, is upwards of $\frac{1}{20}$th of an inch high, and not quite so broad; it has usually two, sometimes three, conical, recurved, diverging points rising from an expanded base. The large kind is usually $\frac{1}{10}$th of an inch high, and is somewhat wider at the base; it is sometimes a little larger, but more frequently much smaller. It is much compressed, and the base is considerably widened; the upper margin is divided into from four to seven much recurved conical denticles, which are sharp pointed, and have four or five stout longitudinal ridges on the arched or dorsal surface. Several large patches of these bodies have occurred, one of which measures twenty inches by fifteen inches. It is therefore pretty clear that they cannot be teeth, which are not usually found together in such vast multitudes; they are much more likely to be dermal tubercles, and these patches to be the remains of the skin of *Gyracanthus*. It should also be mentioned that *Cladodus mirabilis* has occurred three or four times at Newsham, and always associated with these dermal patches. May it not, therefore, prove to be the tooth of *Gyracanthus*?

NOTE.—*Mitrodus quadricornis* of Professor Owen (pl. 3) is undoubtedly nothing more than the larger kind of these dermal tubercles. In size, proportion, and form it agrees exactly with them; and in the minute structure there is no difference whatever, as is demonstrated by the numerous sections of them which we have had the advantage of examining. This "minnow," then, of our shales is found to be identical with *Gyracanthus tuberculatus*, perhaps the largest fish of the Coal-Measures.

In the figure of *Mitrodus* only a small portion of the denticles is shown; the points, being strongly recurved, are necessarily cut away in such a section as that represented. It is only the base of the toothlets that Professor Owen has seen; and, consequently, his knowledge of the true form must be very imperfect. The angles represented at the margin of the denticles indicate the external ridges described above.

DIPLODUS GIBBOSUS, *Agassiz.*

This is a common fossil at Newsham and Cramlington, and is usually found in connexion with a thick granular layer of a substance resembling shagreen, large patches of which frequently occur studded all over with it. One such patch has been obtained, which measured fifteen inches long, and about seven inches wide. On this the *Diplodi* are comparatively few in number, and are scattered about. But in another patch, of which there are fifty-six square inches, they are very numerous, and are crowded together without order.

There can be little doubt that these shagreen-like patches are the remains of the skin of some large fish, and that the *Diplodi* are dermal tubercles in connexion with it, and analogous to the spinous tubercles of the Rays. At the same time it must be admitted that it is possible enough that the larger specimens may have clothed the lips or jaws with a spinous pavement resembling in arrangement the oral armature of the Rays or Cestracionts; or they may have ranged along the back or sides of the body in serial order, as the dermal spines frequently do in the Rays; or perhaps they may have been scattered here and there among the smaller ones, as is not unfrequently the case with such tubercles.

Diplodus has usually three recurved spines, two being large, the third quite small; they stand up from a common, rather deep, rounded or oval base. The two large or lateral spines are ranged side by side; they are stout, conical, and divergent, both being curved from before backwards, and a little compressed in the same direction. The small spine is similar in form, and is placed immediately behind the large ones, at their basal junction; and in front of them, in a similar position, is a large, rounded, depressed tubercle. All the spines are strongly carinated at the sides from the apex to the base; and in well developed specimens there are two other ridges, one in front, the other behind, extending downwards for some distance from the apex.

These are the normal characters of *Diplodus*; but it is very variable in form. The spines are not unfrequently found stiff and short, and much bent and divergent; on the other hand, they often occur much elongated, almost parallel, and comparatively slender. The number of spines also varies; sometimes there are only two, sometimes only one. When the latter is the case, the specimen is usually exposed in profile, and the long heel-like projection is well displayed; when, however, a complete tubercle is buried in the matrix with only one of the lateral spines and its base exposed, the appearance is much the same. A tubercle so seen is represented by M. Agassiz in "Poissons Fossiles," vol. iii., tab. 22 *b*, fig. 5.

If *Diplodus* differs much in form, it also varies greatly in size. The largest are $\frac{3}{4}$ths of an inch from the base to the apex of the large or lateral spines; the smallest, measured in the same way, are not more than $\frac{1}{12}$th of an inch in extent. Between the two extremes, tubercles of every size occur. Now the smaller individuals, which are by far the most numerous, agree very well with *Diplodus minutus* of Agassiz, so far as the imperfect specimens described and figured by that author permit a comparison. M. Agassiz says he was not able to discern the median cone; but this is not to be wondered at, for none of his figures represents the base entire.

NOTE.–*Dittodus divergens*, *Aganodus apicalis*, *Aganodus undatus*, *Pternodus productus*, and *Ochlodus crassus*, described in the paper "On the New Coal Fishlets," are all referable to *Diplodus*. The genus *Dittodus* is established on two very dissimilar fossils: *D. parallelus* is, we have already seen, founded on the fragment of a jaw with a few of the teeth of *Rhizodopsis sauroides; Dittodus divergens* (pl. 2) is apparently nothing more than *Diplodus minutus** of Agassiz; and, like his figure, that given by Professor Owen is represented without the small central spine: indeed it is scarcely possible to show it in such a section as that figured in pl. 2. The size, form, and histological characters all agree with those of our sections of the minute specimens of *Diplodus*.

Pternodus productus (pl. 10) is the single-spined variety of *Diplodus gibbosus* seen in profile, with a well produced base; or it may possibly be a lateral section of a fully developed specimen in which one of the large spines only is exhibited. In either case the same appearance would be presented of the large projecting "heel," with its outline sweeping into the curve of the spine; and, in fact, the form, proportions, and size all exactly agree with those of similar sections in our possession of the single-spined variety of *Diplodus*. The minute structure is precisely the same; the greater portion, however, of the basal marginal boundary, from *m* to *b* in fig. 1, pl. 10, has been ground away; and that which is designated "osseous tissue of jaw" is merely a portion of the osteo-dentine of the pulp-cavity.

There are two species of *Aganodus* described: one, *A. apicalis* (pl. 9), is based apparently on a section made from before backwards of a single straight spine of the small variety of *Diplodus*. The two processes (*o*) below the spine are projecting portion of the base, the most of the base itself having been broken away. The opening between the two processes is in part a natural cavity, frequently seen in sections. *A. undatus* (pl. 10) is a lateral section of a single minute spine of the same variety of *Diplodus*, somewhat abnormal in form. There is no difference of importance in the minute structure, and it exhibits, in a most distinct manner, the numerous concentric layers of dentine mentioned by M. Agassiz as characteristic of *Diplodus* (vol. iii., p. 209).

* "Poissons Fossiles," vol. iii., p. 205, Tab. XXII., f. 6–8.

Diplodus has supplied Professor Owen with still another generic form, which is the fourth based upon this variable fossil. *Ochlodus* (pl. 5) is nothing more than one of the large varieties of this dermal tubercle, crushed laterally, a variety, probably, having originally one of the large spines smaller than the other. A figure of such a tubercle is given by Mr. Binney in the paper before quoted.* From the representation of *Ochlodus* it is evident that the specimen has been crushed: the dentinal walls are cracked in several places, the upper wall has been forced in upon the osteo-dentine of the pulp-cavity, and the continuity of the tissue of the spines has been severed; the osteo-dentine of the pulp-cavity has, in a great measure, been displaced, and the base shattered to fragments. All these appearances are shown in a section now before us, which was made of a specimen crushed laterally or a little diagonally, and which closely resembles in size and contour *Ochlodus*. It is evident, too, that much of the fractured base in this genus, and also a considerable portion of the two smaller spines, have been removed in making the section.

The thickness of the dentine and the size of the pulp-cavity are very variable features in *Diplodus*. Even in the same specimen the peripheral dentine occasionally varies considerably at different parts of the circumference, as may be seen on making a transverse section of the spines; and as they are compressed, as we have stated above, the relative size of the pulp-cavity varies with the plane of the section. This is one source of variation; but were the pulp-cavity quite cylindrical, or rather circular in transverse section, its apparent relative proportion to the dentinal wall would depend upon the degree of eccentricity of the section. The pulp-cavity is consequently found to vary extremely in size in *Diplodus*. In the crushed specimen we have spoken of, this cavity is quite as large as it is represented in the figure of *Ochlodus*; and, again, in other specimens it is no larger than we see it in the figure of the so-called *Pternodus productus*.

The acute points represented in the section of *Ochlodus* are not the apices of the spines, as believed by Prof. Owen; the true apices have all been removed in making the section. These

* "Transactions of the Manchester Geological Society," vol. I., plate V., fig. 17.

sharp prolongations are merely the ridges or keels described above as extending from the apices downwards, seen still projecting after their base (the dentinal support) has been removed. The same appearance is presented at the apex of the figure of *Aganodus undatus*, and strengthens our opinion of the nature of that form.

At the point of the largest spine of *Ochlodus* there is evidence of two of those ridges or keels, one probably being a lateral ridge, the other apparently the intermediate or dorsal one. At the extremity of the small lateral spine, one of the strong lateral keels is well exhibited; and the small central spine displays distinct evidence of two keels. In many of our sections these ridges assume the very same appearance which we see in this *figure; and they are all found to be composed of enamel,* as *these points are represented to be in Ochlodus*; and there can *be no doubt that the trace of enamel described and indicated at g,* on the *large spine,* is a lateral view of the keel, the lower point of which terminates at *g*.

We thus find that *Ochlodus* does not only agree in general form, but even in the minutest details, with *Diplodus*; and we can find no distinguishing histological characters on which to found this so-called genus.

CTENOPTYCHIUS PECTINATUS, *Agassiz.*

This species is not uncommon in the shales of Newsham and Cramlington. One of the authors of this paper has a large suite of specimens gathered at these localities; they agree perfectly well with *C. pectinatus*, though they usually have a greater number of denticles than represented in the figure in "Poissons Fossiles." The number ranges from eight or nine to fifteen or sixteen. Well developed specimens measure ¼th of an inch wide and a little less high. They are in the form of wide, flattened plates, with the upper margin a little arched transversely and denticulated, the denticles being rather obtusely pointed, come from before backwards, and recurved; the marginal surface is concave behind and convex in front, and thickened posteriorly, where it is strongly defined from the base by a deep transverse constriction. A lateral section conseqently presents a sigmoid curve, the lower member of which is the larger and less bent. The whole of the denticulated margin, including the denticles, is coated with a thin layer of enamel, only traces of which can usually be seen in sections. The base narrows suddenly immediately below the denticulated margin, and is frequently considerably longer than the upper glazed or enamelled portion; and the lower margin is often produced into two or more fang-like processes.

In the base of each denticle there is a small pulp-cavity that extends only a short way upwards, and is in direct communication with the wide medullary canals of the basal portion, which are for the most part elongated; but in this respect there is considerable variation. The canals are most elongated, as might be expected, in elongated specimens. The dentinal tubules, which are nearly vertical, are coarse, fasciculated, and much branched; and the osteo-dentine of the base exhibits also a few branched tubules, strongest and most numerous above and at the margins; below they are comparatively small and obscure.

A few specimens have occurred which are much elongated transversely, and have upwards of twenty denticles; these are probably *C. denticulatus* of Agassiz. *Ctenoptychius* is probably a dermal tubercle, though it certainly has more the appearance of a tooth then either *Diplodus* or the spined dermal tubercles which have been assigned to *Gyracanthus.*

Note.—That *Ageleodus diadema* of Prof. Owen (pl. 4) is the fossil above described cannot for a moment be doubted. In general form, size, number, and character of the denticles, as seen in section, all exactly agree; and there is no difference whatever in the histological features, only the specimen figured and described in the paper referred to is shorter than usual; hence the medullary canals are not so decidedly elongated as they frequently are. Now no palæontologist would hesitate to pronounce our specimens to be *Ctenoptychius pectinatus* of Agassiz. It is therefore futile to assert that the figure of the structure of this genus in the "Poissons Fossiles"* shows "at a glance" that it is generically distinct from *Ageleodus*; and it is certainly erroneous: the difference is merely a difference in degree. The medullary canals are more elongated and somewhat more regularly parallel in Agassiz's figure than they are in our specimens, in many of which, however, the parallel and elongated character predominates. In fact, there is quite as great a difference in this respect between individuals of our suite of specimens as there is between some of them and Agassiz's figure referred to. And it must not be forgotten that this figure represents the structure in a different species. We repeat, then, that no generic difference is perceptible at a glance. M. Agassiz certainly states that the substance at the base of the tooth is perfectly homogeneous. *In some of our specimens, too, the basal portion has lost nearly all traces of structure; but such specimens are mounted in balsam, which, we have seen, is liable to render minute structure invisible. It is therefore not improbable that the specimens* of M. Agassiz may have been mounted in this medium; and it is equally likely that the minute structure was not preserved in the fossil examined by him. Such discrepancies must be expected in the examination of *fossils*; and accordingly we have already seen that the minute structure in *Ctenodus* had escaped the observation of that naturalist.

In *Ageleodus* we see another striking instance of the danger of trusting entirely to the sections of objects not previously understood. From this cause the denticles are described as if their whole contour was seen, whereas there is nothing but the mere stumps left in the section, the crowns all having been cut away in making it. As the denticles are (as we have already stated) recurved, they must necessarily, to a great extent, be removed in such a section as that figured. Had this been previously known, the bases of the denticles could never have been mistaken for their crowns, nor could the latter have ever been described as "broader than they are high;" nor could it have been stated that they all "terminate obtusely; and this seems to be an original form, not due to wear or abrasion." In fact,

*Tome III., plate M., figs. 4, 5.

Prof. Owen describes merely a diagonal section of the basal portion, and supposes that he describes the whole denticle. This author has likewise been deceived into the belief of the existence of a common pulp-cavity, by the removal in the section of the osteo-dentine near the centre of the specimen. Here all the substance has been ground away in consequence of the lateral sigmoid bend before described. A lateral section proves that no such cavity exists; and, indeed, the large series of sections now before us, and which were made many years ago, entirely disprove this assertion. The inference drawn from the supposed presence of this cavity is therefore of no avail.

We have now examined the whole of the new genera and species of Fishes and Batrachians proposed by Prof. Owen in his paper published in the "Transactions of the Odontological Society," and find ourselves compelled to conclude that there is positively not a single novelty in the whole series. Thirteen genera were enumerated in the "Abstract" of the paper as read, in the paper as published there are only twelve, one (entitled "*Oreodus*") having been withdrawn. It is unfortunate that some circumspection had not been also observed with regard to the remaining twelve, which we fear are fated to fall into the like obscurity. We have found as we approached the "New Coal Fishlets" that they gradually dwindled away, and at length entirely disappeared; or rather we perceived that they never had had any real existence, and that the "Minnows and Sticklebacks" of the Northumberland coal-shales have yet to be discovered.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. Sternal plates of *Pteroplax cornuta*, about half the natural size: *a a*, lateral plates; *b*, posterior portion of central plate appearing from beneath the former; *c*, posterior process.

Fig. 2. View of underside of central sternal plate, two-thirds natural size: *a*, perfect lateral wing or lobe; *b*, posterior process.

Fig. 3. Præmaxilla of *Pteroplax cornuta*, natural size, the apices of the teeth having been restored: *a*, anterior extremity; *b*, posterior articular process; *c c*, mucus-grooves; *d*, external nostril.

PLATE II.

Fig. 1. Cranial shield of *Pteroplax cornuta*, about two-thirds natural size: *a*, frontals; *b*, parietals; *c*, occipitals; *d*, postfrontals; *e*, epiotics; *f*, parietal foramen; *g*, posterior horns; *h*, inner posterior orbital border.

Fig. 2. Front view of vertebra, three-fourths natural size: *a*, centrum, showing a minute notochordal foramen in the centre; *b*, neutral canal; *c*, spinous process, restored from another specimen; *d*, transverse process; *e*, anterior zygapophysis.

Fig. 3. Inside view of mandibular ramus of *Palæoniscus*, showing the row of laniary teeth almost perfect, but turned by pressure so as to present their sides; the row of small exterior teeth is buried in the matrix: *a*, anterior extremity; *b*, posterior articular process; *c*, impressions of the surface-striæ in the matrix, a portion of the bone having been removed.

Fig. 4. External view of a maxilla of another species of *Palæoniscus*, exhibiting both rows of teeth, the laniary and the small exterior teeth appearing to be in the same line, on account of pressure: *a*, anterior extremity; *b*, tooth figured in the next Plate.

Fig. 5. Inside view of a portion of the alveolar border of the jaw of *Palæoniscus*, showing the row of laniary teeth within the small exterior row; *a*, laniary teeth; *b*, impressions in the matrix of the teeth of the exterior row; *c c*, three of the small exterior teeth left adhering to the matrix.

Fig. 6. External view of a mandibular ramus of *Acanthodopsis Wardi*: *a*, anterior extremity; *b*, posterior extremity; *c*, styliform process attached to the dentigerous bone, *d*.

PLATE III.

Fig. 1. Tooth from maxilla of *Palæoniscus* (Plate II., fig. 4 *b*): enamel-tip.

Fig. 2. Section of tooth of *Palæoniscus*, exhibiting the cap of enamel, *a*; *b*, film of enamel coating the crown, very frequently absent.

Fig. 3. Section of tooth of *Pygopterus*, from Agassiz, showing the enamel-tip, *a*.

Fig. 4. Section of the upper portion of the tooth of *Polypterus*, from Agassiz, showing the cap of enamel, *a*.

Fig. 5 Section of portion of maxilla of *Rhizodopsis*, much enlarged, exhibiting the bony pillars supporting the teeth; *a a*, bony pillars; *b b*. teeth in an abraded condition, the enamel having all disappeared, and, in some instances, portions of the dentine.

V.—*On the Crustacean Fauna of the Salt-Marshes of Northumberland and Durham.* By George S. Brady, C.M.Z.S., &c. (Plates IV., V.)

At the Newcastle Meeting of the British Association, in 1863, I read a short paper "On the Zoology of Hylton Dene,"* in which was recorded the occurrence of various Entomostraca, Foraminifera, and other Invertebrata, in slightly brackish water in the neighbourhood of Sunderland. The subject appeared to me to be one of very great interest, not only as exhibiting the manner and degree in which the various denizens of fresh and salt water are able to accommodate themselves to altered conditions, as in the case of the common shrimp and stickleback, but also as affording an opportunity for the study of a group of animals which seem to be inhabitants exclusively of brackish water, and which may be supposed to be modifications of species originally dwelling in the sea, or perhaps in purely fresh water. Furthermore, the investigation of the inhabitants of our salt-marshes might be expected to throw some light on the real character of those Carboniferous and post-tertiary deposits which are supposed to have been formed in estuaries, or lagoons of brackish water. I have, therefore, during the last three or four years, taken advantage of every opportunity that has come in my way to collect microzoa—especially Entromostraca and Foraminifera—from the salt-marshes of our district; and I do not know of any such locality in Northumberland or Durham which I have not more or less thoroughly examined. The marshes which I have visited are the following:—Cowpen Marsh at the mouth of the Tees, Hartlepool Slake, Hylton Dene and Claxheugh on the

* See "Transactions of Tyneside Naturalists' Field Club," Vol. VI., p. 95.

Wear, Jarrow Slake, Seaton Sluice, the mouths of the Wansbeck, Coquet and Aln, as well as Burgh Marsh on the Solway: besides these I have received some scanty gatherings from the Blyth and Tweed; and the Rev. A. M. Norman and Mr. David Robertson have kindly supplied me with notes of species taken in similar situations in Scotland and the Channel Islands.

My attention has been chiefly confined to the Crustacean Fauna, and it is that alone which I have examined minutely, though, for the sake of more general interest, I have always noted such other animals as presented themselves to my attention.

There seems to be very little variety amongst the Mollusca inhabiting these marshes. *Rissoa ulvæ* is the only gasteropod (excepting Nudibranchs) which I have found alive in strictly brackish water, where it occurs often in great abundance; but pools further removed from the saline influence, and above the highest limit of spring tides, where, to the taste, the water is quite fresh, are frequently inhabited by a peculiar mixed Crustacean Fauna, seeming to indicate some slightly saline character. In such situations we meet with *Limnea peregra* and *Pisidium pulchellum*, which are quite fresh-water species. The only marsh in which I have taken any Nudibranchiate species is Hylton Dene, where *Alderia modesta* occurred in great abundance, in company with a smaller species, *Limapontia depressa*, which was first found there by Mr. Albany Hancock. These two species have also been found in company at Loughor Marsh, near Swansea, by Mr. C. Spence Bate and Mr. Muggridge. In the "debateable ground," between fresh and brackish water, I have also met with the beautiful polyzoon *Plumatella repens*; but in this case the general vegetation and animal life of the pool was decidedly that of fresh water, differing only in the presence of several species of stalk-eyed crustacea, which usually inhabit brackish water.* For further particulars of this interesting locality I must refer the reader to my paper on the Zoology of Hylton Dene.

The higher orders of Crustacea are almost always represented in salt-marsh pools by *Carcinus mænas*, *Palæmon varians*,

* *Palæmon varians*, *Mysis vulgaris*, and *Corophium longicorne* occur in such a situation in Hylton Dene.

Crangon vulgaris, *Mysis vulgaris*, *Gammarus locusta*, *Corophium longicorne*, and *Sphæroma rugicauda*: in Hylton Dene I met also with *Orchestia littorea*, and at Seaton Sluice with *Oniscus asellus*. These usually occur in considerable numbers, though very often a pool will be found tenanted entirely by one species to the exclusion of the rest, while a neighbouring pool will contain a mixture, or perhaps a single different species. In Hartlepool Slake I have seen the water so swarming with *Mysis vulgaris* that a net could not have been dipped in the spaces between the floating balks of timber without capturing scores or perhaps hundreds of them.

The Entomostracan inhabitants of salt-marshes seem to be confined to the two orders, Ostracoda and Copepoda. In pools which are subject to the overflow of ordinary spring-tides the Ostracoda met with are *Cythere castanea*, *Cytheridea littoralis*, and *Loxoconcha elliptica*, the last named until recently an undescribed, and apparently a rather uncommon species; the other two are of very frequent occurrence, *C. littoralis* often existing in astonishing abundance. But in the sub-brackish pools slightly above tidal influence, which have been already referred to, we find two Cypridæ which seem to have a particular liking for these situations, though both are occasionally found in quite fresh water; these are *Cypris salina* and *Cypridopsis aculeata*. The only locality in which I have found the two species in company is a hot-water pond at Monkwearmouth Colliery, the water of which, though of course not at all marine in character, is, nevertheless, owing to its rapid evaporation, constantly saturated with salts of lime, &c., which it deposits copiously in a sort of crust upon the vegetation (*Potamogeton*, *Callitriche*, &c.) which it contains. Besides this locality *C. salina* has been found only twice by Dr. Baird and myself, and in both cases in pools just above high water. The Monkwearmouth pond seems also to afford the only instance of the occurrence of *C. aculeata* apart from salt water, unless, indeed, one of the Suffolk "broads," where it was taken by Mr. E. C. Davison, be an instance of fresh-water habitat. I believe, however, that even this may probably be rightly called a sub-brackish habitat.

The Copepoda which I have found in brackish water are as follows:—*Dias longiremis*, Lilljeborg, *Temora velox*, Lilljeborg, *Cyclops æquoreus*, Fischer, *C. Lubbockii*, n. sp., *Dactylopus tisboides*, Claus, *Delavalia palustris*, n. gen., *Tachidius brevicornis*, Lilljeborg, and two species of *Cleta*, which I have not yet been able to work out satisfactorily.

Temora velox appears to be the most abundant of these species, occurring in great profusion in almost all brackish pools on our coast, more especially in the autumn months. I have only once met with it in the open sea.

At Seaton Sluice a little mite, *Halacarus rhodostigma*, Gosse, occurred pretty plentifully. I did not notice it while alive, and can therefore give no account of its habits. The pools at Seaton Sluice have afforded me a decidedly greater variety of Entomostraca than any other similar locality, and I am disposed to attribute this, in part, to the greater abundance of algæ which they contain. *Vaucheria velutina* and *Conferva linum* form the principal vegetation, and certainly harbour a great number of these microzoa, but many species are found very abundantly where there is scarcely any vegetation, as for instance *Temora velox* and the three species of Ostracoda previously mentioned. *Cytheridea littoralis* and the Foraminifera seem to haunt the mud exclusively, and are not to be taken in any quantity, merely by sweeping the weeds, and I am disposed to think that the genus *Cleta* has the same habit.

I am at a loss to account for the constant existence in salt-marshes, of their characteristic pools. They are quite unlike any other pools, being mostly shallow (about six or eight inches in depth), the bottoms perfectly flat, and the sides perpendicular, as if cleanly punched out of the ground, never shelving or saucer-shaped. Wherever a salt-marsh exists pools of this kind are sure to be found, but the mode of their formation is to me a mystery.

In the following notes on the species of Entomostraca I have not thought it desirable to give descriptions or figures of any except entirely new species, or species new to the British Fauna. The rest have been sufficiently described elsewhere.

Class. CRUSTACEA.

Division. ENTOMOSTRACA.

Order. OSTRACODA.

Family. CYPRIDÆ.

Genus. CYPRIS, *Müller*.

Cypris salina, *Brady*.

Cypris salina, Brady. Monograph of recent British Ostracoda, p. 368, Plate XXVI., figs. 8–13.

Cypris strigata, Baird. British Entomostraca, p. 157. Brady, Intellectual Observer, Vol. I. (1862), p. 452, Woodcut, fig. 6.

This species I at one time supposed, with Dr. Baird, to be perhaps referable to Müller's *C. strigata*, the peculiar surface markings agreeing very well with his description; but the shape and proportions of the carapace are so widely different that I now consider it quite distinct, and I am confirmed in this opinion by the fact that another species more nearly approaching the original *strigata* has been noticed by some continental authors. The only localities in which *C. salina* has yet been found are Monkwearmouth Colliery pond, a pool about high-water mark at Warkworth (G. S. B.), and "pool on sea shore a little above high-water mark, at Thornton Loch, East Lothian, June, 1885" (Dr. Baird).

Genus. CYPRIDOPSIS, *Brady*.

Cypridopsis aculeata (*Lilljeborg*).

Cypris aculeata, Norman. Trans. Tyneside Nat. Field Club, Vol. V., p. 147, Plate III., figs. 7–10.

Cypridopsis aculeata, Brady. Monograph of recent British Ostracoda, p. 376, Plate XXIV., figs. 16–20; and Plate XXXVI., fig. 10.

The genus *Cypridopsis* differs from *Cypris* in the post-abdominal rami being quite rudimentary. *C. aculeata* has been found in this country in the following localities :—Brackish ditches at Gravesend (Professor T. Rupert Jones), Sutton Decoy, Suffolk (Mr. E. C. Davison), Cowpen Marsh, near Stockton (Rev. A. M. Norman), Hylton Dene and Monkwearmouth Colliery pond (G. S. B.).

Family. CYTHERIDÆ.

Genus. CYTHERE, *Müller.*

Cythere castanea, *G. O. Sars.*

Cythere castanea, G. O. Sars. Oversigt af Norges Marine Ostracoder, p. 32. Brady, Monograph of recent British Ostracoda, p. 398, Plate XXVIII., fig. 27; and Plate XXXVIII., fig. 6.

Occurs pretty plentifully in most of our salt-marshes. I have found it at Hylton Dene, Jarrow Slake, and at the mouths of the Seaton Burn, Wansbeck, Aln, and Tweed.

Genus. CYTHERIDEA, *Bosquet.*

Cytheridea littoralis, (*Brady*).

Cyprideis torosa. Brady, Trans. Tyneside Nat. Field Club, Vol. VI., p. 108, Plate III., figs. 11–23. G. O. Sars, Oversigt af Norges marine Ostracoder, p. 51.

Cytheridea torosa, Brady. Monograph of the recent British Ostracoda, p. 425, Plate XXVIII., figs. 7–12; and Plate XXXIX., fig. 5.

There seems to be no valid distinction between the genus *Cyprideis*, proposed by Prof. T. Rupert Jones, and the previously established genus *Cytheridea*, Bosquet. *C. littoralis* occurs often in very great abundance, and almost always in brackish water. The following are the localities where I have taken it :—Jarrow Slake, Seaton Sluice, mouths of the Wansbeck and Coquet; and

I have also seen specimens collected by the Rev. A. M. Norman from Hartlepool, the coast of Somersetshire, and Guernsey. Mr. Norman has also taken it in fresh water near Sedgefield, and Professor T. Rupert Jones in brackish water ditches at Gravesend, and in shell-sand on the Devonshire coast. I have found it abundantly in mud from the Sea of Azoff, and sparingly in gatherings from various places in the Levant.

The confused synonymy of this species requires a few words of explanation. The specific name *torosa* was originally applied by Professor T. Rupert Jones to certain fossil carapaces found at Grays, in Essex, which we now know to be identical with the more recently described *Cythere lacustris* of G. O. Sars. But after preparing his first description, Professor Jones found, in ditches of brackish water at Gravesend, living specimens which he supposed to belong to the same species as his *torosa*. These were referred to in his "Monograph of the Tertiary Entomostraca," published in 1856, as *Cyprideis torosa*. In a short paper published by myself (*loc. cit.*) in 1864, I adopted this view, describing the recent salt-marsh species under the name *Cyprideis torosa*. But in the preparation of my recently published "Monograph of the Recent British Ostracoda," having had the advantage of reference to the original type specimens of *C. torosa*, I found that they (the specimens from Grays) were specifically distinct from the recent brackish water species, and at the same time I became aware that G. O. Sars, not having access to Professor Jones's "Monograph," had described the original *C. torosa* from living specimens, under the name *Cythere lacustris*, and had also followed me in referring the smoother littoral species to *C. torosa*, Jones. Under these circumstances, wishing to avoid the needless introduction of fresh specific names, I proposed in my "Monograph" to retain the name *torosa* for the species which had already been recognised under that term by G. O. Sars and myself, as also in part by Professor Jones, allowing Sars's name *lacustris* to stand for the fresh-water torose form. I was not then aware, as I now learn from Mr. Jones, that his description of the carapace was made wholly from the fossil specimens (from Grays), and the reference to the recent form (Gravesend) was

G. S. Brady, delt.

W. West

made on the ground of similarity of valves to the smoother individuals of *C. torosa*. Subsequently the limbs of the Gravesend specimens were examined and misplaced to the fossil valves (the fossil valves of Grays and the recent carapaces of Gravesend being regarded as belonging to the same species). It seems, therefore, unavoidable, that the term *torosa* must in future be applied exclusively to the fresh-water species (*lacustris*, Sars), and that the smooth brackish water species (*torosa*, Sars and Brady) must take an entirely new name: with this view, the specific name *littoralis* is here proposed.

Genus. LOXOCONCHA. *G. O. Sars.*

Loxoconcha elliptica, *Brady.*

Loxoconcha elliptica, Brady. Monograph of recent British Ostratracoda, p. 435, Plate XXVII., figs. 38, 39, 45–48; and Plate XL., fig. 3.

I first found this species in May, 1865, in pools near the mouth of the Wansbeck; and in May and July, 1867, more abundantly at Seaton Sluice. Mr. Norman has also taken it in Arnold's pool, Guernsey. Still more recently I have found it in various localities in Ireland, and have seen it in a gathering from the estuary of the Thames.

Order. COPEPODA.

Family. CYCLOPIDÆ.

Genus. CYCLOPS, *Müller.*

Cyclops Lubbockii, n. sp. (Plate IV., figs. 1–8.)

Superior antennæ of the female fourteen-jointed, the eighth joint being incompletely divided, the last two joints the largest, seventh, ninth, eleventh, and thirteenth joints each armed with a single long apical seta, the last joint with six. Penultimate joint of the inferior antennæ bearing on the upper margin a row of eight curved setæ, gradually increasing in length from the first to the last. Mandibles broad at the base. Second pair of foot-jaws feeble and sparingly setose. Fifth pair of feet bi-articulate, cylindrical, first joint short, bearing one long seta, the last joint bearing one long and one short terminal seta. First abdominal segment bearing a small laminar appendage or rudimentary foot, which has four unequal terminal spinous setæ. Caudal segments very long and narrow, nearly four times longer than the preceding abdominal segment, and above half the length of the longest apical seta. Length, $\frac{1}{27}$th of an inch.*

Hab.—In pools of brackish water, near the edge of the Slake at Hartlepool, June, 1866.

This species is very closely allied to *Cyclops insignis*, Claus; but the setose armature of the upper antennæ, and the conformation of the rudimentary feet, are both strikingly different. The foot-jaws also seem to be much weaker, and less robustly spined. The form and proportions of the joints of the tail and upper antennæ of *C. insignis*, as figured by Claus (*Weigmann's Archiv.*, 1857) are, however, precisely similar to those of the present species. The only Entomostraca which occurred in company with it were *Temora velox* and *Tachidius brevicornis*, both purely brackish water species. I have pleasure in inscribing this species to Sir John Lubbock, an author who has contributed largely to our knowledge of this order.

CYCLOPS ÆQUOREUS, *Fischer*. (Plate IV., figs. 9–16).

Cyclops æquoreus, Fischer. Abhandl. der Akad. der Wissenschaft, München (1860), Band 8, p. 654, T. XX., figs. 26–29.

Upper antennæ of the female six-jointed, short and stout, rather densely setose along the upper margin; fourth joint the longest, third and fifth both very short, the sixth nearly as long as the fourth, and terminating in four setæ. Lower antennæ

* This is in all cases exclusive of the tail setæ.

small, three-jointed, the basal joint bearing one short apical seta, the second none, the last six curved apical setæ, and a tuft of three or four—one long, the rest short—from the middle of the upper margin. Upper foot-jaw stout and powerfully clawed; lower, weak, slender, bearing three long terminal setæ and several shorter marginal ones. Mandibles small, and slenderly toothed. First four pairs of feet alike; branches short, and nearly equal, the joints very broad; marginal spines of the inner branch ovate-lanceolate, divaricate. First abdominal segment produced at each side into a slender projecting angle from which springs a short bi-articulate seta, representing the fifth foot. To the second abdominal segment is attached at each side a conspicuous triangular lamina, the external margin of which bears four spines, the first and fourth (counting from above) being nearly equal, the second shorter, the third much longer and setiform: margins of the appendage finely ciliated. The lower angles of the abdominal segments are produced downwards, appearing like slender appressed spines. Terminal or caudal segments short, bearing one short seta in the middle, and four terminal setæ, the longest of which considerably exceeds the length of the abdomen. Ovisacs two.

Hab.—Brackish pools at Seaton Sluice, Northumberland.

My specimens agree so closely in many respects with the figures and description of *Cyclops æquoreus*, given by Fischer, that I cannot entertain much doubt as to their identity. The lower antennæ are, however, considerably stouter than those figured by Fischer, and are, as far as I can make out, only three-jointed; the spinous armature of the triangular abdominal appendage of Fischer's specimens also slightly differs from that of mine. It appears to me that the small bi-articulate cylindrical appendage, attached just above the triangular plates, is the true homologue of the fifth foot, and that these plates correspond with the very similar appendages which are found in *C. Lubbockii* (fig. 6 *a*) attached to the segment below the last pair of feet. Fischer's specimens were taken in "sea-water" at Madeira. Mr. Norman has specimens from a marsh in the West of Scotland.

Family. HARPACTIDÆ.

Genus. TACHIDIUS, *Lilljeborg.*

Superior antennæ short, having no flagellum; in the male bearing a vesiculiform appendage, and hooked at the extremity, in the female stout, and densely setose. Lower antennæ small, two-branched; secondary branch small. First four pairs of swimming feet alike, two-branched; each branch tri-articulate; fifth pair rudimentary, and composed of a single setose lamina. One eye. Ovisac single.

Tachidius brevicornis (*Müller*). (Plate V., figs. 1–9.)

Cyclops brevicornis, Müller. Entomostraca, p. 118.

Tachidius brevicornis, Lilljeborg. De Crust. ex Ord. trib., p. 196, Tab. XXII., figs. 12–16; Tab. XXIII., figs. 1, 2, 9; and Tab. XXIV., figs. 17, 18.

Body gradually tapering from the head downwards; lower edge of each segment distinctly pectinated; head beaked. First segment of the cephalothorax equal in length to the following three. Superior antennæ of the female (fig. 4) swollen at the base, the last five joints suddenly narrower, last joint excessively small, penultimate longer than any of the three preceding; the whole antenna densely clothed with long setæ on its upper margin, some of the setæ being strongly plumose, or even almost spinous. Superior antenna of the male (fig. 3) bearing, towards the apex, a large vesiculiform sac from the upper margin of which spring a strong curved spine and three long setæ; the apex of the antenna forming a strong claw or hook. Lower antennæ (fig. 5) two-jointed, the basal joint bearing a small, slender, secondary branch. Third foot-jaw (fig. 6) tri-articulate, slender, chelate. Four pairs of swimming feet (fig. 7), all alike, two-branched, each branch three-jointed. Fifth pair (fig. 9) squamous, bordered with long spiniform setæ. Terminal joints of the abdomen very short (fig. 8); internal (longer) setæ of the tail about half the length of the body, external setæ half the length of the internal, beset along nearly their whole length with short cilia. Length, $\frac{1}{40}$th of an inch.

Hab.—Brackish pools at Hartlepool, and in Hylton Dene, near Sunderland, county of Durham; and at Seaton Sluice, Northumberland.

From the close agreement of my specimens, in most respects, with the figures and descriptions given by Lilljeborg, I have no doubt that they are referable to *Tachidius brevicornis*, though I have not been able to make out precisely the structure of some of the appendages of the mouth. A species closely allied to the present, *T. minutus*, has recently been described by Prof. Claus.*

Genus. DACTYLOPUS, *Claus.*

General conformation of the body as in Canthocamptus. Superior antennæ mostly eight-jointed, armed with a flagellum; secondary branch of the lower antennæ three-jointed. Lower foot-jaws large, subchelate. Both joints of the first pair of feet tri-articulate, armed with digitiform terminal setæ, internal branch prehensile, its first joint much elongated, apical joint very short.

Dactylopus tisboides, *Claus.*

Dactylopus tisboides, Claus. Die frei lebenden Copepoden, p. 127, Taf. XVI., figs. 24–28; and Die Copepoden-Fauna von Nizza, p. 27, Taf. III., figs. 1–7. (*Not* of Brady, Intellectual Observer, Vol. VII., p. 22.)

Body rather broad and massive, often marked with reddish-brown blotches. Head produced into a short, conical beak. Upper antennæ of the female short and densely setose along their whole length, nine-jointed (eight-jointed, *Claus*), tapering gradually from the base, the penultimate and ante-penultimate joints very short. In the male the joints are twisted, and constricted at the sutures; no vesculiform swelling. The secondary branch of the lower antenna is armed with four setæ along its upper margin, and three terminal setæ. Last joint of the lower

* Die Copepoden-Fauna von Nizza, p. 24.

foot-jaw having its margins nearly equally arched, lower margin bearing in the middle a long seta, with several minute ones in front of it; claw long and slender. First pair of feet strong, outer margins of the two branches densely setose and spinous; outer branch very much shorter than the inner; the long branch bearing on its inner margin a single long plumose seta, which never reaches much beyond the base of the terminal spines. Fifth pair of feet somewhat larger, and less angular in the female than the male, bearing several long apical setæ. Abdomen broad, its last segment short; caudal segments also very short, inner tail-setæ fully two-thirds the length of the body, outer seta about half their length. Length, $\frac{1}{45}$th of an inch.

Hab.—In rock pools at Roker, county of Durham; and the Great Isle of Aran, Galway Bay. Also in pools of brackish water at Seaton Sluice, Northumberland.

This species is less common than that which I at one time supposed to be referable to *D. tisboides*, and which I published under that name in the "Intellectual Observer" (*loc. cit.*). The form of *D. tisboides* found in brackish water differs remarkably from the marine form in the strength of the spinous and plumose armature of the limbs. I do not know that this variation is produced by difference of habitat, my observation of the species not having been extensive enough to assure me that a similar variety may not be found in truly marine situations. The following remarks of Dr. Claus on a similar variation in one of a nearly allied genus, will, however, be read with interest:—"The stronger, and, on the average, the larger form of *Harpacticus nicæensis* has a heavy, strong body, ill-bred apparently, inactive, and wanting in mobility; the antennæ clumsy, with their third and fourth joints short and thick, the second joint very long; the second foot-jaw ends in a strong, massive, clasping hand; the first pair of feet are armed with doubly curved claws; the feet, especially the last pair, are strong and clumsy, all the setæ showing a tendency to become plumose. The smaller and slenderer breed has larger antennæ, the third and fourth joints of which are much elongated; the prehensile apparatus of the foot-jaws and first pair of feet more slender; and there is also a much slimmer, slenderer form of the limbs. In general structure and conformation of body, in the peculiar arrangement of setæ, the serration of the abdominal segments, in short, in those points where distinct species mostly diverge, there is here a striking agreement. * * After diligent enquiry, these differences remained unexplained; and I was inclined to consider them as mere individual variations. But further investigation of all parts of the body convinced me that two distinct forms, with qualities diversely useful, had originated two separate races, one slender, swift, and agile, the other clumsy in figure, but robust and powerfully armed. The two races are so far separate that intermediate individuals, partaking of the characters of both, are not met with. The upper antennæ, however, in each case, show a *tendency to similar variations: at the same time these variations are not so profound that they might not have been acquired singly, or in combination. The differences in the relative size of the claws and prehensile organs may be traced back to the youngest stages of growth.* * * * Many species may, no doubt, have been founded on characters no more distinct than these, and on mere deviation of character in the joints, which a critical investigation would prove to be worthless."* It may be noticed that many of the peculiarities here pointed out by Dr. Claus—especially the strong, doubly-curved claws of the first feet in the stronger, and the very slender, simply-curved claws in the weaker, form—have their exact counterparts in the two varieties of *D. tisboides* here referred to.

GENUS. DELAVALIA,† nov. gen.

In general form like *Dactylopus*. Superior antennæ eight-jointed, having no flagellum. Inferior antennæ bearing a bi-articulated secondary branch. First pair of feet two-branched,

* "Die Copepoden-Fauna von Nizza. Ein Beitrag zur Charakteristik der Formen und deren Abänderungen. 'im sinne Darwin's'" von Dr. C. Claus. Marburg und Leipzig, 1866. See also an Abstract of Dr. Claus's Memoir, by the present author, in the "Intellectual Observer, Vol. X., p. 327.

† From Seaton Delaval, near which place the genus was first found.

the external branch three-jointed, the internal two-jointed, not prehensile; both branches of the three following pairs tri-articulate; fifth pair rudimentary, foliaceous. Two ovisacs.

This genus differs from *Dactylopus* and *Thalestris* chiefly in the structure of the first pair of feet, one or both branches of which are, in those genera, prehensile. The absence of a flagellum in the upper antenna, and the presence of two ovisacs constitute further distinctive characters.

Delavalia palustris, n. sp.

Body of the female robust, the segments not pectinated on their lower margins. Upper antennæ short, densely setose on the superior margin, gradually tapering to the apex, last joint slender, longer than any of the preceding. Superior margin of the apical joint of the lower antennæ pectinately setose; the last three setæ longer than the rest, and almost spinous; apex bearing five or six long curved setæ; secondary branch slender, bi-articulate. The two branches of the first pair of feet nearly equal in length; the inner bi-articulate, its apical joint narrow, and much longer than the basal, terminating in two long subequal spinous setæ; external branch composed of three nearly equal joints, the last terminating in two setæ, like those of the inner branch. Both branches of the second, third, and fourth pairs tri-articulate, the outer nearly twice as long as the inner. Fifth pair of feet small, subovate, lower margin bearing about five setæ. Ovisacs two, divergent. Length, $\frac{1}{32}$nd of an inch.

Hab.—In brackish pools at Seaton Sluice, Northumberland.

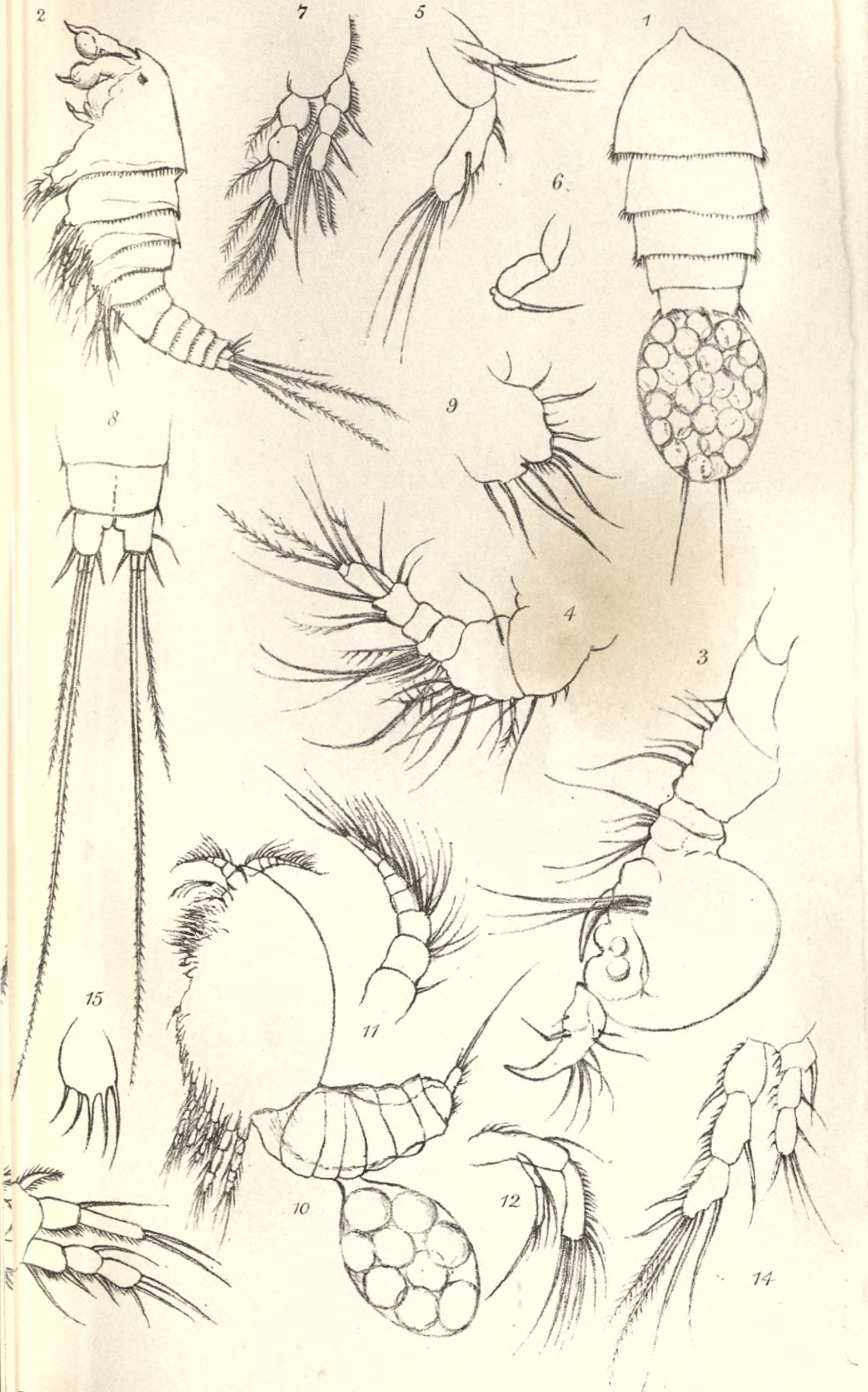
Family. CALANIDÆ.

Genus. TEMORA, *Baird.*

Temora velox, *Lilljeborg.*

Temora velox, Brady. Nat. Hist. Trans. North. and Durham, Vol. I., p. 38, Plate I., fig. 16, and Plate III., figs. 1–11.

This is the most abundant of all the brackish-water Copepoda.



..Brady delt.

W. West, imp.

I have taken it in great numbers at Hylton Dene; also at Hartlepool, Seaton Sluice, Alnmouth, and Burgh Marsh, near Carlisle. Mr. Norman finds it in a similar situation in the Isle of Cumbrae. I have only once noticed it in the open sea, and then only one or two specimens were taken; this was on the coast near Sunderland Docks.

Genus. DIAS, *Lilljeborg.*

Dias longiremis, *Lilljeborg.*

Dias longiremis, Brady. Nat. Hist. Trans. North. and Durham, Vol. I., p. 35, Plate I., fig. 14; and Plate II., figs. 11–18.

D. longiremis has occurred in brackish water at Alnmouth, and at Burgh Marsh Cumberland; but is more abundant and of much finer growth in the open sea.

EXPLANATION OF THE PLATES.

PLATE IV.

Cyclops Lubbockii.

Fig. 1. Upper antenna of female, × 210.
Fig. 2. ,, ,, male, × 210
Fig. 3. Lower antenna, × 210.
Fig. 4. Upper foot-jaw, × 210.
Fig. 5. Lower foot-jaw, 400.
Fig. 6. Fifth foot of male, × 400.
Fig. 6*a*. Appendage of first abdominal segment, × 400.
Fig. 7. Upper abdominal segments of male, × 210.
Fig. 8. Tail, × 210.

Cyclops æquoreus.

Fig. 9. Upper antenna of female, × 210.
Fig. 10. Lower antenna, × 210.
Fig. 11. Mandible, × 210.

Fig. 12. Lower foot-jaw, × 210.
Fig. 13. Upper foot-jaw, × 210.
Fig. 14. Foot of first pair, × 210.
Fig. 15. Abdomen and lower segments of cephalothorax, × 120.
Fig. 16. Foot of fifth pair, × 210.

PLATE V.

Tachidius brevicornis.

Fig. 1. Female seen from below, × 85.
Fig. 2. Male seen from side, × 85.
Fig. 3. Superior antenna of male, × 400.
Fig. 4. ,, ,, female, × 400.
Fig. 5. Inferior antenna, × 400.
Fig. 6. Third foot-jaw, × 210.
Fig. 7. Foot of second pair, × 210.
Fig. 8. Extremity of abdomen, × 210.
Fig. 9. Fifth foot of female, × 210.

Delavalia palustris.

Fig. 10. Female seen from side, × 85.
Fig. 11. Superior antenna of female, × 210.
Fig. 12. Inferior antenna, × 210.
Fig. 13. Foot of first pair, × 210.
Fig. 14. ,, fourth pair, × 210.
Fig. 15. ,, fifth pair, × 210.

VI.—*A Catalogue of the Insects of Northumberland and Durham* (Aculeate Hymenoptera). By Thomas John Bold, Vice-President of the Tyneside Naturalists' Field Club.

This division of the large order Hymenoptera, the *Aculeata*, is so called because in it the females and workers, or neuters, of the social species are furnished with an *aculeus* or sting. It includes the Ants, Sand and Wood Wasps, Wasps, and Bees, all pre-eminent amongst insects for the wonderful development of their instincts.

The economy of the Ant has been an object of wonder from the earliest times; its industry and forethought have become proverbial. The assiduity with which it seeks out food for its young, and its methodical manner of carrying it home, are equally worthy of our admiration. A brood of caterpillars is discovered feeding on the foliage of a tree; up swarm the Ants and carry off the spoilers. That they may not impede each other, the empty ones march from the nest by one path, up one side of the bole, whilst the laden ones descend by the other, and go home by another road. Again, a forager finds a dead beetle or a defunct worm, both beyond its strength to transport, but by some means or other the colony become informed of the event, and the prey is borne off by the united labour of the community. Their fondness for the secretions of Aphides is well known; and that they may always have a supply within reach, they collect and carry into their nests some of the root-feeding species. How curious, too, are their nests; what wonders of combined labour and of constructive ability; those of the burrowing species being a wonderful reticulation of most intricate tunnelling, and often of such length as comparatively to dwarf into insignificance the most gigantic burrowing of mankind!

Amongst the *Sand* and *Wood Wasps* we find many instances of actions which appear to be almost more than instinctive: one species is recorded, which, arriving in the vicinity of its nest with a living caterpillar, and not finding the place at once, it fastened the prey between two stems of grass until it sought out the burrow, when it returned and recaptured the prisoner, which it then carried direct home. Another, whose quarry is flies, finds them to become too wary for capture by the usual means, and simulates death to bring them within its reach. A species which feeds its young with the larva which forms those patches of froth so common on plants in summer, has been seen to insert its sting into the secretion, and to catch the maker when it endeavoured to escape by issuing at the other side. More curious still is the fact, that the prey which these insects entomb, as food for their young, is nearly without exception, when the cells are examined, found to be alive, but in a state of stupor. How this comatose state is produced is not exactly known; most probably they have been stung, but in such a manner as not to cause death. There can be no doubt but that it is produced intentionally by some act of the parent insect, whereby two ends are attained: by being so treated they are prevented from injuring the egg, or larva, of the Wasp, and are also kept sweet and fresh until their turn comes to be eaten.

The economy of the *Social* or *Common Wasps* is exceedingly curious and interesting. Their nests are marvels of insect architecture; wonderfully adapted to circumstances, and to the rearing and sheltering of a numerous progeny. The perseverance and industry which they display in searching for food, the care and affection with which they tend and feed their young, and the courage with which they defend them, are all admirable traits in the character of these much persecuted creatures.

Amongst the *Solitary Bees* we find the same varied instincts, and the same admirable adaption of means to an end. The diversity of habit amongst the species of *Osmia* alone is of the most extraordinary nature. They burrow in the soil, in the mortar of old walls, or in old trees: some excavate dead bramble sticks, others adapt themselves to ready-made excavations, such as the straws of thatch, or the hollows of reeds; and what is more extraordinary still, one at least utilizes the empty shells of various species of Helix, whilst another simply attaches her cocoons to the underside of a slate or stone. Those circles, long ovals, &c., so often cut in the foliage of roses and other plants, are the work of the *leaf-cutting Bees, Megachile.* The pieces cut out are used for lining their burrows, the circular ones for the ends, and the ovals for the sides of the cells. It is very interesting to watch a female as she proceeds with her work: alighting on the edge of a leaf, which she grasps on each side with her two pairs of fore feet, she uses her mandibles like a pair of scissors, turns, as it were, on a pivot, quickly clips out the piece, and takes flight with it at the moment it becomes detached.

The *Humble Bees* are the largest, most numerous, most generally distributed, and the most industrious of all our Hymenoptera. Their bright colours and cheerful summer-like hum make them universal favourites. They show considerable sagacity when seeking for sweets: if the flower is large enough they boldy enter, but if not they insert their tongue into the corolla. Some of the Bees, however, being furnished with a proboscis too short for doing this in the usual way, adopt another plan: they bite a hole or holes at the base of the corolla, or in some cases through both the calix and corolla, immediately over the nectary, and so come at the desired nectar.*

The economy of the *Hive* or *Honey Bee* is so wonderful, and many of the facts connected with its history so strange, as to appear almost incredible. These wonders, however, are so generally well known that it would be presumptuous in me to do more than allude to them.

The Aculeata have been so much neglected by provincial entomologists that there are no local catalogues whatever. We can only, therefore, compare our list of local species with those recorded by Mr. F. Smith, in his Monograph for the whole of Great Britain. His families, subfamilies, and numbers of each

* Mr. R. Howse has kindly allowed me to examine a number of the flowers of a Menziezia, which he had preserved in spirit. Each of these has from one to four bilobed holes at the base of the corolla, not simply punctured, but the lobes neatly bitten out. Mr. Albany Hancock has determined this to be the work of *Bombus lucorum*, by taking the female in the act. Amongst other plants in which the calyx, or corolla, or both, have been similarly treated, we find garden and field beans, scarlet beans, larkspurs, azaleas, fuschias, salvias, snapdragons, &c. To beans these punctures are thought to be injurious, by causing the incipient pod to be either partially or entirely abortive.

are tabulated below, with ours in a parallel column, as the easiest means of comparison.

Families and Sub-Families.		Smith. No. of Species.	North. & Dur. No. of Species.
Formicidæ		12	5
Poneridæ		1	1
Myrmicidæ		15	5
Mutillidæ		5	2
Scoliadæ		2	...
Sapygidæ		2	...
Pompilidæ		23	9
Sphegidæ		5	...
Larridæ		7	...
Nyssonidæ		14	6
Crabronidæ		64	21
Philanthidæ		8	...
Euminidæ		13	6
Vespidæ		7	7
Andrenidæ		116	35
Andrenoides'	Apidæ	2	...
Cuculinæ	Apidæ	36	9
Dasygastræ	Apidæ	25	6
Scopulipedes	Apidæ	6	2
Sociales	Apidæ	23	19
Total		386	133

Or more shortly—

	Smith. No. of Species.	North. & Dur. No. of Species.
Ants	33	13
Sand and Wood Wasps	138	42
Wasps	7	7
Solitary Bees	185	52
Humble and Hive Bees	23	19
Total	386	133

From the above table it will be seen that we have in our district little more than one-third of the recorded British species. Five families and one subfamily are totally wanting to it. In several other families, more especially those containing the Sand and Wood Wasps, and Solitary Bees, we are very poor indeed.

No doubt this may, in a great measure, be the result of our northern latitude, variable climate, and strong clay subsoils, all of which are most unfavourable to the development of this order of insects, who are pre-eminently creatures of a southern clime, a hot sun, and sandy soil. On the other hand, we are rich in the more robust species; we have all the Social or Common Wasps, and nearly the whole of the Humble Bees. Many more species will probably be added to our list when the southern part of the County of Durham, and the northern part of Northumberland, come to be examined, neither of which the business engagements of the writer have allowed him to visit. The Cheviot range of hills will be sure to produce boreal species, particularly Bombi, some of which are peculiar to mountains. The fine turnip and *barley soils of the Wooler district are likely to suit the burrowing habits of these creatures better, and to be richer in species than the tenacious clays of the Coal-Measures.*

The principal books to which reference is made in the following pages, are:—Linnæus, "Fauna Suecica, and Systema Naturæ;" Fabricius, "Systema Piezatorum;" Latreille, "Histoire Naturelle des Fourmis;" Kirby, "Monographia Apium Angliae;" Curtis, "British Entomology;" Shuckard, "Fossorial Hymenoptera;" Stephens, "Illustrations of British Entomology, supp.;" Saint Fargeau, "Historie Naturelle des Insects;" Dahlbom, "Hymenoptera Europæa;" Zetterstedt, "Insecta Lapponica;" Wesmael, "Monographie des Odyneris de la Belgique;" Wesmael, "Revue Critique Fouisseurs de la Belgique;" Smith,* "Monograph of the Bees of Great Britain;" Smith, "Monograph of the British Fossorial Hymenoptera, Formicidæ and Vespidæ."

* Although issued under the humble name of "Catalogues of the British Museum," these two volumes are in reality most valuable and carefully executed Monographs, which are quite indispensible to the British student. The plates, engraved by Mr. Smith himself, are perfect models of entomological delineation.

Order. HYMENOPTERA, *Linn.*

Tribe I. HETEROGYNA, *Latr.*

Division II. HYMENOPTERA ACULEATA, *Latr.*

Family I. FORMICIDÆ, *Leach.**

Genus I. FORMICA, *Linn* (In part).

1. *F. rufa*, Linn. The Wood Ant. Linn., Faun. Suec., No. 1721; Smith, Monog., 4, 1.

Not abundant in the vicinity of Newcastle; more plentiful in the woods at Gibside, Dilston, and Shotley Bridge, and in immense numbers by the side of the Devil's Water, above Dilston. I have occasionally taken a few examples on the sea coast, near Whitley, and noticed it in plenty in Bothal Woods. In the latter place, on one of the Club's field days, the Ants wore seen streaming across the footpath, up one side of a large tree, and down the other. Those coming down were each laden with a small green caterpillar.

2. *F. fusca*, Linn. Linn., Faun. Suec., 226, No. 1722. Smith, Monog., 9, 5.

Exceedingly abundant everywhere; nesting in dry banks, walls, beneath stones, in posts, decaying wood, &c. On the strong clay lands, north-east of Newcastle, it frequently takes possession of the gate posts, which it excavates from end to end, with its intricate galleries. I have often seen *Platysma niger* near the nests of the Ants, I think for the purpose of devouring them or their progeny.

3. *F. fuliginosa*, Latr. The Jet Ant. Latr., Hist. Nat. Fourm, 140; Smith, Monog., 10, 6.

This Ant is not common with us, and I have only taken it at

* This family is composed of insects living in communities, which consist of males, females, and workers. They are hence called Social Ants, and their economy is exceedingly curious and interesting.

Whitley, Sunderland, and a little to the west of Gilsland. Mr. W. Peacock, of Sunderland, directed my attention to a colony in his garden, which were travelling up a tree for the sake of the Aphides.

4. *F. nigra*, Linn. The Garden Ant. Linn., Faun. Suec., 1723; Smith, Monog., 13, 8.

This, the most abundant Ant in the South of England, is with us not nearly so common as *F. fusca*. Whilst it would be difficult to find a place where the latter does not occur, *F. nigra* is mostly restricted to the sandy flats near streams, where it nests beneath stones. I have, however, occasionally found it in hedge-rows, and once found a large colony in a decaying stump, but never at any great distance from the water. A beetle, *Myrmedonia limbata*, is often found in attendance upon this and the following species.

5. *F. flava*, De Geer. The Turf Ant. De Geer, Ins., II., 1089, 5; Smith, Monog., 15, 10.

Very abundant everywhere. In sandy places, near streams, and in meadows, it is found in hillocks; but in hilly localities, and in many places near the sea coast, it nests under stones.

Family 2. PONERIDÆ, *Smith.*

Genus 1. PONERA, *Latr.*

1. *P. contracta*, Latr. Latr., Nat. Hist. Fourm., 195; Smith, Monog, 19, 1.

Exceedingly rare, the worker only having occurred on the sand-hills near South Shields, in May.

Family 3. MYRMICIDÆ, *Smith.*

Genus 1. MYRMICA, *Latr.*

1. *M. ruginodus*, Nyl. Nyl., Adno. Mon. Form. Bor. Eur., 929, 2; Smith, Monog., 20, 1.

This is a very abundant species, and found nearly everywhere.

It nests in a great variety of situations; in woods it is commonly found in decaying wood, or beneath the bark of decaying trees.

2. *M. scabrinodis*, Nyl. Nyl., l. c., 930, 3.; Smith, Monog., 21, 2.

Also a common insect, but not so abundant as No. 1. I have specimens from Gosforth, Heaton, South Shields, Whitley, &c. At Whitley I found a colony beneath a stone, within a few feet of a very large nest of the next species.

3. *M. lævinodus*, Nyl. Nyl., l. c., 1052, 18; Smith, Monog., 23, 3.

The most abundant species of the genus in our district, occurring nearly everywhere, but most copiously on the sea coast. Behind the ballast heaps at South Shields it is found, nesting beneath stones in immense profusion, and there I have often taken a large beetle, *Staphylinus stercorarius*, in its nests.

4. *M. lobicornis*, Nyl. Nyl., l. c., 932, 4; Smith, Monog., 25, 5.

This appears to be a rare insect everywhere. With us it has only been found on the sea coast, and there very sparingly. On the sand-hills near South Shields I found a female and a worker, in April. On Whitley links, in May, I got other workers, and in August met with a nest beneath a stone, but it only contained about a dozen of the same sex. I have also an individual from Lanercost, in Cumberland.

5. *M. acervorum*, Fab. Fab., Ent, Syst., II., 358, 38; Smith, Monog., 29, 8.

Somewhat rare in the district. I have the sexes from Gosforth Woods. It occurred, in some plenty, on the shore at Tain, in Rosshire, in September, nesting beneath stones.

Note.—I have, in former times, seen an Ant or Ants very abundant in stoves and hot-houses, but latterly I have not been able to meet with them.

Family 4. MUTILLIDÆ,* *Leach.*

Genus 1. MUTILLA, *Linn.*

1. *M. Europæ*, Linn. Linn., Faun. Suec., No. 1727; Smith, Monog., 39, 1.

Occasionally found on the sand-hills near South Shields.

Genus 2. MYRMOSA, *Latr.*

1. *M. melanocephala*, Fab. Latr., Hist. Nat., XIII., 266; Monog., 43, 1.

Somewhat rare; taken near Haltwhistle, and near Naworth.

Tribe 2. FOSSORES,† *Latr.*

Family 5. POMPILIDÆ, *Leach.*

Genus 1. POMPILUS, *Fab.* (In part).

1. *P. gibbus*, Fab. Fab., Ent. Syst. Supp., 249, 17; Smith, Monog., 55, 2.

Exceedingly abundant. I have taken it from the sea coast up to our farthest western limit. It preys upon spiders.

2. *P. pectinipes*, Linn. Linn., Faun. Suec., No. 1654; Smith, Monog., 56, 3.

Apparently rare with us. I have two females, taken on the links hear South Shields.

3. *P. spissus*, Schi. Dahlb., Hym. Europ., I., 70, 34; Smith, Monog., 57, 4.

Also rare. I have the male from Mitford, and the female from Haltwhistle.

* The Solitary Ants, in which there are only males and females, the former always winged, and the females apterous.

† The insects of this family are known as Sand and Wood Wasps; and having winged males and females only, are consequently solitary in their habits, burrowing in the earth, or in wood, and provisioning their nests with living insects, larva, and spiders.

4. *P. plumbeus*, Fab. Dahlb., Hym. Europ., I., 42, 21, and 444, 3; Smith, Monog., 58, 5.

Apparently confined to the sea coast. It is common on the sand-hills near South Shields, from July to September.

5. *P. niger*, Fab. Dahlb., Hym. Europ., I., 45, 24; Smith, Monog., 59, 6.

Not an abundant species with us. I have specimens of both sexes, taken near Featherstone, in July; and others from Naworth and Lanercost. It is a most active creature, and the females sting very painfully. The nest is provisioned with caterpillars.

6. *P. melancerius*, Van D. Lind. Dahlb., Hymn. Europ., I, 46, 25; Bold, Entom. Mon. Mag., IV., 226.

This species, which is new to Britain, was captured by the Irthing side, a little to the west of Gilsland, in July. It appears to be very rare; my specimen, a female, and another of the same sex, taken near Dumfries, are the only British examples known.

7. *P.* (*Priocnemis*) *sepicola*, Smith. Smith, Monog., 63, 10; *Priocnemis fuscus*, Dahlb., Hym. Europ., I., 102, 46.

Not uncommon about Haltwhistle, Naworth, and Lanercost, at the end of June. It is said to prey upon spiders.

8. *P.* (*Priocnemis*) *exaltatus*, Fab. Smith, Monog., 65, 13; *Priocnemis exaltatus*, Dahlb., Hym. Europ., I., 113, 55.

An abundant species in most parts of the country, but has only occurred sparingly within our district.

9. *P.* (*Priocnemis*) *agilis*, Shuck. Shuck, Foss. Hym. App., 251, Var. *B. P. exaltatus*, 67; Smith, Monog., 66, 14.

Rare; only one specimen, a female, having been taken, the exact locality of which I had omitted to note.

FAMILY 6. NYSSONIDÆ, *Leach.*

GENUS 1. NYSSON, *Latr.*

1. *N. spinosus*, Fab. Dahlb., Hym. Europ., I., 168, 100, and 484, 1; Smith, Monog., 97, 1.

Near Swalwell, Mr. J. Hardy. I have found it abundantly in the western part of Northumberland, and about Lanercost, in June and July. Unlike most of the order, it is a very sluggish creature.

GENUS 2. GORYTES, *Latr.*

1. *G. mystaceus*, Linn. Dahlb. Hmym. Europ., I., 166, 98; Smith, Monog., 102, I.

Gidside, and elsewhere, abundant. July. I have seen it repeatedly searching strawberry beds for the larva of *Ptyelus spumaria,* which it carries off, clasped most lovingly to its breast with the intermediate legs.

2. *G. quadrifasciatus*, Fab. Shuck, Foss. Hym., 215, 3; Smith, Monog., 105, 3.

Not uncommon by the Derwent side, near Axwell Park. June to August.

GENUS 3. HARPACTUS, *Shuck.*

1. *H. tumidus*, Panz. Shuck, Foss. Hym., 222, 2; Smith, Monog., 109, 1.

Gibside, Mr. J. Hardy.

GENUS 4. MELLINUS, *Fab.*

1. *M. arvensis*, Linn. Dahlb., Hym. Europ., I., 226, 131; Smith, Monog., 113, 1.

This, the most abundant of our local Sand Wasps, frequents sandy places, both on the sea coast and inland. It preys upon large flies, which it shows great sagacity in capturing. The flies are attracted by patches of dung, and to these places the Mellinus resorts, moving about quietly, as if it had no evil intentions whatever. It gradually nears one of its companions, makes a sudden grab, secures it in its jaws, and immediately carries off its prey. Another plan, mentioned by Mr. F. Smith, I have often seen adopted. The Wasp stretches itself upon the dung as if dead, lying quite motionless until a fly comes within reach, when it is quickly secured. This manœuvre is, I believe, mostly resorted to when the dung is dry, and less attractive to the flies, who may then also be more upon their guard.

2. *M. sabulosus*, Fab. Dahlb., Hym. Europ., I., 230, 133; Smith, "Monog.," 114, 2.

Newcastle-on-Tyne, Mr. Hewitson. Smith's Monograph, 116.

Family 7. CRABRONIDÆ, *Leach.*

Genus 1. TRYPOYLON, *Latr.*

1. *T. clavicerum*, St. Farg. Dahlb., Hym., Europ., I., 279, 175; Smith, Monog., 118, 2.

North Seaton, burrowing in woods. July.

Genus 2. CRABRO, *Fab.* (In part).

1. *C. clavipes*, Linn. Smith, Monog., 122, 1; *Rhopalum clavipes*, Dahlb., Hym. Eur., I., 291, 178.

Rare. Little Benton in July, burrowing in the tops of the fir palings.

2. *C. tibialis*, Fab. Smith, Monog. 123, 2; *Rhopalum tibiale*, Dahlb., Hym. Eur., I., 288, 177.

Very rarely at Gosforth. June.

3. *C. dimidiatus*, Fab. Dahlb., Hym., Europ., I., 345, 228; Smith, Monog., 127, 3.

A very abundant species in Durham, Northumberland, and Cumberland. July.

4. *C. luteipalpis*, St. Farg. Smith, Monog., 127, 5; *C. elongatulus*, Dahlb., Hym. Europ., I., 315, 196.

Rather common. Mitford, Long Benton, Heaton, Haltwhistle, and Lanercost. June and July. At Long Benton it makes its nests in "blisters" of the lime on the garden wall, which it provisions with Aphides from the roses at its foot.

5. *C. varius*, St. Farg. Smith, Monog., 129, 7; *C. spinipectus*, Dahlb., Hym. Europ., I., 327, 215.

Somewhat rare. Mitford and Lanercost. July.

6. *C. leucostoma*, Linn. Dahlb., Hym. Europ., I., 341, 243; Smith, Monog., 131, 10.

Not uncommon, Gibside, Mr. J. Hardy. In great numbers, burrowing in decayed willows, and provisioning its nest with Diptera, at Long Benton, in July.

7. *C. podagricus*, Van D. Dind. Shuck, Foss. Hym., 157, 19; Smith, Monog., 134, 12.

An abundant species. Long Benton, Mitford, Gibside, Haltwhistle, and Lanercost. July.

8. *C. quadrimaculatus*, Fab. Dahlb., Hym. Europ., I., 351; 30; Smith, Monog., 142, 21.

Apparently rare. I have three males taken at Gibside.

9. *C. cetratus*. Shuck. Dahlb., Hym. Europ., I., 337, 221; Smith, Monog., 145, 23; *C. melanarius*, Bold, Zool., XV., 5631.

Somewhat rare near Haltwhistle; more plentiful near Lanercost, breeding in decaying wood, and provisioning its nest with small Diptera. July.

10. *C. cribrarius*, Linn. Dahlb., Hym., Europ., I., 353, 231; Smith, Monog., 149, 27.

Found abundantly throughout our district. It frequents sandy places, and burrows in the ground, provisioning its nest with Diptera.

I once found a large female in the fangs of a spider, which, I think, it must have been trying to capture, and had itself been caught, as the spider held it "Sus. per Col." from the under side of its web, which was not at all damaged.

11. *C. patellatus*, Panz. Dahlb. Hym. Europ., I., 356, 232 Smith. Monog., 151, 28.

Rare. Male and female taken near Axwell Park.

12. *C. palmipes*, Linn. Dahlb. Hym. Europ., I., 332, 217; Smith, Monog., 152, 29.

Very rare, only one female taken. July.

13. *C. vagus*, Linn. Dahlb., Hym. Europ., I., 392, 268; Smith, Monog., 155, 31.

Abundant in the district. It burrows in decaying wood, and provisions its nest with Diptera. July and August.

14. *C. chrysostomus*, St. Farg. Smith. Monog., 156, 32; *C. lapidarius*, Dahlb., Hym, Europ., I., 405, 272.

Also very common, burrowing in wood, preferring willows, and preying on flies. July and August.

Genus 3. OXYBELUS, *Latr.*

1. *O. uniglumis*, Linn. Dahlb., Hym. Europ., 1, 273, 172; Smith, Monog., 162, 1.

"The small black and yellow Apis (Linn., Faun. Suec., p. 303, n. 1011) is frequent in gardens and about old houses. It is a small, but beautiful insect of the Wasp kind; the thorax, head, and antennæ black; four of the articulations or segments of the body of the same colour, with annular golden *fasciæ* glossy and splendent. Though it is so small, it will assault and kill a common domestic fly three or four times as large as itself, and drag it with ease to its recess."—Wallis, "Nat. Hist. and Antiq. of Northumberland." I., 350–7.

Genus 4. PASSOLŒCUS, *Shuck.*

1. *P. monilicornis*, Dahlb. Dahlb.. Hym. Europ., 1, 243; Bold, Entom. Mon. Mag., IV., 226.

Four males of this species, which is new to the British Fauna, were taken entering the cracks of a gate-post, near Wallholme, a small "town" a mile or two west from Gilsland.

Genus 5. PEMPHREDON, *Latr.*

1. *P. lugubris*, Fab. Dahlb., Hym. Europ., I., 259, 159; Smith, Monog., 175, 1.

Common. Burrows in decayed wood, and provisions its nest with Aphides. Male and female taken in copula in July.

As showing that the last deposited egg is the first to be developed into the perfect insect, I may mention that I one day filled a large quill with the pupæ of this species, placing the uppermost one at the bottom of the quill. On reaching home I found that the warmth of my pocket had brought out a male from the lowest cocoon in the quill, and in his endeavours to escape he had eaten his way through more than a dozen of the other pupæ.

Genus 6. CEMONUS, *Jurine.*

1. *C. unicolor*, Latr. Dahlb., Hym. Europ., I., 255, 155; Smith, Monog., 178, 1.

Very common; it excavates bramble and rasp sticks, providing its young with Aphides.

2. *C. lethifer*, Shuck. Dahlb., Hym. Europ., I., 254. 154; Smith, Monog., 179, 2.

Also very common, and of similar habits to the preceding. At Benton it excavates the cut rasp sticks, which are used for tying up flowers, for breeding in.

Genus 7. MIMESA, *Shuck.*

1. *M. bicolar*, Jurine. Shuck., Foss. Hym., 230, 2; Smith, Monog.. 183, 2.

Plentiful in a sandy field by the Derwent side, below the Spa well at Axwell Park, in August.

Tribe 3. DIPLOPTERA, *Latr.*

Family 1. EUMENIDÆ,* *Westa.*

Genus 1. ODYNERUS, *Latr.*

1. *O. spinipes*, Linn. Wesm., Mon. Odyn. Belg.. 6, 2; Smith, Monog., 203, 4.

In sandy places exceedingly common. It forms curious tubes of sand, as thick as a stout quill, at the entrance of its nest, which it provisions with small caterpillars.

2. *O. parietum*, Linn. Wesm., Mon. Odyn., 16, Supp. 4; Smith, Monog., 206, 7.

Very common about old walls, sand-banks, &c., throughout the district.

3. *O. trifasciatus*, Oliv. Wesm., Mon. Odyn., Supp. 7; Smith, Monog., 208, 9.

Burrows in old posts, rails, &c., and is very abundant, and generally distributed.

4. *O. trimarginatus*, Zett. Smith, Monog., 209, 10; *O. Scoticus*, Curtis, Brit. Ent., III., 138.

Equally common with the foregoing. I have taken it in Northumberland, Durham, and Cumberland.

5. *O. pictus*, Curb. Curtis, Brit. Ent., III., 138; Smith, Monog., 210, 2.

Rare, Gibside, Mr. James Hardy. I have also taken it at Long Benton.

* The Solitary Wasps, of which there are males and females only. Many of them fabricate their cocoons with mud, and provision them with caterpillars.

6. *O. Antilope*, Panz. Wesm., Mon. Odyn., 32; Smith, Monog., 210, 12.

Rare, Long Benton. The male only taken.

Family 2. VESPIDÆ, *Leach*.*

Genus 1. VESPA, *Linn.* (In part).

1. *V. vulgaris*, Linn. The common Wasp. St. Farg., Hym. I., 516, 14, t. 10; Smith, Monog., 215, 1.

Nests in the ground, and is very abundant all over the district.

2. *V. Germanica, Fab.* St. Farg., Hym., I., 515, 13; Smith, *Monog., 216,* 2.

More sparingly distributed than *vulgaris*, but by no means rare. Also breeding in the earth.

3. *V. rufa*, Linn. Curtis, Brit. Ent., XVI., t. 760; Smith, Monog., 217, 3.

Also common. I have taken it in Northumberland, Durham, and Cumberland, About Long Benton it is quite as common as *vulgaris.* It is a ground Wasp, and I have frequently seen it breeding in the walls of sunk fences.

4. *V. arborea*, Smith. Sauss., Mon. Guepes Soc., 122, 5, Plates 14, 18; Smith, Monog., 218, 4.

Not abundant in the vicinity of Newcastle. Mr. Selby records its occurrence at Twizell. I used to take the females rather commonly about Lanercost, but was unable to find the other sexes, or the nest, which is said to be built on fir trees. The female has also occurred at Haltwhistle and Bardon Mill. I have two males which were taken at Long Benton.

* The Social Wasps, dwelling in large communities, consisting of males, females, and workers.

5. *V. sylvestris.*, Scop. The Campanular Wasp. Smith, Monog., 219, 5; *V. holsatica*, Fab., Ent. Syst., II., 257. 14.

Somewhat rare, but occurring in widely separated localities. Its nest I have not seen.

6. *V. Norvegica*, Fab. The tree Wasp. Smith, Monog., 220, 6; *V. Britannica*, Leach, Zool. Miscell., I., III., t. 50.

The commonest of the tree Wasps with us. Mr. Selby records its occurrence at Twizell. About Newcastle it is moderately common, becoming more abundant as we proceed westward. I have seen it in immense profusion near Naworth and Lanercost. It builds its beautiful pendent nest on trees, in hedges, and has a great liking for gooseberry bushes in gardens. It is very "waspish" when its domicile is touched. I one day kicked over what I thought was a heap of dirty rags, but which was in reality an immense Wasp nest—evidently squashed by a fall from an overhanging branch—out of which issued a perfect cloud of the infuriated inmates, who chased me at racing speed over two fields, nor would I then have escaped but for a stiff breeze which greatly retarded their flight, and fortunately enabled me to elude their vengeance.

7. *V. crabro*, Linn. The Hornet. Linn., Faun. Suec., 1670; Zett., Ins. Lapp., 35, 1; Smith, Monog., 221, 7.

Wallis, in his "Natural History and Antiquities of Northumberland," Vol. I., 349, 5, records the finding of a nest near Chipchase, North Tyne, which I have no doubt was that of the Hornet. His account is so circumstantial and full of interest that I introduce the species, and give his account in full:—"The Hornet is rarely seen with us, except in a very hot summer. It is a formidable but beautiful *apis*; the colours a bright yellow, red, and green, and black; the thorax black, and some of the rings or circles elegantly pectinated. A large commonwealth of them was discovered in the hollow of an oak tree, by the very brink of North Tyne, in Bromehaugh, near Chipchase, in the year 1762, a remarkably hot summer; and on the 30th of August a preiod was put to it by suffocation with lighted straw, for the sake of seeing the mechanical skill in the structure of their combs. They were six in number, one of the outer combs measuring twenty-one inches in circumference, the middle comb nineteen inches and-a-half, the other combs gradually less, the waxen cells extremely thin and fine, elegantly variegated with a light and deep brown, many of them measuring an inch-and-a-half in depth, those in the last outer comb empty, a numerous vermicular generation in all the rest, covered at the top with a thin film of a pearl colour, round and prominent, glossy, and shining like polished pearls. So many ranges of combs, constructed with so much beauty, and with the art of the nicest geometrician, is a surprising spectacle. So noble a piece of architecture *cannot be viewed or reviewed without admiration and a profound reverence of that Being who is the fountain of wisdom. I am obliged for this curiosity* to my respectful friend, Christopher Reed, of Chipchase, Esq., who first discovered it, and was present with me to see it carefully taken out by his servants."

The gamekeeper, who was a south-country man and knew the insect well, told my friend Geo. Wailes, Esq., that he had seen the Hornet in the woods at Meldon Park. There is nothing improbable in the occurrence of the Hornet with us, as it is found much further to the north. Linnæus found it in Sweden, and Zetterstedt in Lapland.

TRIBE 4.—ANTHOPHILA, *Latr.*

FAMILY 1. ANDRENIDÆ, *Latr.**

SUB-FAMILY 1. OBTUSILINGUES, *Westw.*

GENUS 1. COLLETES, *Latr.*

1. *C. succincta*, Lin. Smith, Monog., 3, 1; *Melitta succincta*, Kirby, Mon. Ap. Angl., ii., 32.

Plentiful near Wooler, September, Mr. J. Hardy.

* Solitary Bees, consisting of males and females only.

2. *C. Daviesana*, Kirby. Smith, Monog., 6, 4; *Melitta Daviesana*, Kirby, MSS., II.

Gibside, Lumley, and a little to the west of Gilsland. September. It burrows in the sides of sand-pits, placing its pretty cocoons in a row end to end. Some cocoons that I collected produced numbers of small leaping Hymenoptera, as well as the Bees.

GENUS 2. SPHECODES, *Latr.*

1. *S. gibbus*, Linn. Smith, Monog., 16, 1; *Mellita Sphecoides*, Kirby, Mon. Ap. Angl., II., 46; *Militta monilicornis*, Kirby, l, c., 47, t., 15, f. 6.

"Ornsby's Durham, 206, Castle Eden Dene." Near Axwell Park, Mr. J. Hardy.

2. *S. ephippia*, Linn. Smith, Monog., 19, 4; *Melitta Geoffreella*, Kirby, Mon. Ap. Angl., II., 45, 8, t. 15, fig. 5.

An abundant species, which I have taken in Northumberland, Durham, and Cumberland.

GENUS 3. HALICTUS, *Latr.*

1. *H. rubicundus*, Christ. Smith, Monog., 23, 1; *Melitta rubicunda*, Kirby, Mon. Ap. Angl., II., 53, 14.

Exceedingly abundant throughout our district, breeding in banks, and I have occasionally seen good-sized colonies of it in foot-paths.

2. *H. cylindricus*, Fab. Smith, Monog., 30, 9; *Melitta abdominalis*, Kirby, Mon. Ap. Angl., II., 73, 30 ♂; *Meritta fulvocincta*, Kirby, l. c., 28 ♀.

Also a very common species in our district, and in Cumberland.

3. *H. albipes*, Fab. Smith, Monog., 32, 10; *Melitta albipes*, Kirby, Mon. Ap. Angl., II., 70, 29.

Somewhat rare, Ouseburn Dene, Axwell, and Gibside.

4. *H. lugubris*, Kirby. Smith, Monog., 33, 12; *Melitta lugubris*, Kirby, Mon. Ap. Angl., II., 81, 86 ♂; *Melitta lævigates*, Kirby, Mon. Ap. Angl., II., 75, 32 ♀.

Rare, occurring about Haltwhistle and Naworth in July. Males only.

5. *H. flavipes*, Fab. Smith, Monog., 54, 13; *Melitta flavipes*, Kirby, Monog. Ap. Angl., II., 55, 15.

Rarely at Mitford in July.

6. *H. æratus*, Kirby. Smith, Monog., 37, 16; *Melitta aerata*, Mon. Ap. Angl., II., 58, 17.

Also rare. Long Benton in May, and at Mitford in August.

7. *H. morio*, Fab. Smith, Monog., 38, 17; *Melitta morio*, Kirby, Mon. Ap. Angl., II, 60, 19.

Haltwhistle and Lanercost. July.

8. *H. leucopus*, Kirby. Smith, Monog., 39, 18; *Melitta leucopus*, Kirby, Mon. Ap. Angl., II., 59, 18 ♂.

Rare, and very local.

9. *H. subfasciatus*, Nyland. Nyland, Ap. Boreal., p. 200; Smith, Monog., 41, 21.

Rare, four females taken near Haltwhistle, in July.

10. *H. minutus*, Kirby. Smith, Monog., 42, 23; *Melitta minuta*, Kirby, Mon. Ap. Angl., 61, 20.

An abundant species, occurring throughout our district. April, May, and September.

11. *H. villosulus*, Kirby. Smith, Zoologist. VI., 2105; *Melitta villosula*, Kirby, Mon. Ap. Angl., II., 62, 21 ♂; *Melitta punctulata*, Kirby, Mon. Ap. Angl., II., 66, 25 ♀.

Gibside, Mr. J. Hardy. I have also taken the female not uncommonly about Haltwhistle and Lanercost in June and July.

12. *H. nitidiusculus*, Kirby. Smith, Monog., 43, 24; *Melitta nitidiusculus*, Kirby, Mon. Ap. Angl., II., 64, 23.

Somewhat rare. Swalwell, Mr. J. Hardy. Gosforth, Long Benton, Benton Bank, &c. I have found it occasionally burrowing in the mortar of old walls.

GENUS 4. ANDRENA, *Fab.* (In part).

1. *A. cingulata*, Fab. Smith, Monog., 57, 7; *Melitta cingulata*, Kirby, Mon. Ap. Angl., II., 88, 41.

On flowers of stitchwort, Ravensworth, Mr. J. Hardy. Common at Morpeth and Mitford in May, and near Lanercost in July.

2. *A. cineraria*, Linn. Smith, Monog., 58, 9; *Melitta cineraria*, Kirby, Mon. Ap. Angl., II., 98, 47.

Rather an abundant species. I have it from Mitford, Gosforth, Long Benton, Heaton, and Lanercost. It burrows in pathways, and seldom appears with us before May.

3. *A. albicans*, Kirby. Smith, Monog., 62, 14; *Melitta albicans*, Kirby, Mon. Ap. Angl., II., 94, 45.

Exceedingly abundant all over the district. Burrows in hedge-rows, in sandy flats, &c., and is the first of the genus to appear in spring.

4. *A. fulva*, Schrank. Smith, Monog., 64, 16; *Melitta fulva*, Kirby, Mon. Ap. Ang., II., 128, 68.

On flowers of the bird cherry, Swalwell, and at Prestwick Carr, Mr. J. Hardy. Not uncommon about Axwell and Gibside. The females are more commonly seen than the males; of the latter I have only one specimen, which was taken on the flower of the butterbur (*Tussilago petasites*) at Gibside, in May.

5. *A. Clarkella*, Kirby. Smith, Monog., 65, 17; *Melitta Clarkella*, Kirby, Mon. Ap. Angl., II., 130, 69.

An abundant species, burrowing in hedge-rows and in bank sides in woods. With us it comes abroad towards the end of March.

6. *A. Gwynana*, Kirby. Smith, Monog., 67, 18; *Melitta Gwynana*, Kirby, Mon. Ap. Angl., II., 120, 60.

Sparingly, but widely distributed. It has been taken in Northumberland, Durham, and Cumberland. April and May.

7. *A. bicolor*, Fab. Fab., Syst. Ent., 376, 4; Smith, Monog., 67, 19.

A little to the west of Gilsland, in flowers of Campanulæ. July. When handled it emits a powerful scent not unlike garlic.

8. *A. nigro-ænea*, Kirby. Smith, Monog., 71, 24; *Melitta nigro-ænea*, Kirby, Mon. Ap. Angl., II., 109, 54.

Ravensworth, Mr. J. Hardy. I have it from South Shields, *April; Castle* Eden Dene, May; and Long Benton, June.

9. *A. Trimmerana*, Kirby. Smith, Monog., 72, 25.; *Melitta Trimmerana*, Kirby, Mon. Ap. Angl., II., 116, 57.

Common. Burrows in foot-paths, hedge-rows, &c. June and July. Has a smell of onions, or garlic.

10. *A. fulvicrus*, Kirby. Smith, Monog., 86, 44; *Melitta fulvicrus*, Kirby, Mon. Ap. Angl., II., 138, 77.

Rare. The female only has been taken, July.

11. *A. longipes*, Smith. Smith, Monog., 90, 49; *A. bucephala*, Steph., Illust., Mand., VII., 17, Plate XLIII., f. 6.

Not uncommon in July about Gilsland and Lanercost.

12. *A. albicrus*, Kirby. Smith, Monog., 91, 50; *Melitta albicrus*, Kirby, Mon. Ap. Angl., II., 156, 96.

Burrows in the ground, and is abundant throughout the district from April to July. There is a large colony of this species on a sandy flat by the Wansbeck side, at Morpeth, and here, early one morning in May, I saw the sexes in copula; on a female showing herself at the mouth of a burrow, a little mob of males would rush forward, fighting and scrambling over each other in their eagerness to secure her favours.

13. *A. Coitana*, Kirby. Smith, Monog., 94, 53; *Melitta Coitana*, Kirby, Mon. Ap. Angl., II., 147, 86 ♂; *Melitta Shawella*, Kirby, Mon. Ap. Angl., 160, 100 ♀.

Not common near Newcastle, but more abundant westward. Gibside, Wylam, Haltwhistle, Gilsland, and Lanercost. July. I have generally found the male to frequent flowers of Campanulæ, and the female those of the wild rose. Stylopized females occasionally occur.

14. *A. analis*, Panz. Panz., Faun. Germ., 90, 14 ♂ 15, ♀; Smith, Monog., 95, 54.

Swalwell and Wooler, Mr. J. Hardy. Abundant near Haltwhistle. In a lane leading northwards from Naworth railway station, and at Lanercost, in July. George Wailes, Esq., and myself have both taken *Nomada xanthosticta*, ♂ ♀, flying about the colonies of this pretty species.

15. *A. minutula*, Kirby. Smith, Monog., 96, 55; Kirby, Mon. Ap. Angl.," II., 161, 101.

Rare. Mitford, in a hedge-row. May. To the west of Gilsland. June.

16. *A. nana*, Kirby. Smith, Monog., 97, 56; *Melitta nana*, Kirby, Mon. Ap. Angl.," II., 161, 102.

Rare. Mitford. July.

17. *A. fuscula*, Kirby. Smith, Monog., 100, 61; *Melitta nana*, Kirby, Mon. Ap. Angl., II., 169, 107.

Rare.

18. *A. Afzeliella*, Kirby. Smith, Monog., 101, 62; *Melitta Afzeliella*, Kirby, Mon. Ap. Angl., II., 169, 108.

Also rare. Gosforth, Gilsland, and Lanercost. June.

19. *A. Collinsonana*, Kirby. Smith, Monog., 104, 65; *Melitta Collinsonana*, Kirby, Mon. Ap. Angl., II., 153, 93 ♂; *Melitta proxima*, Kirby., Mon. Ap. Angl., II., 146, 95 ♀.

Not uncommon at Gibside, and near Lanercost. July.

FAMILY 2. APIDÆ, *Leach*.

SUB-FAMILY 2. CUCULINÆ, *Latr*.

GENUS 1. NOMADA, *Fab*.

1. *N. ruficornis*, Linn. Smith, Monag., 118, 1; *Apis ruficornis*, Kirby, Mon. Ap. Angl., II., 210, 27.

Abundant throughout the district.

2. *N. ochrostoma*, Kirby. Smith, Monog., 122, 4; *Apis ochrostoma*, Kirby, Mon. Ap. Angl., II., 209, 26.

This fine species is only of rare occurrence with us. I have taken it at Long Benton, Ouseburn Dene, and Lanercost, in May and June.

3. *N. borealis*, Zett. Zetterstedt, Insecta Lapponica, 470, 1; Smith, Monog., 123, 5.

Rather abundant throughout our district, and in the east of Cumberland. It appears early in April, and frequents the burrows of *Andrenna Clarkella*. It is a very variable species both in size and colour; some of the specimens, especially the smaller ones, are so much maculated with ferruginous markings as to closely resemble dark forms of *ruficornis*. In this case the spines of the posterior tibia furnish reliable specific characters. Those of *ruficornis* being weak, pale coloured, and few in number, whilst in *borealis* they are strong, black, and numerous. The latter, too, has the thorax less pubescent, more glossy, and of a deeper black than *ruficornis*.

4. *N. xanthosticta*, Kirby. Smith, Monog., 128, 9; *Apis xanthosticta*, Kirby, Mon. Ap. Angl., II., 212, 28; *Nomada mistura*, Smith, Monog., 133, 15. ♂.

Of rare occurrence, both in the vicinity of Newcastle and elsewhere. I have reason to believe that *mistura* is the male of this species, as I have taken them in company flying about colonies of *Andrena analis*, in July, near Haltwhistle, and in the lane leading from Naworth Railway Station.

5. *N. flavo-guttata*, Kirby. Smith, Monog., 128, 10; *Apis flavo-gutta*, Kirby, Mon Ap. Angl., II., 215, 31 ♂.

Very rare. Ouseburn Dene. June.

6. *N. furva*, Panz. Smith, Monog., 132, 14; *Apis rufocincta*, Kirby, Mon. Ap. Angl., II., 216, 32.

Not common, but occurring in several localities in our district, also in Cumberland in June.

7. *N. alternata*, Kirby. Smith, Monog., 140, 122; *Apis alternata* and *marshamella*, Kirby, Mon. Ap. Angl., II., 185, 188.

Abundant in Northumberland, Durham, and Cumberland. May and June.

8. *N. succincta*, Panz. Smith, Monog. 142, 24; *Apis Goodeniana*, Kirby, Mon. Ap. Angl., II., 180, 4.

Taken between Swalwell and Dunston, by Mr. James Hardy.

Genus 2. CŒLIOXYS, *Latr.*

1. *C. simplex*, Nylander. Smith, Monog., 147, 2.

Taken on the "Bents," at South Shields, many years ago by Mr. John Hancock. *Megachile circumcincta* occurs there in plenty, and the *Cœlioxys* is most probably its parasite. It has also been taken at Newbiggen-by-the-Sea by Mr. H. T. Mennell.

Sub-Family 3. DASYGASTRÆ, *Latr.*

Genus 3. OSMIA, *Latr.*

1. *O. rufa*, Linn. Smith, Monog., 162, 1; *Apis bicornis*, Kirby, Mon. Ap. Angl., II., 271, 57.

Gibside, Mr. J. Hardy. Common at Long Benton, where it breeds in decaying willows. The males frequent the blossoms of the apple and pear trees; and I once took a fine series of the females by watching a clayhole from which they were carrying clay. I have taken the female feeding on the flowers of the common bramble.

2. *O. xanthomelana*, Kirby. Smith, Monog., 165, 4; *Apis xanthomelana*, Kirby, Mon. Ap. Angl., II., 246, 46.

Rare. The only known local specimen is a large male, which was taken near Axwell Park, by Mr. J. Hardy.

3. *O. ænea*, Linn. Smith, Monog., 170, 9; *Apis ænea*, Linn., Faun. Suec., 421, 1695 ♂; *Apis cærulescens*, Faun. Suec., 421, 1696 ♀.

Burrows in posts and rails, occurring sparingly all over our district. June and July.

Genus 4. MEGACHILE, *Latr.* (In part.)

1. *M. centuncularis*, Linn. Smith, Monog., 174, 1; *Apis centuncularis*, Linn., Faun. Suec., 420, 1687.

Also generally distributed, but is by no means common. It breeds in decaying wood. I have taken it in June and July.

2. *M. circumcincta*, Kirby. Smith, Monog., 180, 7; *Apis circumcincta*, Kirby, Mon. Ap. Angl., II., 246, 45, t. 16, f. 10 ♀.

Abundant, especially on the sea coast, where it burrows in dry banks, and forms its nest of the leaves of *Rosa spinosissima*. In gardens it selects the smoother leaves of the French roses. It breeds in large communities, and is in most abundance in June and July.

Genus 5. CHELOSTOMA, *Latr.*

1. *C. florisomne*, Linn. Smith, Monog., 189, 1; *Apis florisomnis*, Linn., Faun. Suec., 413.

Common, breeds in gate posts, preferring those of hard oak.

I have often found them in the common blue-bell, coiled up round the stamens and sound asleep. Taken in June and July.

SUB-FAMILY 4. SCOPULIPEDES, *Latr.*

GENUS 6. ANTHOPHORA, *Latr.*

1. *A. acervorum*, Fab. Smith, Monog., 204, 2; *Apis retusa*, Kirby, Mon. Ap. Angl., II., 296, 69.

Gateshead Fell, Mr. J. Hancock. Morpeth and the Derwent side, not uncommon. There is a colony of this species established in the gable of the toll-house, near Axwell Park, which is also frequented by *Odynerus parietum*, perhaps parasitically attached to the Bee.

2. *A. furcata*, Panz. Smith, Monog., 206, 4; *Apis furcata*, Kirby, Mon. Ap. Angl., II., 288, 64.

One female, taken at Gibside by Mr. J. Hardy.

SUB-FAMILY 5. SOCIALES, *Latr.*

GENUS 7. BOMBUS, *Auct.**

1. *B. muscorum*, Linn. Common brown Humble Bee. Smith, Monog., 212, 1; *Apis muscorum*, Linn., Faun. Suec., 425, 1714; *Apis agrorum, &c.*, Kirby, Mon. Ap. Angl., II., 326, &c.

Very common, and very variable in colour. Breeds on the ground in a nest formed of moss. With us it seldom comes abroad until near the end of March.

Mr. Smith remarks that the moss-building Bees may be robbed of their honey with impunity, but with us this species is regarded as a waspish one, stinging on very slight provocation. It is very interesting to watch the female of this species, and the small female or worker of *B. lucorum*, rifling the Snapdragon of its sweets, which they do in this wise :—Alighting on the flower,

* Social Bees (Humble Bees) breeding in communities composed of males, females, and workers. Most interesting accounts are given of their economy by Kirby and Spence, in their "Introduction to Entomology," and by other writers.

the bee applies the two pairs of fore feet to the lower lip, its head to the upper one, forces open the mouth, and enters, the mouth of the flower closing immediately behind it: the insect appears as if caught in a trap, and is completely out of sight; but no, staying a few seconds, out she comes backwards, and flies off to repeat the process elsewhere. Occasionally she appears to be unable to open the flower in the usual way, but is not to be baffled, for quickly reversing her position, she forces the mouth open, and enters back downwards. Wonderful, indeed, is the instinct which teaches this little creature thus to secure the store provided for its use by a bountiful Providence!

2. *B. senilis*, Fab. Smith, Monog., 214, 2; *B. cognatus*, Steph., Illust. Supp.

Found throughout our district, but nowhere in abundance. I have seen a good number of males feeding on the heather on the Cumberland Moors, in August. The females are first seen in May, thence up to the end of September.

3. *B. fragrans*, Pallas. Smith, Monog., 216, 4; Kirby, Mon. Ap. Angl., II., 329, 83 ♂.

Sparingly distributed inland; rather more abundant on the coast between Sunderland and Shields, where I once, in July, saw a great many females feeding on the common red clover (*Trifolium pratense*). The males frequent the thistles in August and September. When alive, this species has an agreeable perfume, resembling roses.

4. *B. sylvarum*, Linn. Smith, Monog., 217, 5; *Apis sylvarum*, Kirby, Mon. Ap. Angl., II., 326, 82, t. 17, f. 15 ♀, 16 ♂.

A very beautiful species, found throughout our district, and by no means rare. I have not seen the female astir before the first week in June. Both female and worker have a very shrill piping note, which is quite distinct from that of any other species.

5. *B. Derhamellus*, Kirby. Smith, Monog., 219, 7; *Apis Derhamella*, Kirby, Mon. Ap. Angl., II., 363, 105 ♂; *Apis raiella*, Kirby, Mon. Ap. Angl., II., 367, 107 ♀.

Gateshead Fell, Mr. James Hardy. Long Benton, and elsewhere, but very sparingly. Not uncommon about Lanercost, and very abundant about Carlisle, where I was told, by the late Mr. Heysham, it became the common red-tailed species, to the exclusion of *lapidarius*.

6. *B. pratorum*, Linn. Smith, Monog., 220, 8; *Apis pratorum*, Kirby, Mon. Ap. Angl., II., 360, 103.

A universally distributed, but not a very abundant species with us. It is one of the most active and industrious species of the genus; and what is very unusual, the males work nearly as hard as the females and neuters. The flowers of the rasp are much frequented by all the sexes in June.

7. *B. Scrimshiranus*, Kirby. Smith, Monog., 222, 10; *Apis Scrimshiranus*, Kirby, Mon. Ap. Angl., II., 342, 92 ♀.

Not of frequent occurrence, Gibside, Mr. J. Hardy. Occasionally at Long Benton in spring, feeding on the gooseberry; in summer it frequents the flowers of the bramble. I have a female, which was taken on the sands at South Shields so early as the 30th of March.

8. *B. terrestris*, Linn. Smith, Monog., 224, 12; *Apis terrestris*, Kirby, Mon. Ap. Angl., II., 351, *var.*

Sparingly distributed over the district, being somewhat more abundant in the immediate vicinity of Newcastle than elsewhere.

9. *B. lucorum*, Linn. Smith, Monog., 225, 13; *Apis lucorum*, Kirby, Mon. Ap. Angl., II., 336, 89.

This is by far the most abundant species of the genus with us; frequenting alike the most highly cultivated districts, the woods, and the wildest moorlands. It makes its nest in dry hedge-rows, often burrowing to a considerable depth. I once only noticed a departure from this habit: a colony had been established in the wall of a stable, probably to avoid the discomforts of a wet season. I found it nearly as common at Tain, in Rosshire.

10. *B. soroensis*, Fab. Smith, Monog., 227, 14; *Apis Cullumanis*, Kirby, Mon. Ap. Angl., II., 359, 102 ♂.

The sexes of this elegant species have occurred but very rarely at Gosforth; where I have also taken the Var. *B.* of the male of *Scrimshiranus* of Mr. Smith's "Monograph," with "the two basal segments yellow," and which he now regards as the Var. *collinus* of *soroensis*.

11. *B. lapidarius*, Linn. Smith, Monog., 228, 15; *Apis lapidaria*, Kirby, Mon. Ap. Angl., II., 363, 106.

The common red-tailed "Bumler" of our district. It is found in plenty both inland and on the sea coast. On Whitley Links it is very abundant; and there I have seen the male and female in copula on the sand at the end of August. This species was also plentiful at Tain in September.

12. *B. hortorum*, Linn. Smith, Monog., 230, 16; *Apis hortorum*, Kirby, Mon. Ap. Angl., II., 339, 91.

This is a very common and generally distributed species, which may be known at once by its long proboscis, and the shape of its head, which is more elongate than in other species. I took the sexes of this species in copula on the wing, at Long Benton, on the 26th of July.

13. *B. subterraneus*, Linn. Smith, Monog., 232, 18; *Apis Harrisella*, Kirby, Mon. Ap. Angl., II., 373, 110, t. 18, fig. 7, ♀, 8, ♂.

Gibside, Mr. J. Hardy. I have taken the female sparingly on the links, near Blyth, and Whitley, in May and June.

GENUS 8. APATHUS,* *Newman.*

1. *A. rupestris,* Fab. Smith, Monog., 234, 1; *Apis rupestris,* Kirby, Mon. Ap. Angl., II., 369, 108 ♀.

Somewhat rare. I have taken it at Sunderland, Marsden, Long Benton, &c., in July and September. This species is believed to be parasitically attached to *Bombus lapidarius.*

2. *A. campestris,* Kirby, Mon. Ap. Angl., II., 335, 88, t. 18, fig. 2.

Very common. The females in June and July; and the males, which are very variable in colour, in August and September. I have a local specimen of Mr. Smith's Var. *Y.* of the female, which has "the pubescence entirely black, having only a few fuscous hairs at the apex of the abdomen." Probably parasitical upon *Bombus hortorum.*

3. *A. Barbutellus,* Kirby. Smith, Monog., 237, 3; *Apis Barbutella,* Kirby, Mon. Ap. Angl., II., 343, 93, t. 18, fig. 4. ♂.

Also of common occurrence, and is a parasite of *Bombus pratorum.*

4. *A. vestalis,* Fourc. Smith, Monog., 238, 4; *Apis vestalis,* Kirby, Mon. Ap. Angl., II., 347, 95, t. 18, fig. 3 ♀.

Abundant throughout our district, and equally common in Cumberland. Mr. Smith found both sexes of this parasite in the nest of *Bombus terrestris.*

GENUS 9. APIS, *Linn.*

1. *A mellifica,* Linn. The Hive Bee. Linn., Faun. Suec., 1697; Smith, Monog., 241, 1.

The Hive or Honey Bee is exceedingly abundant in domestication throughout our district.

Mr. James Hardy has published ("Scottish Gardener," Vol.

* The bees of this genus frequent the nests of various species of Bombus, on which they are surposed to be parasitical. In it we find males and females only.

III., 1855) a most valuable paper on "The Plants frequented by the Hive Bees," which will be found very interesting to those who "cultivate" Bees. In a valuable paper contributed to the "Annals and Magazine of Natural History," for May, 1865, by Mr. F. Smith, on "The Species and Varieties of the Honey Bees," we find a paragraph which shows how universally our common brown Hive Bee has become distributed by the agency of mankind. He writes:—"Of the unicolorous form of this species I have seen specimens from nearly all parts of Europe, from most of the West India Islands, from New York, Canada, Florida, Texas, California, and Mexico, from the Cape of Good Hope, Sierra Leone, Australia, and New Zealand; of the Ligurian form, examples from Italy, Switzerland, and the Cape of Good Hope." Mr. R. Howse observed some Hive Bees in Knaresdale, carrying from the flowers of the garden Comfrey, in which he found from one to three holes bitten in the corolla, immediately over the nectaries.

2. *A. ligustica*, Spinola. The Italian Yellow Alp Bee. *Apis helvetica*, Hermann.

This pretty variety of the Honey Bee was introduced into the district, about four or five years ago, by George Wailes, Esq., of Burghfield Lodge, Gateshead. The pubescence is much yellower than that of the common species, and the first segment of the abdomen is reddish yellow. A very high degree of excellence is claimed for this Bee, as being more robust, more hardy, and more industrious, coming out earlier in spring, and working later in autumn; also as being more easy to manage, from its better temper, than the brown Bee. I believe, however, that the latter portion of the character scarcely holds good, for Mr. Wailes has found it to be rather waspish in its nature, and to sting on very slight provocation.

INDEX TO THE GENERA.

VII.—*Entomological Notes for the Year* 1868. By Thomas John Bold.

Sirex juvencus.—A specimen of this fine insect was brought to the Museum in the latter part of August. It was taken in an office in Grey Street, where its appearance was hailed with anything but pleasure, as the long ovipositor was thought to be a sting, and from its size very venomous. It is a harmless creature, its larva burrowing in, and feeding upon, fir timber; hence it is frequently found in houses, &c.

Livia juncorum.—I have frequently taken this curious little creature on the margins of the lake at Gosforth. It lives upon the common rush, and is said to deposit its eggs in the flowers, where the action of the sap produces a monstrosity resembling a bundle of grass, in which the insect resides in its various states, supporting itself upon the juices of the plant. It is beautifully figured by Curtis, in his British Entomology, pl. 492.

Cynthia cardui, the Painted Lady Butterfly.—This handsome insect has this year been abundant throughout our district. On the coast, near Marsden, it was in profusion, and great numbers of its larva were found feeding upon thistles, which fed up very quickly, and produced most beautiful cabinet specimens.

Vanessa Io, the Peacock Butterfly.—Can this conspicuous species be disappearing in our district? It has for some years been gradually becoming scarcer. This year (although very productive of Lepidoptera) I cannot find that more than a single specimen has been noticed, which was taken in our own garden at Long Benton.

Argynnis Aglaia, the Dark Green Fritillary.—Three specimens of this pretty thing were taken in August, at Woodlands, Shotley Bridge, by Mr. Bulmer, of Annfield Plain.

Sphinx convolvuli, the Convolvulus Hawk-Moth.—A beautiful specimen of this splendid insect was taken at sea, on the 29th of September, on board the "Lord Raglan" steamer, when she was about five miles off Tynemouth, and is now in the collection of Mr. J. Hamilton, Shieldfield, Newcastle. I have a large specimen of the same species which was also taken at sea, but on board a sailing vessel, to which it had been attracted by the binnacle light when she was making for the Tyne. Unfortunately it was much broken by its efforts to escape from confinement in an inverted tumbler glass. When these large moths are met with they should be killed as soon as possible, and this may be quickly done by pushing a darning needle or shawl pin, for about half its length, through the centre of a card, then, grasping the moth firmly between your fore-finger and thumb, so as to hold back the wings, you insert the point of the needle or pin into the front of its thorax, just below the head, and hold the contrary end of the needle or pin in the flame of a candle, the heat from which will kill the moth in a few seconds. The card prevents the proboscis, antenna, or wings from coming in contact with the flame.

Cherocampa porcellus, the Small Elephant Hawk-Moth, has twice occurred this year, in both instances on the sea coast: three specimens of the perfect insect were taken on the banks opposite to St. Mary's Island in the last week of July, by Mr. Johnson, Dean Street, Newcastle; and the larva was found feeding on the Yellow Lady's Bedstraw at the end of August, on Whitley Links, by Mr. Henderson, Jesmond.

Macroglossa stellatarum, the Humming Bird Hawk-Moth, has been somewhat common this season, and great numbers of its larva have been found feeding on the Yellow Lady's Bedstraw. The larva fed freely in confinement, and were found to be easily reared into the imago state.

Sphecia bembeciformis was taken in abundance, in July, issuing from some Black Italian Poplar trees near Sandyford. They appeared to come out of the pupa state early in the morning only, for the captor found that if he was later than half-past seven A.M. the whole brood had got their wings dried and flown away, and not a specimen was to be seen during the rest of the day.

Abraxas grossulariata, the Large Magpie Moth, has been so exceedingly abundant in the gardens in Long Benton as to have been a perfect pest. Generally, it only attacks the foliage of the red and white currants, but this year scarcely anything green has escaped its ravages: red, white, and black currants, gooseberries, apple trees, hollyhocks, cabbages, &c., were all eaten; indeed, the number of individuals was so great, that many of them must have been starved had they not become general feeders. In our garden the warm dry spring brought out the larva before the leaves of the gooseberry were developed, and they fed upon the unopened buds, which they ate up so effectually that many of the small bushes never showed a leaf; whilst, somewhat later, they cleared the larger ones of leaves, fruit, and young shoots. Thousands of the larva were slain by shaking the bushes and collecting them as they dangled at the end of their lines, whilst many hundreds of pupa were afterwards sought for and burnt.

Centipede and Moth.—One of our most assiduous collectors of Lepidoptera, Mr. Hamilton, when mothing this summer, got a specimen rather curiously. He had sugared a strip of a wall near Jesmond, and was considerably surprised when he returned with his lanthorn, shortly afterwards, to find a stout moth, a

Noctua, struggling in the grasp of *Lithobius forcipatus*. Grasping the wall with its hind legs, the *Lithobius* held the moth with the greatest ease, although it made the most violent efforts to escape; but on Mr. H. taking hold of the moth the centipede, baffled of its prey, fell to the ground, and disappeared. The *Lithobius* (called by many people the British centipede) is one of the *Myriapoda:* when full grown it is nearly two inches long, depressed, glossy brown, with long legs, and is an exceedingly active creature. During the day it lies concealed beneath stones, logs of wood, decayed bark, &c., issuing thence at night to prey on insects and other small game. It abounds all over our district.

VIII.—*Notice of some Rare Birds seen recently.* By the RIGHT HON. LORD RAVENSWORTH.

ON the 22nd of September, 1868, a Roller (*Coracias garrula*) was seen in a plantation near Thrunton Mill, in the parish of Whittingham, Northumberland, and was shot immediately afterwards by William Cochun, Esq., then residing at Eslington House. This beautiful species is extremely rare in England, so rare, according to Bewick, as hardly to deserve the name of a British bird. Other examples, however, have since been recorded—notably one in the woods of Howick, the seat of Earl Grey.

The specimen in question is not quite so brilliant as some others; but on dissection it proved to be a male bird, and is thought an adult specimen. It was shy and restless, but appeared somewhat bewildered and lost.

On the following day, September 23rd, a fine specimen of the greater Spotted Woodpecker (*Picus major*) was shot close to Whittingham by the same gentleman, and another was remarked in the pine woods under Thrunton Crags. This is also a bird of rare occurrence, though by no means so uncommon as the Roller.

On the next day, September 24th, two specimens of the Pintail Duck (*Anas acuta*), and a specimen of the Shoveller (*Anas clypeata* of Linnæus) were shot by the Eslington keeper at a pond in the same neighbourhood. These were all females, and young birds of the year. They are of rare occurrence in the Northern Counties, though numbers of the Pintail are brought to the London market from the decoys in the Midland and Southern Counties. The Shoveller is nowhere common in Great Britain. The bill of this immature specimen presented a remarkable appearance. Large and flat in its proportions it was extremely thin, almost transparent in its texture, and about as limp as a kid glove. Both the Pintail and the Shoveller are much esteemed for the table.

On the 1st of October a Gannet was observed by a shooting party from Ravensworth Castle wheeling over Gateshead Low Fell, near the farm of Chowdean. It was not more than sixty or seventy yards above the surface of the earth, and seemed on the look-out for prey, sweeping round with the easy graceful flight peculiar to this fine race of sea birds. This was a bird of the year, probably driven inland by the north-easterly gales then prevalent.

The fact of so many scarce birds having come under my own observation in one week is worth recording.

I add a postscript to this "Chapter of Accidents" to record another singular fact, that on Saturday evening, October 3rd, a magnificent female Sparrow-hawk (*Falco nisus*) killed herself by dashing against a wire fence, probably in pursuit of her prey. The shock must have been instantaneously fatal, for she lay without a single feather being disturbed, and her plumage is quite beautiful.

IX.—*Miscellaneous Notices and Observations.*

Note on the Glow-worm.—Being out last night (June 10th) about ten o'clock, in a wood on the banks of the Derwent, I was much pleased to meet with females of the Glow-worm (*Lampyris noctiluca*) in some numbers. They were displaying their lights most vigorously amongst the herbage by a road-side leading through a wood, and were confined to a space of about twenty yards in length. I put four or five into a small bottle which they quite illuminated for some hours; but on looking at them this morning I found they were all dead: they were resting on what appeared to be *Centaurea nigra*. This insect has never been noticed in abundance in our district.

In 1846 some specimens were obtained by the late Mr. W. K. Loftus, a few miles east of the same locality.
—*Thomas Thompson, Winlaton, June 11th*, 1868.

Notes on local Fishes.—With regard to the under jaw of the *Lophius piscatorius*, which I presented last spring to the Newcastle Museum, through the Rev. Mr. Wheeler, and about which I had some difficulty. I think it well, to remove all doubts concerning its identity, to refer you to Owen's beautiful work on *Odontography*, where, at plate 56, Vol. II., fig. 1, it is excellently represented; and if I had known of it at first it would have saved me much trouble. It and the teeth are well described by Owen, Vol. I., p. 152. The individual to which the jaw and rows of sharp canine teeth belonged must have been one of very great and unusual size.

I saw this summer, at Hartlepool, several specimens of the *Lophius*, but none longer than eighteen or nineteen inches, and the jaws not to be compared with that large one.

Of other fishes which I noticed this summer at Seaton, were only several "Rock Herrings," or *Twaites*, with minute teeth (*Clupea finta* of Cuvier). I tasted one boiled, but I did not much like it: it had rather a strong taste, somewhat resembling that of the common Herring, but not so good. The weight was scarcely two pounds; length to centre of the tail, $8\frac{3}{4}$ inches;

breadth in front of the dorsal fin, $4\frac{3}{8}$ inches. It is a handsome fish, with bright and golden colours, and scales of a beautiful silvery hue. It usually has four or five black spots on the side in a line nearly with the eye; but one I saw on August 9th was rather larger, and had *twelve spots* on the side. I also noticed a few *Sprats*, but Salmon were scarce off and in the Tees this season. A small *Sturgeon* was taken in the Tees this summer. —*John Hogg, Norton, September 28th*, 1868.

ADDRESS TO THE MEMBERS OF THE TYNESIDE NATURALISTS' FIELD CLUB,

READ BY THE PRESIDENT, THE REV. ANGUS BETHUNE, M.A., AT THE TWENTY-SECOND ANNIVERSARY MEETING, HELD IN THE MUSEUM OF THE NATURAL HISTORY SOCIETY, NEWCASTLE-UPON-TYNE, ON THURSDAY, APRIL 23RD, 1868.

Gentlemen,—At the close of my period of office as President I have the honour to address you, and proceed, according to custom, to give some account of the transactions of the year.

I am happy to say that the Club has manifested no signs of decay in the year that is past. The meetings have all been well attended: fifty-one names have been added to the already large list of members: some useful work has been done; and, in short, the Club has been reasonably fulfilling the intention of its founders, and while contributing to the store of scientific facts from local sources, has been extending in the locality a taste for Natural History.

Referring to the Field Meetings of the year I am unable to state, indeed, that they have yielded any new facts of scientific value to be recorded; but this is, perhaps, neither matter for surprise nor regret. These meetings owe their usefulness, not so much to the direct fruits which they yield to the stores of the Club, as to the opportunities which they afford of studying actual nature—to the older members of renewing their acquaintance with objects and scenes already known; to the younger of acquiring knowledge in the presence of those who can stimulate and aid them; and to all opportunities of pleasant intercourse and mutual improvement. At these meetings the root-work is done, which, like that of Nature, is silent and unobserved, but in due time the results appear. Of this kind I doubt not good work has been done at the meetings I refer to. There are few who took part in them, I am persuaded, who did not carry away something more than a pleasant reminiscence.

But there is another consideration which prevents me from presenting to you, in much detail, an account of the proceedings at these meetings. Though they may not have been productive of notable scientific discoveries, yet they might well afford ample and varied matter for interesting narrative if the subject were new to the members. But it has become the practice to give a full account of each meeting, as it occurred, in the local papers. These accounts are generally very well done. The members read them; and by a good arrangement they are inserted and preserved in the minute book of the Club. All this seems to render the address of the President, in so far as it served the purpose of a record of proceedings, unnecessary; and it has appeared to me that I should occupy your time more profitably if, after a very cursory notice of what was done at the meetings, I should pass on to some subject of permanent and fresher interest.

The First Field Meeting was at Cawsey Dene, on the 22nd of May. The day was a very fine one, and abont forty members were present. This dene is one of the few spots in this work-stained district where Nature has taken sanctuary, and has contrived to preserve its loveliness in adversity. At Cawsey Dene the party enjoyed a most pleasant ramble, and found many objects of interest, especially ferns; among others, *Polypodium dryopteris* and *phegopteris*, almost in the presence of the usual sights and sounds of a great colliery district. The meeting terminated at Tanfield, where two papers were read; one contributed by G. C. Atkinson, Esq., on "*Salmon in the Tyne in* 1866," and the other by T. J. Bold, Esq., on "*Some additions to the local Homoptera and Coleoptera.*"

The Second Meeting, at Hexham and Dipton, on the 26th of June, was of more varied interest. The day was remarkably fine, and a large party of the members assembled at Hexham, and enjoyed the advantage of visiting the antiquities of the town under the guidance of the late President; and the Abbey Church and its restorations, with the addition of the local knowledge of a resident, Dr. Fairless. From Hexham the party proceeded across the country to Dipton Burn, an affluent of the Devil's Water, flowing in a wooded dell which winds through the moorland, full of natural beauty and romantic traditions. It was entered at Queen Margaret's Cave, and thence followed to the junction with the Devil's Water. It was found to be a very paradise of ferns, with one form conspicuous for its absence, the common *Scolopendrium*. The party proceeded along the beautiful banks of the Devil's Water to Dilston, where, after partaking of the hospitality of Mr. Grey, the ruined tower, and the tomb of the last unfortunate Earl of Derwentwater were visited. Corbridge was at length reached; and after dinner a paper was submitted to the meeting by the Rev. A. M. Norman and G. S. Brady, Esq., "*On the British Entomostraca of the Families Bosminidæ, Macrothricidæ, and Lynceidæ.*" A delightful excursion was closed by a visit to the old church at Corbridge, which was found to be undergoing a thorough restoration.

The Third Meeting was at Cockfield and Raby, on the 25th of July. Here again the weather on the whole was favourable, and the attendance good.

At Cockfield the dyke was of course the centre of interest. The party found themselves near the out-crop of the Coal-Measures, and had an opportunity of examining, under very favourable conditions, very marked traces of those eruptive convulsions which broke up and dislocated our coal-beds, and added so much to the difficulty of working them. These effects are in most parts concealed from view by the overlying Magnesian Limestone. Here they are covered only by the drift which leaves them in many places visible. The eruptive matter at Cockfield fills the dyke to the surface without protrusion, having been subjected to the action which rounded and smoothed the adjacent rocks. The main dyke, which here runs nearly E. and W., is well seen, being quarried for road material. Where it is thus laid bare it is seen to be crossed nearly at right angles by another and lesser dyke, locally known as the *Doghole Dyke.* The effect of this is to break the line of the main dyke at the intersection by exactly its own width (twenty-two yards), but without changing its direction. The effect of the dyke on the coal was of course not visible at the surface, but specimens were produced, and Mr. Dixon, of Cockfield Colliery, was present, and supplied ample and trustworthy information. Dr. Philipson read an interesting paper descriptive of the dyke by the late Mr. Witham, of Lartington. The members verified for themselves, as far as possible, the accuracy of Mr. Witham's description as to the effects upon the coal and sandstone in contact with the dyke; the amount and direction of dislocation caused by each; and the extent of shrinkage in cooling, &c. The effects on the coal appear to be very remarkable. In contact with the dyke it is converted into a sort of indurated soot (dawk or swad), the five-quarter seam being reduced to nine inches in thickness; and it is more or less changed to the distance of forty-five yards on either side.

The party visited the outcrop of the coal seam in a neighbouring gill; and, having spent a couple of hours very instructively at Cockfield, proceeded to Raby, which, by the kindness of the Duke of Cleveland, was thrown open to them. After a pleasant walk the grand old castle was seen, standing stately and grey in its noble park, with little in its aspect to disturb the visions of the past with which fancy loves to surround such a place. I will not detain you with what occupied the party at Raby for a couple of delightful hours. Afterwards they proceeded to Staindrop, where the church and its monuments were duly visited. After dinner Mr. T. Thompson exhibited a fine specimen of *Acherontia atropos* taken at Ravensworth shortly before.

The Fourth Meeting was at Dunstanbro' on the 16th of August. Again the weather proving propitious, between forty and fifty members joined the excursion. From Christon Bank Station the party proceeded through Embleton to Dunstanbro'.

A visit was paid to the church at Embleton, which was examined with much interest. Having been lately restored, it was pleasing to observe the care with which old fragments, discovered in the course of restoration, were preserved. Several of these, which are very curious, were inserted in the chancel wall within the vestry, where they are perfectly visible but secure. How many valuable things might have been saved if some such method had been generally adopted. An interesting relic was observed in the vestry, namely, an old altar cloth, now used as a cover for the vestry table. It has a faded needlework border about ten or twelve inches broad, once very rich and beautifully executed, representing the story of the Prodigal Son in compartments. There is a peculiarity in this church which strikes the visitor oddly—the axis of the nave is not parallel to that of the tower and chancel, but varies from it several degrees. The tower is handsome. It is separated from the nave by a lofty arch, and is rib-vaulted with stone.

From Embleton a walk along the sand-hills which skirt the shore brought the party to Dunstanbro'. The remains of the castle, which has been for four centuries a ruin, stand on a mass of basalt, part of the out-flow from the Great Whin Sill, which here forms a group of hummocky hills. That on which the castle stands is broken on the north side into fine cliffs having a rudely columnar structure, and showing in section its relation to the Scar Limestone beds lying below, on which it rests immediately without any ash bed. The centre of eruption is not visible; but the force with which the erupted matter was injected into the limestone strata is curiously seen in the contorted form of some of the rocks. The saddle rock to the north of the castle is a remarkable instance. After examining and discussing these phenomena the party proceeded along the shore towards Howick, and through the beautiful grounds of Howick to Longhoughton.

Some of the members who had proceeded further along the shore to visit the Rumble-kirn, reported having seen a woman digging peat in a small bay on the shore and below sea-level. The peat was said to be full of hazel twigs and nuts. From the account given of it this peat bed would appear to be similar to those which are well known to exist at Whitburn, at West Hartlepool, and Seaton Carew, and which indicate a comparatively recent subsidence of the coast; but the examinations hitherto made as to their contents and relation to the Boulder Clay, are not sufficient to determine whether they are pre-glacial and contemporary with the sunken forests of the Norfolk coast; or, as is more probable, post-glacial, and much more recent. In this case they may be indicative of a settlement still going on, a probability which the continual recession of the coast-line would seem to confirm.

After dinner Mr. Tate, of Alnwick, read a paper, giving some curious extracts from the Longhoughton parish register.

The Fifth Meeting took place at Birtley and the North Tyne, on the 11th of September. Owing to absence from England at the time I had not the pleasure of being there; but the members had the advantage of the presidency of Dr. Bruce on the occasion, and the meeting was most successful and largely attended. The party began by renewing at Gunnerton Crags the acquaintance formed at Dunstanbro' with the Great Whin Sill. There also some ancient British camps and hut circles were pointed out and explained by the Rev. G. R. Hall, of Birtley, under whose valuable guidance some other British remains and terraced slopes near Birtley were visited. The proceedings included a most interesting visit to Chipchase Castle, where the party was hospitably entertained by Mr. Hugh Taylor. The day was concluded with dinner at Birtley; after which Mr. Hall read a valuable paper on the terraced sloped previously visited.

The Last Meeting of the Season was held as usual at Marsden, on the 4th of October. About fifty members attended. After some hours agreeably spent in search among the rocks or in pleasant discussion and conversation, the party proceeded to dinner, Dr. Embleton taking the chair. Being compelled by an engagement to withdraw at this stage, I had not the advantage of hearing an interesting paper which Mr. Howse read afterwards "*On the Carboniferous Rocks of Northumberland.*"

The FIRST EVENING MEETING was held on the 19th of December. It is at these Evening Meetings that the contributions of the Club to science, and signs of its real work, appear. Referring to the meetings of last year there is no reason to look back on them with dissatisfaction. At both meetings important papers, containing matters of permanent value, were read, which would do honour to any scientific society. As these will appear in the published Transactions of the Club, it is unnecessary that I should do more than enumerate them. But I may refer more particularly, as examples, to Mr. Atthey's exhaustive papers and beautifully prepared illustrative specimens of fish and reptilian remains, from the shales of the Low-Main seam at Newsham and Cramlington, both valuable contributions to Palæontology, the latter being the first authenticated instance of reptile remains derived from the Northern Coal Field; and to Mr. G. S. Brady's paper on the Fauna of some neighbouring salt-marshes, the bearing of the facts stated in which, on the question of the duration of species under altered conditions of living, and on some difficulties as to the mode of the deposition of some coal-beds, is obvious and important.

The titles of the papers read were as follows:—

At the FIRST MEETING—

1. "*Remarks on some Fish Remains obtained from the Northumberland Coal Field,*" by Thomas Atthey.

2. "*On the Climatology and Physical Geography of Northumberland and Durham (being chapters introducing a new Flora of the two Counties),*" by John G. Baker, F.L.S.

At the SECOND MEETING—

1. "*On the Crustacean Fauna of the Salt-Marshes of Northumberland and Durham,*" by G. S. Brady, with an appendix "*On the Foraminifera,*" by H. B. Brady, F.L.S.

2. "*Notes on the Hive Bee*," by Robert Draper.

3. "*Notes on the Remains of Reptiles and Fishes from the Shales of the Northumberland Coal Field*," by T. Atthey.

4. *Remarks on the Nature and Modes of deposit of certain Minerals which resemble in their external Characters organized Bodies*," by H. B. Brady, F.L.S.

The reading of this paper was deferred.

Having now referred, briefly, for the reason I stated at the commencement, to our proceedings during the past year, I shall pass on to a subject respecting which it has occurred to me to offer some remarks on this occasion, and which I cannot think will be deemed foreign to the objects of the Club. The subject I refer to is the question relating to the existence and limits of what is called *Reason* in the lower animals. It has been suggested by what every one must have observed of late, viz., the multitude of books in the publishers' lists, made up of wonderful anecdotes of animals. These now form almost a branch of literature; and they bear to the sober facts of Natural History about the same relation that sensation novels do to common life. They betray very vague ideas, both in the writers and in the popular mind, as to the nature of instinct, and the limits of sagacity in brutes. The marvellous anecdotes I refer to are generally related on the authority of *truthful* but *inaccurate* observers. They proceed, not from bad faith, but generally from admiration for a favourite in persons of inaccurate thought, who have no rational estimate of the faculties of animals to guide their observations, or to check their acceptance of what is told them. The stories hence arising become, of course, more marvellous at each repetition, till they grow at length into the stock anecdotes with which we are all familiar.

Now, most of these stories have a basis of fact sufficiently wonderful in itself, but they are often rendered incredible or absurd by some impossible addition arising from ignorance in the narrator. That such stories should be so generally received, and admitted into educational books, is surely somewhat of a reproach to natural science. If it be the object of such a society as this to aid in the correction of popular errors respecting the structure and specific relations of animals, it ought to be within its province to contribute towards disabusing the popular mind of what may be contrary to fact in regard to the instincts and mental capabilities of animals, and to ascertain what may be really known on a subject possessing so much interest. This is only to be done by careful induction from accurately observed facts, and such facts all may give their aid in accumulating.

To collect these facts is, however, by no means an easy matter. It requires some power of mental analysis, as well as industry and truthfulness. The subject is very obscure. The instincts of brutes, and the relation which their faculties bear to those of the human mind, touch at so many points on some of the most difficult questions of mental science, that it is perhaps not surprising that the subject has been so seldom approached, and so little that is satisfactory has been written about it. Let it not be thought that I profess now to supply what is wanting, or to say what may not be known to many already: my wish is simply to bring the subject before this meeting as one very worthy of attention, and perhaps to indicate a few lines of thought which may possibly prove suggestive.

It is easy in a general way to draw a line between man and the lower animals. The former, we say, is *guided by reason;* the latter, *governed by instinct.* This, though true as a characteristic distinction, is, however, by no means exhaustive or accurate as a definition. As man is not without instincts, so are brutes not destitute of intelligence manifested in conduct which often cannot be distinguished *in kind* from similar conduct in reasonable beings. There is a want of precision, also, in the terms *Reason* and *Instinct* in this definition. As the term Reason is commonly applied to the faculties of the *understanding,* which have to do with *sense* and *the facts of experience* alone, as well as to the *Reason* properly so-called, the organ of thought, including self-consciousness, and dealing with necessary convictions and universal truths—things entirely different; so is the term Instinct loosely understood. Not only is it used to express the power in animals of adapting means to ends without conscious purpose and previously to experience, but also as including, on the one hand mere organic functions, and on the other animal intelligence or sagacity. We must keep these distinctions in view in order to avoid confusion.

Excluding, then, merely functional and involuntary acts, such as breathing, the action of the heart, and the peristaltic motion of the bowels, Instinct may be held to be the performance of acts in which certain ends are accomplished by the untaught use of appropriate means, in a more or less uniform and determinate manner, according to varying circumstances and the organization of the animal, but not according to the varying purposes of an intelligent will.

Of such instincts examples might be given from every department of animal life. I need only refer to the well-known instances in the habits of the bee, the ant, the spider, &c.

It may be asked, are these instincts original endowments, or are they resolvable into simpler elements?

In answering this question a remarkable order of facts must be taken into account, I mean those usually referred to as cases of variation of Instinct. Take the case mentioned at the last Evening Meeting here by Mr. Howse. The bee, as we all know, seeks its food by entering the flower and so approaching the nectaries; but it sometimes finds itself in the presence of flowers rich in food which its tongue cannot reach in the usual way, on account of some structural peculiarity in the flower. In such cases it is known to depart from its usual procedure, and to reach the nectary by piercing the base of the corolla from without. Messrs. Howse and Hancock observed bees thus feeding on the *Menziesia* near Rothbury, many of the flowers of which were found to be thus pierced at the base.

Now, in this, and many other similar departures from the ordinary mode of an instinct which might be mentioned, there is evidently a special adaptation of means to meet an emergency—an act of understanding similar to that of the dog who, when he finds the front door shut, goes round to the back. And it is said this adaptive power, and the law of habit operating through the individual on the race, with changing circumstances as the prime mover, are data sufficient to account for the phenomena of Instinct.

But when these postulates have been granted how much is there, especially in the instincts of ganglionic creatures, of which no account can be given! Without insisting on the somewhat trite subject of bee architecture and geometry, how account in this way for the case quoted by Kirby and Spence, from the elder Huber, in which some hundreds of bees engaged in building a comb, which is an aggregate of independent cells, on opposite sides, and built from the bottom, to avoid a slip of glass placed in their way, on reaching the proper distance from it, without pause or hesitation bent the comb in a direction at right angles to the plane they were working in. The feat was accomplished by widening the cells on the convex side at the bottom and contracting them at top, and reversing the process on the concave side, and doing this by a graduated increment and decrement till the proper curvature was attained. Here was adaptative power put forth to meet an emergency—but whose? It must have sprung up simultaneously in each of the thousand independent workers. To have proceeded from one, without language, were inconceivable; and indeed with it, if that were possible, is an effort of constructive concert which is simply inexplicable. Imagine an analogous departure from an architect's plan taking place even after discussion and explanation!

How account, again, for the *transmission* of a *habit* in the case of *neuter* insects? In the case of the bee, all the wonderful operations of the hive are conducted by them. The male and female have, and ought *ex hypothesi* to transmit, habits entirely different.

And how account for intelligent acts in ganglionic creatures at all, which are destitute of the organ which, in the higher animals, according to the experiments of Flourens and others, is requisite to intelligence?

These difficulties, and many more which might be mentioned, are very perplexing; and they seem to force upon us the reflection that whatever may be the proximate agency in the phenomena of Instinct *Reason* is there, in that mode of it, at least, which is manifested unconnected with organization throughout the universe. Shall we say impersonal Reason? or rather with Newton that of the Creator, of which he believed Instinct to be an immediate phenomenon!

But I leave the subject of Instinct in the lower orders of animals, a subject full of interest as well as mystery, but which I cannot dwell on further now, and pass on to *intelligence* especially in the higher animals. Here the adaptive power, which in the ganglionic is only rarely and exceptionally manifested, unless it be in the form of a confirmed habit or instinct, is more developed and more free. We perceive in them mental faculties resembling our own: in what respect do they differ—in *degree* or in *kind?*

Now, if we observe attentively the dog, we see that he has not only the same senses that we have, sight, hearing, touch, taste, smell, with the sensations and perceptions peculiar to each, but also certain other mental faculties similar to our own. He can reproduce the impressions made on his senses by *memory*. Those ideas are linked together by the same laws of association, so that one idea suggests another in a connected train—the dog dreams and forms mental habits. He has judgment;—of two or more suggested ideas, he can select that adapted to a proximate end. He has *attention* or the power of concentrating his faculties on the subject which occupies him, and, consequently, *abstraction*. We see these faculties of intelligence set in motion by certain appetites and desires; accompanied by certain emotions of pleasure and pain; and governed by love, hate, anger, fear. Such is the mental furniture which we find in him; and there is nothing to distinguish it *in kind*, as far as it goes, from the analogous powers of the human mind.

Now let it be observed, that these faculties belong exclusively to what is termed the *Understanding* in man, which deals with sense and the contingent facts of experience alone, as distinguished from *Reason*, which deals with these in their relation to a higher sphere, that of *thought*, which has to do with truths above sense, necessary principles and universal laws; which includes self-consciousness, freedom of will, spiritual intuition; which enables man to recognise his personal existence in a higher sphere than the outward and phenomenal, and his allegiance to the moral law. Of this Reason there is no trace in the brutes. The first condition of thought is a subject thinking, i.e., the self-conscious ego, and the thing thought. The former term is wanting in the lower animals. They *feel* themselves, but they have no conception of themselves. No parrot, it has been said, has ever learned to use the personal pronoun. Animals exist, but they do not know that they exist. They manifest intelligence and various forms of activity, but they take no account to themselves of these powers. They never rise above the present and the particular. It is reserved to man to lead the double life, the life of the animal and the higher life of reason; to exist and to know that he exists; to be intelligent and to know that he is so; to realise, in self-consciousness, his relation to the universe of being, and to draw thence motives to guide the purposes of an intelligent will, and hopes and fears, for which the animal has no organ, and which are to him as light and darkness to the blind.

But, assuming that the intelligent faculties of the brutes belong exclusively to the mental region of the understanding, which, metaphysicians hold, differs from that of the Reason, not in *degree* but in *kind*, there is a further specific distinction to be noted in the faculties common to them and to man, which has an important bearing on any attempt to explain their conduct. The *understanding* in man ministers to his *Reason*. It supplies or suggests the subjects on which reason is exercised; and the faculties which compose it are materially influenced by this alliance, and seem to be invested with qualities which do not necessarily belong to them. The faculties of the brutes, though the same in kind with the corresponding ones in man, differ from them in being dissevered from Reason, which exalts the faculties of the human understanding and associates them with qualities of *thought*, which in the case of the brutes must be carefully separated from them. In them the same faculties are seen, not in alliance with Reason, but in alliance with *Instinct*, which means more than the absolute negation of reason.

Inattention to this distinction is the cause of much confusion and misconception in estimating the powers which animals possess. For example, because a dog can distinguish a three-cornered figure from a square, it would be absurd to suppose him capable of forming the rational conception of a triangle; or because he is capable of simple judgments, that he can reason. In like manner, though animals *remember*, they do not *recollect*. They have sensations, but not sentiments; *volitions*, but not *will*. They have the perception of form and colour, but not the sense of beauty. They can distinguish and imitate tones, but they have not the sense of musical harmony: the piping bullfinch can no more be said to have the musical sense, than the talking starling the gift of language. In these cases there are elements of *thought* blended with the sense, derived from a region of mind which the brutes cannot reach.

But now, keeping in view the difference drawn between animal sagacity and reason, and the further distinction in the faculties common to men and beasts arising from the connection of these faculties with reason in man, how far, it may be asked, does it accord with facts? How far do the faculties here assigned to the brutes, and under the limitations stated, enable us to account for the phenomena observed in their conduct?

In answer to this I can only now state my belief, that a satisfactory explanation can be given in accordance with these principles of the actions of brutes, and that in so large a majority of cases as to rule what is doubtful, and to afford a presumptive test of the accuracy of what is told of them. It was my intention to endeavour to justify this belief by showing the application of these principles to some of the anecdotes referred to above, but I find that to do so would exceed the limits to which I wish to confine these remarks. Instead of doing so I will just point out, before I have done, one or two considerations bearing on the solution of such cases.

The key to very much in the actions and habits of animals is to be found in the law of the association of ideas which plays a more important part in their mental processes than in those of man, partly on account of the greater simplicity of their mental endowments, and partly on account of the disturbing action of the will in man. By this law contiguous or similar sensations or volitions or emotions have a tendency to cohere and mutually to suggest each other without effort, and, as it were, instinctively. Professor Bain has shown the physiological basis there is for such law; and he has pointed out a circumstance in its mode of operation which it is important to note when tracing the action of the law in the lower animals. The circumstance I refer to is the influence of particular senses in modifying its action. In man the visual nexus prevails. As is well known the sense of sight takes the place of the other senses, and supplies the form of nearly all our ideas and the links which bind them together; and it does so to the extent of colouring all our language on the subject, and making it difficult for us to conceive trains of thought under other conditions. Yet such conditions arise from necessity, or the habitual use of some of the other senses. The blind think in forms derived from touch. The musician thinks in sounds; the cook in tastes; and these severally have their ideas associated more or less through these senses: and who can doubt that the blind, but for intercourse with others and the corrective effect of language, would manifest mental habits which would be often obscure and perplexing. Now, the predominance of the sense of smell in the dog, and its connection with his natural instincts, no doubt exercise a similar influence on the form of his ideas and the structure of his mental habits. If we do not take this into account we shall often mistake him and attribute perhaps to *thought* what is only an instance of obscure association; whereas, if we keep it in view, it will help to throw light on several things that are difficult to explain in his conduct—in the conduct of the sheep-dog, for instance, and on that curious faculty the dog has of finding his way in the absence of known or visible landmarks.

I refer to this as indicating one source of obscurity in interpreting the actions of brutes.

But there is another circumstance to be noted. The animals whose conduct supplies the most difficult problems for solution, the dog, the elephant, the monkey, &c., are chiefly known to us in a state of domestication, that is, *educated* by their connection with man; not only having their faculties developed by that connection, but having habits formed in which there is often a nexus of *thought* derived, not from the action of their own minds, but from the reason of man. In cases of direct instruction this is obvious enough, but I refer to cases in which there has been no direct instruction, but in which the animal adopts, by imitation, acts involving thought which it has often witnessed, and which, by the action of association, become ordinary phenomena of adaptation. I may refer as instances to the cases told of dogs using the latch to open a door, and ponies that of a gate or of a cornbin. To the same circumstance is to be attributed the increased intelligence said to be manifested by certain persecuted races, the rat and the fox for example, arising from their contest with man and the trained agents employed by him, and their increased cunning in eluding his snares.

The question has hence been raised, are animals rendered more or less intelligent by domestication?

That they acquire new and special aptitudes is of course admitted, but it has been denied that on the whole their intelligence has been increased. They soon reach the limit of their powers, it is said, beyond which no progress is made; and this must be the case if the foregoing principles be true. It has even been maintained that animals lose by domestication. Buffon came to this opinion from observing the beaver at the Jardin des Plantes, and the analogy of the effect of slavery on man has been quoted in support of the opinion.

But this view cannot be maintained. If animals do not gain much in general intelligence under domestication, it would be contrary to analogy that their special faculties should not be rendered more acute by companionship with man. That the beaver, whose intelligence, apart from his special instinct, is not of the highest order, should have disappointed his admirers and shown some awkwardness in his new sphere of life is not surprising; and had as much been done to educate the negro as the sheep dog, his case might not have been quoted. As to the sheep dog, it is the opinion of intelligent shepherds that their dogs have improved in intelligence and usefulness in the last fifty years. Nor is this surprising considering the increased attention paid to selection and training from the great extension of sheep husbandry in the period. Still the improvement is admitted to have been small, notwithstanding much culture. Progress in its sense as applied to man there can have been none, for its condition is thought, and that condition was wanting.

There are persons who shrink from allowing mental faculties to the brutes at all for fear of degrading man. When rightly understood it does not *degrade* man, but it *raises* the brutes. If the distinctions I have drawn seem to deprive them of powers they are sometimes supposed to possess, it leaves them all the qualities which we love, and it leaves them a share in our inheritance of *mind* which entitles them to our kindness. On the other hand, this distinction brings more clearly into view the peculiar excellency of man, which is not *intelligence*, for that as we see may coexist with the brute life, but self conscious Reason, moral purity, and loving loyalty to God.

THE FIELD MEETINGS for 1868 were arranged to be held as follows:—

MAY	Bothal and Sheepwash.
JUNE....................	Derwent above Shotley.
JULY....................	Richmond.
AUGUST	Bambro'.
SEPTEMBER	Simonburn, North Tyne.
OCTOBER	St. Mary's Island.

THE Treasurer's report (see p. 195) was read and adopted.

The following gentlemen were elected officers of the Club for the year 1868-9:—

PRESIDENT.

E. J. J. Browell, Esq.

VICE-PRESIDENTS.

John Hancock, Esq.
Thomas John Bold, Esq.
Albany Hancock, Esq., F.L.S.
E. C. Robson, Esq.

Ralph Carr, Esq.
Rev. J. F. Bigge, M.A.
D. Embleton, Esq., M.D.
R. Ingham, Esq.
Sir W. C. Trevelyan, Bart.
T. Sopwith, Esq., F.R.S.
Rowland Burdon, Esq.
J. Hogg, Esq., F.R.S.
Rev. H. B. Tristram, LL.D.
George Wailes, Esq.
Rev. W. Greenwell, M.A.
Edward Charlton, Esq., M.D.
Rev. G. C. Abbes, M.A.
Rev. A. M. Norman, M.A.
Rev. J. C. Bruce, LL.D.
Rev. A. Bethune, M.A.

TREASURER.

Robert Y. Green.

SECRETARIES.

George S. Brady.
Thomas Thompson.
G. H. Philipson, M.D.

LOCAL SECCRETARIES.

Shields, W. H. Brown.
Durham, John Booth.
Hexham, Rev. W. T. Shields.
Morpeth, W. Creighton.

COMMITTEE.

Joseph Blacklock.
R. B. Bowman.
H. B. Brady.
James Clephan.
John Daglish.
James W. Dees.
William Dinning.
D. O. Drewett.
George Hodge.
Richard Howse.
J. W. Kirkby.
G. C. Pecket, jun.

AUDITORS.

J. S. Foster.
T. P. Barkas.

The following gentlemen were elected members of the Tyneside Naturalists' Field Club during the year 1867–8:—

At the Anniversary Meeting, 1867: Messrs. John Douglas, Gateshead; S. B. Coxon, Usworth Hall; A. D. Park, J. T. Hoyle, T. F. Potts, Joseph Wilson, G. A. Brumell, and M. S. Dodds, Newcastle; Thos. Ray, J. B. Tilley, jun., John Moore, Sunderland; Hugh McClean, M.D., Corbridge; C. Hutchinson, Whitburn.

At the First Field Meeting:—Messrs. Geo. Brewis, James Hogg, Joseph Jordan, and Joseph Pattinson, Newcastle; Chas. J. Spence, North Shields; R. K. A. Ellis, Whitburn.

At the Second Field Meeting:—Messrs. Robert Mack and John Kell, Newcastle; Wm. Clark, Gateshead; Jas. Snowball, Cramer Dykes; H. Hill, North Shields; — Shiel, Chester-le-Street.

At the Third Field Meeting: Messrs. R. H. Haggie, James Reid, and J. M. Gregory, Newcastle; Thos. Newmarch, Tynemouth; Richardson Peele, Durham; Alex. Gillies, Gateshead.

At the Fourth Field Meeting:—Messrs. Robert Nicholson, Newcastle; George Hunter, Wallsend; Robert Swan, London.

At the Fifth Field Meeting:—Rev. Hugh Taylor, Wark; Rev. C. Bird, Chollerton Vicarage; Messrs. Hugh Taylor, Chipchase Castle; W. C. Bousfield, J. J. Britton, and Fred. Hall, Newcastle; Robert Dixon, Bensham; Rev. Jas. Taylor, South Shields.

At the Sixth Field Meeting:—Messrs. Samuel Neville, Newcastle; Adolphus Mann, Gateshead; W. Thompson, Acklington Park.

At the First Evening Meeting:—Messrs. Lawrence W. Adamson, Newcastle; M. C. Cooke, London.

At the Second Enening Meeting:—Rev. F. Burnley, Newcastle; Messrs. Edwin Dodds, Gateshead Low Fell; A. W. Johnson, Gateshead; W. M. Bywater, London.

THE TREASURER IN ACCOUNT WITH THE TYNESIDE NATURALISTS' FIELD CLUB.

Dr.

1867.	£	s.	d.
To Balance brought forward..................	74	15	8
" Natural History Society, 150 Copies of "Transactions," Vol. I., Part III....	16	19	0
" Half Expense Wood-cut	2	17	0
" Sale of Transactions........................	2	13	4
" Subscriptions and Entrance Fees	159	5	0
	£256	10	0

Cr.

1867.	£	s.	d.
By Printing Transactions	63	17	0
" Engraving and printing Plates	62	2	6
" Printing Circulars and Stationery.........	27	2	6
" Commission....................................	7	14	9
" Postage and delivering Circulars	19	2	2
" Sundries	9	11	7
1868. Balance.......................................	66	19	6
	£256	10	0

1868,

Examined and found correct,

T. P. BARKAS, Auditor.

REPORT OF THE COMMITTEE

OF THE

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE,

PRESENTED AT THE ANNIVERSARY MEETING, HELD JULY 9TH, 1868.

JOSEPH BLACKLOCK, ESQ., IN THE CHAIR.

To chronicle the events of a year, in a Society whose chief functions consist in a routine of unobtrusive duties, needs under ordinary circumstances but few lines, and this is particularly the case in the season of calm which succeeds one of unusual exertion. A few years ago your Committee, in its periodical reports, could command the interest of the members by recounting the progress of those alterations in the property and internal economy of the Society, the liberal and efficient scale of which has caused subsequent changes to be confined to matters of detail. Your Committee have therefore but little to record of the past year save the continuance of steady efficiency, due in a measure to the improvements alluded to.

The most important incident since the last Anniversary Meeting is the addition to the Museum and Library of the various zoological collections and the scientific library which belonged to our late Vice-President, Joshua Alder. It had been the desire of Mr. Alder, who was one of the founders of the Society, that these companions of his life's labour should enrich a Museum already indebted in no common degree to his active and watchful care; but his wish might have been entirely frustrated had it not been for the liberality of Sir W. G. Armstrong. At Mr. Alder's decease his cabinet came into the hands of Sir W.

G. Armstrong, who presented it, together with his books, to the Society.

The number of specimens contained in this collection is very great, and a considerable proportion of them illustrates divisions of the animal kingdom seldom well represented in public museums; but their value cannot be estimated by mere numerical strength. A large number of the specimens are those upon which new genera and species have been established, and others in so many cases have been regarded as types for reference, that the cabinet has acquired amongst naturalists an almost classical interest. Though embracing in degree almost every department of Marine Zoology, the series is especially rich in Zoophytes and Mollusca; indeed, in either of these two classes there exist few collections, so far as pertains to British species, of the same size and importance.

Mr. Alder's library consists of about 300 volumes, embracing most of the standard authors on the Invertebrata, and is especially complete in those departments which were his peculiar study. Many of the more important volumes are presentation copies from their respective authors.

Your Committee would remind the members of the Society that these fine collections are not intended to lie idle in the cabinets, in which, thanks to the care of Messrs. A. and J. Hancock and the Rev. A. M. Norman, they are now so excellently arranged. Their true value consists in the assistance they offer to succeeding students, indicating how far our present knowledge reaches, and thereby suggesting the extension of its boundaries.

Amongst the other presentations to the Museum, one or two call for passing notice. A specimen of the Great Greenland Shark (*Squalus borealis*), due to the kindness of Messrs. J. Hancock Richardson, and J. C. Gilchrist, is an important addition to our still defective series of fishes. It is a fine young example of a rare visitor to our shores—so rare, that there are but three or four instances recorded of its capture in British waters.

The Entomological collections are in process of revision at the hands of Messrs. J. A. R. and D. L. P. Morison, and the Society is indebted to those gentlemen, not only for the time and attention they have bestowed, but for their kindness in supplying many desiderata from their own cabinets.

Pursuing the system of illustration by means of *models* in those departments of Natural History where, from small size, perishable nature, or other inherent quality, typical specimens of the animals themselves cannot be shown to advantage, your Committee has recently acquired, by purchase, a set of plaster models of *Polycystina*. These models, prepared under the direction of Dr. Anton Fritsch, of Prague, represent admirably the structure of the more important types of a most interesting class of microzoa; a division concerning which much still is wanting to complete our knowledge of their life history.

The Museum continues to be attractive to the general public; the number of visitors paying for admission during 1867 being thirteen thousand nine hundred and seventy, and presenting no great difference from former years. The sum thus raised (nearly £120) is an important addition to the income of the Society, and is derived from a class who otherwise contribute little towards the maintenance of such institutions.

The Winter Evening Meetings have been continued during the past season as heretofore. An attempt was made in January to provide an entertainment for a juvenile audience, which was attended with much success, and it will be a question for the incoming Committee to decide whether a similar experiment should again be tried.

The treasurer's statement appended to this report shows a tolerably satisfactory financial condition. The long-standing arrears of interest due to Mr. Clayton have now been liquidated, and thus a considerable obstacle to the usefulness of the Society has been removed.

RALPH BROWN, ESQ., TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY.

CURRENT ACCOUNT 31ST MARCH, 1867, TO 31ST MARCH, 1868.

1867.	Dr.	£	s.	d.
April 1.	To Balance brought forward......	55	0	9
	,, Subscriptions from Members,	160	8	0
	,, Ditto from Associates,	2	15	0
	,, Amount received for Admissions	128	19	7
	,, Literary and Philosophical Society	40	0	0
	,, Institute of Mining Engineers	20	0	0
		£407	3	4
1868.				
April 1.	To Balance brought forward......	148	15	10

1867.	Cr.	£	s.	d.
	By Keeper's Salary (Jos. Wright)	75	0	0
	,, Sundries, per Joseph Wright,	32	7	7
	,, Tradesmen's Accounts.........	6	12	4
	,, R. Howse, Curator, arranging Fossils	4	16	0
	,, Fire Insurance	18	15	7
	,, Share of Cost of "Nat. History Transactions of Northumberland and Durham"...	19	16	0
Nov. 30.	,, John Clayton, Esq., in full of all Interest and Arrears due,	101	0	0
	,, Balance due from Treasurer,	148	15	10
		£407	3	4

OFFICERS OF THE NATURAL HISTORY SOCIETY,

1868–9.

PATRON.

His Grace the Duke of Northumberland.

PRESIDENT.

The Lord Bishop of Durham.

VICE-PRESIDENTS.

Sir Walter C. Trevelyan, Bart.
The Rt. Hon. the Lord Ravensworth.
The Rt. Hon. the Earl of Tankerville.
Sir W. G. Armstrong, C.B.
A. J. B. Cresswell, Esq.
John Clayton, Esq.
Matthew Bell, Esq.
Venerable Archdeacon Prest.
Lieut.-Col. Addison Potter.
The Worshipful the Mayor of Newcastle.
John Hodgson Hinde, Esq.
Ralph Carr, Esq.
Robert Ingham, Esq,, M.P.
Rev. John F. Bigge.
Edward Charlton, Esq., M.D.
I. Lowthian Bell, Esq.
R. S. Newall, Esq.
G. C. Atkinson, Esq.
Albany Hancock, Esq.
D. Embleton, Esq., M.D.

TREASURER.

Joseph Blacklock, Esq.

SECRETARIES.

Mr. H. B. Brady.
Mr. George Hodge.

COMMITTEE.

Mr. Thomas Bell.
Mr. H. Bowman.
Mr. R. B. Bowman.
Mr. E. Boyd.
Mr. John Coppin.
Mr. John Daglish.
Mr. R. R. Dees.
Mr. D. O. Drewett.
Mr. J. Hancock.
Mr. H. T. Mennell.
Mr. A. J. R. Morison.
G. H. Philipson, M.D.
Mr. J. H. Richardson.
Mr. John Rogerson.
Mr. C. Thompson, jun.

HONORARY CURATORS.

ZOOLOGY.

VERTEBRATA.

E. Charlton, M.D.
D. Embleton, M.D.
A. Hancock.
J. Hancock.
J. Hancock Richardson.

ARTICULATA.

T. J. Bold.
G. S. Brady.
W. Dinning.
J. Hancock.
George Hodge.
Rev. A. M. Norman.
J. A. R. Morison.

MOLLUSCA.

Rev. A. M. Norman.
A. Hancock.

RADIATA.

H. B. Brady.
D. O. Drewett.
George Hodge.
J. Coppin.
Rev. A. M. Norman.

BOTANY.

Rev. J. F. Bigge.
R. B. Bowman.
G. S. Brady.
H. B. Brady.

GEOLOGY.

E. Boyd.
E. J. J. Browell.
J. Daglish.
J. W. Kirkby.
Joseph Watson, jun.

MINERALOGY.

Henry Bowman.
E. Charlton, M.D.
A. Freire-Marreco.

GENERAL CURATOR.

Richard Howse.

KEEPER OF THE MUSEUM.

Joseph Wright.

LIST OF PRESENTS TO THE MUSEUM AND LIBRARY

OF THE

NATURAL HISTORY SOCIETY,

FROM APRIL, 1867, TO APRIL, 1868.

FOSSILS.

Coal Fossils from West Cramlington. *John Hancock, Esq.*
Fossil Corals from Devonshire. *W. Pengelly, Esq., F.R.S., Torquay.*
Specimens of Lepidodendron and Trigonocarpon, from Denton Quarry, Brampton, Cumberland. *Mr. Paisley, Bolton Wood House, Wigton.*
A Calamite, from a Quarry near Holywell. *Mr. Thos. Thompson.*
Fossil Bones of a Moa (*Dinornis Casuarinus*, Owen), from New Zealand. *Mrs. Dodd, Ravensworth Terrace.*
Fossil Bones of a Moa (*D. ——?*) *Capt. Llyth, per J. Hancock, Esq.*
Specimen of Calc Spar. *Messrs. J. Dove & Co., per J. W. Dees, Esq.*

MISCELLANEOUS.

Portion of a Helmet found on a Skull at Pompeii. *D. O. Drewett, Esq.*
A Kaffir Fiddle. *Capt. West, R.N.*

BOOKS.

Report of the Liverpool Naturalists' Field Club, 1866–7. *The Club.*
Transactions of the Imperial Royal Botanical and Zoological Society of Vienna, 1866; and other Papers. *The Society.*
Proceedings of the Academy of Natural Sciences, Philadelphia, U.S., 1866. *The Academy.*
Fordhandlinger i Videnskalis-Selskabet of Christiania for 1858-64; and other Papers. *The Royal Norske University, Christiania.*
Proceedings of the Zoological Society of London, 1866. *The Society.*
Report of the Smithsonian Institute, 1865. *The Smithsonian Institute.*
Binney on the Land and Fresh Water Shells of North America, Parts 2 & 3. *The Smithsonian Institute.*
A Monograph of American Corbiculadæ, Recent and Fossil, by Temple Prime. *The Smithsonian Institute.*

G. S. Brady del. Tuffen West sc.

Check List of Invertebrate Fossils of North America (*Eocene* and *Oligocene*), by T. Conrad. *The Smithsonian Institute.*

Synopsis of the Species of Starfish in the British Museum, by Dr. J. E. Gray, F.R.S., &c. *The Author, per Rev. A. M. Norman.*

Transactions of the Natural History Society of Isis in Dresden, Nos. 4–9. *The Society.*

Annual Report and Transactions of the Plymouth Institution, and Devon and Cornwall Natural History Society, Part 2, Vol. II. *The Society.*

X.—*Description of an Entomostracan inhabiting a Coal-Mine.* By G. Stewardson Brady, C.M.Z.S., &c. (Plate VI).

The interest attaching to the little animal here described lies chiefly in the peculiarity of its habitat. The members of the order Copepoda, to which it belongs, are widely distributed, inhabiting, in vast numbers, both fresh and salt water. They occur abundantly in lakes, ponds, and ditches, where they are chiefly represented by various species of the genera *Cyclops*, *Diaptomus*, and *Canthocamptus;* in brackish water by *Temora*, *Tachidius*, &c.; and in the sea by a large number of families and genera of free-swimming habits; but besides these there is a large group of species which are entirely parasitic, being found in the branchial cavities of Ascidians and in other analogous situations. But the species now under notice was found living under circumstances widely different from any of these. The roof of a part of the workings of Cramlington Colliery is kept constantly wet by the percolation of water from above, and here, amongst a slimy, gelatinous vegetable growth, consisting, apparently, of imperfectly developed Algæ such as *Chætophora?* this little creature lives and multiplies. In anatomical structure it does not depart very widely from the genus *Canthocamptus*, under which I have here placed it; but there is great difficulty in accurately ascertaining the structure of the limbs and maxillary organs of animals so minute as this, and of which no great supply of specimens is easily attainable. The position here assigned to it must therefore be looked upon as merely provisional.

Order. COPEPODA.

Family. HARPACTIDÆ.

Genus. CANTHOCAMPTUS.

Canthocamptus cryptorum, nov. sp.

Body slender, gradually tapered, the cephalothorax not very much stouter than the abdomen; first segment equal in length to the following five. Superior antennæ eight-jointed, those of the *female* (fig. 2) slightly tapering from base to apex, somewhat constricted at the fifth joint; joints not much differing in length, fifth and seventh rather the shortest, sparingly setose, and having no distinct flagellum; two long setæ from the upper margin of the second joint, five or six from the third, one or two from the fourth, fifth, sixth, and seventh, and about six from the apical joint, two of which are much longer than the rest. First four joints of the upper antennæ of the *male* (fig. 3) stouter than the rest, the fourth swollen and bearing six or eight setæ, penultimate joint very short, last joint bearing four short terminal setæ. Inferior antennæ (fig. 4) bi-articulate, bearing a short secondary branch. Lower foot-jaw (fig. 5) weak, chelate, terminal claw slender and slightly curved. First pair of feet (fig. 6) two-branched, both branches tri-articulate and of nearly equal length, terminal joints the longest, basal joint of the inner branch having round its distal margin a spinous fringe; terminal joint scarcely twice as long as the middle one and armed with one short and one very long apical seta, the middle joint having one seta at its apex; the terminal joint of the outer branch has two long but unequal apical seta, one strong spine, and on the outer margin two short and one rather longer spine; the preceding joints are armed with a similar arrangement of spines. Inner branch of second pair of feet (fig. 7) uni-articulate, with two long and equal apical and several shorter marginal setæ. Third and fourth pairs of feet (fig. 8) longer, but in other respects nearly similar to the second; the arrangement of the setæ of the inner branch is, however, slightly different; the outer branches of the second, third, and fourth pairs are three-jointed, the middle joint in the second pair is, however, much shorter than the others; while in the third and fourth pairs the last two joints are long and nearly equal, the first being the shortest. Fifth foot laminar, composed of two segments (fig. 9), each of which is fringed with long ciliated setæ. Terminal abdominal segments short, tail setæ finely plumose, more than half the length of the body. The lower border of the last abdominal ring, between the two caudal segments (fig. 10), is strongly pectinated. *Eyes wanting ?. Length (exclusive of tail setæ), $\frac{1}{45}$th of an inch.*

Habitat.—Roof of the Low Main, West Cramlington Colliery, near Newcastle.

The credit of the discovery of this species is due to my friend Mr. Thomas Atthey, of Gosforth, who kindly forwarded to me specimens both living and mounted for the microscope.

EXPLANATION OF PLATE.

Fig. 1. *Canthocamptus cryptorum*, female, × 120.
Fig. 2. Superior antenna of the same, × 400.
Fig. 3. ,, ,, male, × 400.
Fig. 4. Inferior antenna, × 400.
Fig. 5. Lower footjaw, × 400.
Fig. 6. Foot of first pair, × 400.
Fig. 7. ,, second pair, × 400.
Fig. 8. ,, fourth pair, × 400.
Fig. 9. ,, fifth pair, × 400.
Fig. 10. Last abdominal segments, × 400.

XI.—*Meteorological Report for* 1868. Edited by the Rev. R. F. Wheeler, M.A.

The year 1868 was a period of great interest in a meteorological point of view. It was very remarkable in many respects. While the early months were characterized by a great prevalence of stormy winds, which did very great damage to shipping and to harbour works, the summer was one of unusual dryness and heat, not only in England, but on the continent of Europe and in America. The closing months were mild, but with more than an average quantity of wet.

Some shocks of earthquake were felt at different places in England and Ireland. On January the 4th in Somersetshire, and on the 30th of October over a district extending from Liverpool to Torquay, and from Pembroke to London. A slight shock was previously felt in Ireland.

There seems to be a general idea that earthquakes are very rare occurrences in our Islands, but that is far from the true state of the case, as the following list will show:—

Centuries.	No. of British earthquakes.	SCENE OF OCCURRENCE.
10th......	1.........	General.
11th......	10.........	Worcester and Derby.
12th......	12.........	Nottingham, Lincoln, Shrewsbury, London, Durham, and Somerset.
13th......	13.........	Kent, London, Bath, Wells, St. Albans, and Chilterns.
14th......	4.........	No place named.
15th......	1.........	No place named.
16th......	6.........	Reigate, Herefordshire, York, Gloucester, Bristol, Denbigh, Ruthven, London, Dover, Dorset, and Kent.
17th......	20.........	Staffordshire, Oxford, Aylesbury, Burford, Abington, and Bedford.
18th......	84.........	General.

The shocks experienced in England in 1868 were but as the last ripple of the great earth waves which worked such fearful havoc elsewhere. On January the 3rd Vesuvius exhibited great activity, and continued for many months in a very unquiet state, bursting out with extreme violence in November. On March the 27th the Island of Hawaii, in the Sandwich group, was violently convulsed, and much damage was done. The eruption of Mauna Loa was perhaps the grandest on record. In August a shock was felt at Gibraltar, the first for many years. But the most tremendous visitation of the year was in Peru and Ecuador on August the 13th. The movement was felt from 8° S. to 42° S., and at Juan Fernandez. The strip of land at the western foot of the Pyrenees, twelve hundred miles in length, was ruined, while twenty thousand persons lost their lives, and property to the value of sixty millions was destroyed. The sea was fearfully disturbed, and huge waves travelled over the whole of the Pacific. About the same time the vibrations, which for three-quarters of the year had affected the Island of St. Thomas in the West Indies, came to an end. On October the 21st an earthquake of considerable violence visited California, damaging the city of San Francisco, and causing some loss of life. Later on in the year an earthquake was reported from Taranaki in New Zealand, which did great damage.

As to the proximate cause of these earthquakes there can be but little doubt. At least, grant that the interior of the earth is a sea of liquid fire, and the key to the solution of the phenomena will not be far to seek. The land is perpetually, though of course gradually, wearing away. The sea and rivers, with their constant and ceaseless action, are thinning away the surface of the land. The pressure on the mass of central fire is consequently lightened at that point. The material so removed from the land is carried out and deposited at sea; and as Sir John Herschel remarks—"The whole bed of the sea is in the act of being pressed down by the laying of new solid substance over its bottom." ...."Now following out this idea, where should we naturally expect (volcanic) outbreaks to take place? Why of course along those lines where the relief of pressure on the land side is greatest, and also its increase on the sea side; that is to say, along or in the neighbourhood of the sea coasts where the destruction of the land is going on with the greatest activity. It is a remarkable fact in the history of volcanos, that there is hardly an instance of an active volcano at any considerable distance from the sea coast. The great volcanic chain of the Andes, Etna, Vesuvius, Teneriffe, Mount Erebus, are all close to the sea. Out of two hundred and twenty-five volcanos which are known to have been in eruption over the whole earth within the last one hundred and fifty years, I remember only a single instance of one more than three hundred and twenty miles from the sea, and even that is on the edge of the Caspian, the largest of all the inland seas: I mean Mount Demavend, in Persia."

Very little attention has been, comparatively speaking, paid to this subject by scientific observers hitherto, but the remarkable eruptions of 1868 seem to have attracted enquiry to the subject, and it is to be hoped that as it is more thoroughly investigated, we shall soon come to a clearer understanding of the laws which regulate the phenomena of the earthquake and volcano.

The editor now gladly proceeds to give a summary of the notes on the months, which have been supplied by the very able staff of contributors who labour so well in this department of the work of the Tyneside Club.

NOTES ON THE MONTHS.

January.—

> "When the grass grows in Janiveer,
> It grows the worse for't all the year."
> —*Old Proverb.*

Greenwich.—The wind was cold during the first eleven days of the year; for this period the deficiency of daily temperature averaged 6½° daily. On the 12th the wind changed from N.E. to S.W., and the temperature increased to above the average. The mean temperature for the month was 37·2°, being 1° higher than the average of 97 years, and 3° higher than January, 1867. At Kew Observatory the mean height of the barometer for the month was 29·890; the highest reading was on the 20th, 30·314, the lowest was 29·053. The velocity of the wind was generally moderate up to midnight on the 12th. During the next two days it blew at the rate of twenty to thirty miles an hour. The 24th was the most stormy day, the velocity being thirty-seven miles an hour at midnight.

Mr. Thomas Stevenson, the well known engineer, describes the storm of January the 24th as being the greatest which had occurred in Scotland for one hundred and sixty-five years, or since the one commemorated by Defoe, which happened on November the 27th, 1703. Mr. Stevenson says that "from 11 in the morning until 6 at night the storm raged with peculiar fury. Carriages were upset in the streets, and business was to a large extent suspended..........So deep was the impression produced on nervous persons, by the violence of the wind, as it gathered in heavy blasts around each trembling tenement, that many were unable to collect their thoughts, or to give attention to the most ordinary household duties............The cost of the damage in the city of Edinburgh was estimated at not far short of twenty thousand pounds; while the same storm, which extended far to the North, made great havoc, especially among plantations. On the estate of Cawdor alone, ten thousand five hundred and ninety-three trees, from fifty-eight to sixty-five years old, were torn up. The price of timber in Morayshire fell from thirty to forty per cent., in consequence of so many trees being brought suddenly into the market."

The warm weather of January in England was not common to the Continent. Throughout France the cold was great. At Lyons nearly half the Rhone was frozen over. At Dijon and other places the temperature fell to 5°. The Seine had not been so completely frozen for twenty years as it was in January, 1868. The weather was very severe in Russia.

Otterburn.—The month was remarkable for the constant prevalence of very high winds. Rain fell on twenty-two days. Wind N.E. to the 8th; S.E. to the 11th; S.W. to the 18th; N. to the 23rd; S.W. to the 31st. Lowest reading of the thermometer 20° on the 23rd.

Wallington.—The weather throughout the month was very changeable, alternating between fresh, frost, snow, and heavy falls of rain: only seven days of really fine weather. The thermometer fell on the 24th to 18°. There were constant and violent gales of wind during the month. On the 31st several large beech trees were uprooted. On the 26th some shooting stars were remarked.

Lilburn Tower.—The year began with sudden changes from frost to fresh, with frequent showers and gales of wind. On the whole the weather was very open. The snowfall was light and of short duration.

Whitley.—A large meteor was seen in N.W. on the 15th.

Wylam.—A mild, changeable month, as the fluctuations of the barometer indicated.

A great deal of wind, sometimes very heavy, accompanied by sudden falls of rain, which brought down the Tyne in floods as sudden; for instance, on the 13th, at 6 P.M., the river was four feet deep at Wylam Bridge; but at 10 P.M. had risen to sixteen feet, and fell again to 4·5 feet at 9 A.M. of the 14th.

The barometer fell, with sudden fluctuations, from 30·136 on the 9th, to 28·339 on the 19th, and then rose, with similar fluctuations, to about 30·000 on the 26th. There was a gale of wind from the S. on the 24th, which was felt all over England and Scotland: it commenced in Caithness much earlier than here. Mean height of barometer 29·756 inches.

Mean temperature of the month	38·47°.
Ditto of thirteen years (1856 to 1868 both included)	37·04°.
Excess of 1868	1·43°.

The lowest temperature of the year was on the 4th, when it fell to 22°.

Mean direction of wind, W. 10° S.

Rain fell on ten days, snow on eight, total amount, 3·15 inches.

Mean height of river at Wylam Bridge, 3·06 feet.

Darlington.—The month set in with frost and snow. There was a heavy fall of snow on the 3rd, changing to rain on the 4th.

Lunar Halos were seen at North Shields on the 29th; at Hendon on the 5th, 10th, and 15th.

Solar halos were seen at Hendon on the 19th and 21st.

Auroræ were seen at Wallington on the 23rd; at Allenheads on the 23rd; at North Shields on the 23rd; at West Hendon on the 28th and 30th.

Lightning was seen, but thunder was not heard, at Wallington on the 14th; at Allenheads on the 14th; at Whitley on the 14th; at West Hendon on the 14th.

Hail fell at Byrness on the 14th and 22nd; at North Sunderland on the 21st and 22nd; at Middlesbro' on the 24th; at Seaham Harbour on the 19th and 22nd; at Whitley on the 1st.

Snow or Sleet fell at Byrness on the 1st, 2nd, 3rd, 11th, 22nd, 23rd, and 29th; at Otterburn on the 1st, 2nd, 3rd, 11th, and 22nd; at North Sunderland on the 10th, 11th, and 24th; at Wallington on the 1st, 2nd, 3rd, 10th, 11th, 22nd, and 24th; at Whitley on the 1st, 4th, 10th, 11th, 20th, and 24th; at Greta Bridge from the 3rd to the 8th, 11th, and 23rd; at Middlesbro' on the 24th; at Newcastle-on-Tyne on the 1st, 2nd, 3rd, 11th, and 24th.

February.—

> "February fill dyke, be it black or be it white;
> But if it be black, it's better to like."
>
> —*Old Proverb.*

Greenwich.—The month of February was remarkably warm. There was less than the average of east winds and compounds of east winds both in February and March. The weather in February was more like spring than winter. The mean temperature of February was 43·0°, being 4·6° higher than the average of the preceding ninety-seven years, 1·7° lower than the preceding year, and higher than the corresponding temperature of any year except 1867 and 1859 as far back as 1851. At Kew Observatory the mean height of the barometer for the month was 30·123. The highest reading was 30·542 on the 16th; the lowest was 29·415 on the 1st. The 25th was the warmest day of the month, the temperature being 52·1°.

Otterburn.—The wind varied from S.W. to N.W. all through the month. The highest reading of the thermometer was 53°, the lowest 24°. Very strong gale of wind on the 5th.

Wallington.—This month, like the preceding, was very changeable at the commencement. Strong winds were again prevalent. Trees were blown down on the 6th. There was frost on five nights, but the thermometer only fell a little below the freezing point. On the 9th 9° of frost were registered. Out of door work went on with scarcely any hindrance, and the hunting meets were not interrupted. The weather was very mild towards the end of the month. A lunar rainbow was seen on the 10th, about 7 P.M. Its direction was from N. to S.

Wylam.—A fine month, with a great deal of wind nearly daily. Barometer rising in a fluctuating curve from 28·631 on the 1st, to 30·306 on the 9th, and then falling in the same way to 29·561 at the end of the month. The river again made a sudden rise on the 1st: it was three feet on January 31st, sixteen feet on February 1st, and five feet on the 2nd. The very sudden rise and fall of last month and of the present are unusual, and indicate sudden and copious rainfalls in the west, as well as one of the consequences of agricultural drainage.

Mean height of barometer, 29·794 inches.

Mean temperature	43·14°.
Ditto of thirteen years....................................	38·94°.
Excess of 1868..	4·20°.

Mean direction of wind, W. 3° S.

Rain fell on fourteen days: amount, 1·89 inches.

Mean height of river, 4·15 feet.

Whitley.—A large meteor was seen on the 25th about 8 P.M. in the N.N.W.

LUNAR HALOS were seen at Byrness on the 6th and 7th; at

Wallington on the 2nd, 3rd, and 8th; at West Hendon on the 1st, 2nd, 5th, 6th, 7th, 8th, and 10th; at North Shields on the 3rd, 6th, 8th, and 10th.

Solar Halos were seen at Byrness on the 2nd and 20th; at West Hendon on the 2nd, 6th, 15th, 20th, and 27th.

Auroræ were seen at North Shields on the 10th; at Whitley on the 21st; at West Hendon on the 19th.

Hail fell at Acklam, near Middlesbro', on the 1st.

Snow or Sleet fell at Byrness on the 3rd, 15th, 22nd, and 29th; at Otterburn on the 4th; at North Sunderland on the 1st; at Wallington on the 3rd, 4th, 8th, 21st, 22nd, and 23rd; at Whitley on the 3rd and 15th; at Seaham on the 3rd and 15th; at Seaham Harbour on the 3rd; at Greta Bridge on the 3rd and 4th; at Acklam, near Middlesbro', on the 3rd.

March.—

"Comes in as a lion and goes out like a lamb."
Old Proverb.

Greenwich.—The month of March, though less settled than February, was still favourable to agricultural pursuits, and good progress was made in ploughing, sowing, and planting generally throughout England. At the end of March vegetation was in advance of ordinary seasons, and the harvest prospects were favourable. The mean temperature of March was 44°, being 3·1° higher than the average of the preceding ninety-seven years, and higher than the corresponding temperature of any year since 1859. At Kew Observatory the mean height of the barometer for the month was 29·982. The highest reading was 30·578 on the 20th; the lowest reading was 29·143 on the 8th. The month was generally drier than Jaunary or February.

The excess of temperature for the eighty days (January the 11th to March the 31st) was more than 3½° daily.

Byrness.—Two mock suns were seen between 10 A.M. and 12·30 P.M. on the 9th. A rainbow with supplementary arc was seen on the 10th.

Otterburn.—A very fine month. Wind chiefly from S.W. and N.W. Highest reading of thermometer 54°, lowest 24°.

Wallington.—This was a very mild month. There was frost on eighteen nights but rarely severe. On seven nights the thermometer never fell below the freezing point. The lowest reading was on the 25th, when 13° of frost were registered. No rain fell from March 25th to April 5th.

Wylam.—Most beautiful, fine, mild weather all this month. The apricots on cold wall blossomed on the 4th, six days earlier than usual; and the pear trees on cold wall on the 21st, ten days earlier.

The barometer seemed settling after the fluctuations of January and February, and gradually rose during the last three weeks of the month.

Its mean height was 29·816 inches.

Mean temperature of month	44·03°.
Ditto of thirteen years	40·67°.
Excess of 1868	3·36°.

Mean direction of wind, W., 14° S.

Rain fell on eight days: amount, 1·72 inches.

Mean height of river 3·95 feet.

Darlington.—The weather was fine to the 5th; showery for the next few days; from the 10th to the 24th fine and dry. On the 25th snow fell, and we then had fine weather to the end of the month.

Lunar Halos were seen at Byrness on the 1st; at Wallington on the 7th; at Alston on the 7th; At North Shields on the 1st, 2nd, 6th, and 7th.

Solar Halos were seen at Byrness on the 9th, 18th, 24th, and 25th; at Wallington on the 24th and 25th.

Auroræ were seen at North Sunderland on the 24th; at Wallington on the 20th; at Whitley on the 20th; at Seaham on the 9th.

Lightning was seen, but thunder was not heard, at Byrness on the 9th.

Thunder was heard, but lightning was not seen, at Otterburn on the 17th; at Wallington on the 16th; at Allenheads on the 8th; at Whitley on the 17th.

Thunderstorms occurred at Byrness on the 17th; at North Sunderland on the 17th; at Allenheads on the 7th; at Newcastle-on-Tyne on the 17th; at North Shields on the 17th; at Seaham Harbour on the 17th.

Hail fell at Byrness on the 17th; at North Sunderland on the 17th, 23rd, and 24th; at Wallington on the 16th and 17th; at Whitley on the 17th; at Seaham on the 17th.

Snow or Sleet fell at Byrness on the 7th, 22nd, and 25th; at Otterburn on the 22nd and 25th; at North Sunderland on the 25th; at Wallington on the 22nd and 23rd; at Whitley on the 24th; at Seaham on the 17th and 24th; at Greta Bridge on the 23rd.

The fine weather during the first three months of the year appears to have exercised a very beneficial effect on the public health. Fever and diseases that attack the younger part of the population, seem to have been less fatal than usual in many districts which in other seasons had suffered from their ravages; and the result was a singularly low mortality for the country generally. There are only two instances on record in which the death-rate was so low as for the first three months of 1868.

For 1868 it was 2·234 per cent.
,, 1846 it was 2·157 ,,
,, 1856 it was 2·179 ,,

The estimated population of the largest towns in Northumberland and Durham, and the respective death-rates for the first quarter of 1868 were as follows :—

		Estimated Population.*	Deaths.	Annual Rate to 1000 living for first three months, 1868.
Newcastle (Borough boundaries).....		127,701	820	25·77
Sunderland (Municipal boundaries)...		108,762	694	25·59
South Shields	ditto ...	52,803	431	32·74
Gateshead	ditto ...	40,041	294	29·45
Tynemouth	ditto ...	39,415	252	25·64

Scarlatina prevailed extensively and fatally in the county of Durham, Tynemouth, and at Bedlington, where two hundred and twenty deaths occurred, being about one hundred above the average owing to the prevalence of this complaint, of which there were one hundred and twenty-one cases.

April.—

"March winds and April showers
Bring forth May flowers."

—*Old Proverb.*

Greenwich.—The month of April was warm but not remarkably so, for since the year 1771 there have been twenty-four Aprils of higher temperature. The mean temperature of the month was 48·1°, being 2·2° higher than the average of ninety-seven years, and 0·9° lower than the corresponding temperature of 1867. At Kew Observatory the mean height of the barometer for the month was 29·927. The highest reading for the month was 30·391; the lowest 29·150 on the 2nd. The 12th was the coldest day of the month, 37·4°. On the 23rd the thermometer fell 10° between 4 and 5 P.M., and rose 7° before 6 P.M. The month was generally dry.

Thunderstorms appear to have been unusually prevalent

* Allowance is made in the estimate of the population for the more than average increase.

throughout the kingdom during April, especially on the 23rd, 24th, 25th, 26th, and 27th of the month.

Otterburn.—Wet and cold month. Not much frost. Wind W. to the 7th, N.E. to 14th, W. for the remainder of the month. The highest reading of the thermometer was 64°; the lowest 26° on the 11th.

Wallington.—During a great part of the month the weather was very wet. The temperature was high. Vegetation progressed favourably, and was fully ten days in advance of 1867. There was a trifling amount of frost on eleven nights. The lowest temperature registered was on the 12th, when the thermometer fell to 24°.

Wylam.—A very fine month; everything very forward. Large numbers of female wasps, which however seem to have died soon, as there were very few wasps in the autumn.

The oak leaf was out as large as a shilling on the 19th; white thorn in flower on the 28th; both however in sunny warm situations by the river.

Barometer very steady, the mean height being 29·919 inches.

Mean temperature of month	46·58°.
Ditto of thirteen years....................................	45·87°.
Excess of 1868	0·71°.

Mean direction of wind, W.

Rain on eleven days, snow on two days: amount, 3·60 inches.

Mean height of river 2·90 feet.

Darlington.—Fine to the 6th; next four days rain and snow at intervals. From the 10th to the 14th dry and fine. Dull with rain until the 21st. The next three days were fine. On the 25th the weather broke and continued wet till the end.

Lunar Halos were seen at Byrness on the 3rd and 6th; at Wallington on the 3rd, 6th, and 28th; at Alston on the 3rd and 6th; at Allenheads on the 3rd; at North Shields on the 3rd and 6th.

Solar Halos were seen at Byrness on the 5th and 6th.

Lightning was seen, but thunder was not heard, at Alston on the 15th.

Thunder was heard, but lightning was not seen, at Alston on the 19th and 20th; Allenheads on the 25th; Greta Bridge on the 5th and 27th.

Thunderstorms occurred at Alston on the 26th; at Horsley, near Wylam, on the 26th; at Bywell on the 26th; at North Shields on the 26th; at Whitley on the 26th; at Seaham Harbour on the 26th; at Greta Bridge on the 7th.

Hail fell at Byrness on the 23rd; at Wallington on the 26th; at Alston on the 26th; at North Shields on the 8th and 9th; at Seaham on the 8th and 26th; at Acklam Hall, near Middlesbro', on the 8th and 9th.

Snow or Sleet fell at Byrness on the 8th, 9th, and 25th; at Otterburn on the 8th; at North Sunderland on the 8th and 9th; at Wallington on the 8th and 9th; at North Shields on the 8th and 9th; at Whitley on the 8th; at Seaham on the 8th; at Greta Bridge on the 8th; at Acklam, near Middlesbro', on the 8th and 9th.

May.—

> "Look at your corn in May, and you'll come weeping away;
> Look at the same in June, and you'll come home in another tune."
> —*Old Proverb.*

Greenwich.—The mean temperature of May was 57·3°, being 4·8° higher than the average of the preceding ninety-seven years, and higher than the corresponding temperatures of any year since 1848, when it was 59·7°, or 2·4° warmer than in 1868. The next and only other instance back to 1771 was in 1833, when the mean temperature of May was 59·4°. The mean temperature of all the other Mays was less than 57°. The month of May was remarkable for brilliant sunshine, high temperature, general forwardness of the season, and the promising appearance of the corn crops. At Kew Observatory the highest reading of the barometer for the month was 30·311 on the 14th; the lowest 29·567 on the 23rd; the mean height was 29·982. The coldest day of the month was the 6th, the mean temperature of which was 45·6°. The 19th was the warmest, 71·2°. The humidity of the atmosphere varied more than in April. The greater part of May was very calm.

Wallington.—After the 1st the temperature began to fall. On the 4th the thermometer fell below the freezing point; and on the 6th 12° of frost were registered, which did great damage to the fruit crops. The after part of the month was favourable to vegetation.

Wylam.—Fine month. Barometer very steady; mean height 29·924 inches.

Mean temperature	54·14°.
Ditto of thirteen years....................................	51·34°.
Excess of 1868..	2·80°.

Mean direction of wind, E.

Rain on five days: amount, 0·77 inch.

Mean height of river 1·87 feet.

Violent thunderstorms all over England south of the Humber on the 29th.

Darlington.—May began with clear and dry weather. With the exception of three days (the 9th, 11th, and 23rd) the month was fine throughout.

Solar Halos were seen at Wallington on the 6th.

Lightning was seen, but thunder was not heard, at Allenheads on the 18th; at Wallington on the 18th; at Whitley on the 29th.

Thunder was heard, but lightning was not seen, at Allenheads on the 24th; at Wallington on the 11th, 21st, and 24th; at

Bywell on the 11th, 12th, 23rd, and 24th; At North Shields on the 12th; at Whitley on the 18th; At Acklam Hall, near Middlesbro', on the 29th.

THUNDERSTORMS occurred at Byrness on the 11th and 19th; at Otterburn on the 11th and 19th; at Wallington on the 19th; at Alston on the 19th; at Allenheads on the 11th and 19th; at Horsley, near Wylam, on the 11th and 19th; at Bywell on the 19th; at North Shields on the 11th; at Seaham on the 19th and 24th; at Seaham Harbour on the 19th and 24th; at Acklam, near Middlesbro', on the 19th.

June.—

"Calm weather in June sets the corn in tune."

—*Old Proverb.*

Greenwich.—The average mean temperature of June was 62°, or 3·9° higher than the average of the preceding ninety-seven years. The month of June was of high temperature, but was greatly exceeded in the year 1846, when it was 65·3°, or 3·3° warmer. The other instances in June of higher temperature than in June of the present year, back to the year 1771, were in the years 1775, 1781, 1818, 1822, 1842. The highest of them was 62·9° in 1842 and 1818; the lowest 62·5° in 1781.

The mean temperature for the three months ending June was 55·8°. For the same period in 1775 it was 55·5°; in 1822 55°; in 1844 55·1°; in 1846 55·7; in 1848 55·3; and in 1865 56·2°; so that the only instance in ninety-eight years of higher temperature in the corresponding quarter of 1868 was in 1865. In the latter year the temperature in April was 52·3°, being higher than any other April on record.

The other years since 1771, when the mean temperature of the three months ending with June exceeded 54° and was less than 55°, were 1778, 1779, 1788, 1798, 1811, 1826, 1833, 1834, and 1858.

It will be interesting to compare the mean temperature of the longer period, viz., February to June. The mean temperature of this period for 1868 was 50·9°; that for the corresponding period of the other years distinguished for high temperature is as follows:—

1775.........	50·0°.	1826.........	49·5°.
1779.........	51·0°.	1846.........	50·8°.
1794.........	49·4°.	1848.........	50·6°.
1822.........	51·1°.	1859.........	50·1°.

The mean temperature of these five months for all the other years since 1771 was less than 50°. In two instances therefore, viz., in the years 1779 and 1822, have these five months been of higher temperature than 1868, and in both by so small an amount as one-fifth of a degree. But if we compare the mean temperature of the one hundred and seventy-one days (January the 12th to June the 30th) with the corresponding period of other years, we find that the year 1822 is the only one distinguished by an excess of temperature over 1868. The average daily excess for these one hundred and seventy-one days was more than $3\frac{1}{4}°$.

The five months (February to June) have also been distinguished by having an almost constant atmospheric pressure above the average: the mean monthly excess was more than 0·1 inch. At Greenwich there was also a deficiency of rain in each month. The amount below the average for the five months was 2·5 inches; but taking the six months, January to June, the quantity very closely approximated to the average, the deficiency being only about the hundredth of an inch. There was an excess over the average fall for January of 2·4 inches.

The highest temperature occurred at Greenwich on the 19th June when it was 87°, and on the 13th and 14th, when it was 85°. These temperatures were exceeded at some places in the Midland Counties.

It is a very remarkable fact, only one thunderstorm occurred at Greenwich during the quarter, viz., on May the 29th, on which day the greater part of the rain for the month fell. The number of thunderstorms over the country generally was much less than usual.

The highest reading of the barometer for the month at Kew Observatory was 30·138 on the 29th; the lowest reading was 29·683 on the 22nd. The mean height for the month was 30·122. The month was unusually dry, the days of greatest dryness being the 13th and 27th. On these days the amount of moisture present in the air was 0·48 (complete saturation = 1·00). The mean humidity for that month was 0·64.

Byrness.—Two slight mock suns were seen on the 17th.

Wallington.—Rain only fell on eight days, and then only in such small quantities as just sufficient to moisten the foliage of trees and plants. It was very refreshing when it came. On four nights the temperature was down to the freezing point.

Lilburn Tower.—The great drought had a most damaging effect on the crops. The pastures were burnt up; the corn stunted in its growth; large fields which were sown for turnips were mere fallows; potatoes were generally small and inferior.

Wylam.—Very fine month, but very dry; vegetation much burnt up for want of rain. Barometer very steady. Mean height of barometer 30·054 inches.

Mean temperature of month	57·98°.
Ditto of thirteen years	57·04°.
Excess of 1868	0·94°.

Strawberries ripe on the 12th.
Mean direction of wind, W.
Rain on two days: amount, ·54 inch.
Mean height of river 1·22 foot.

Darlington.—June set in with clear and dry weather and so continued until the 21st, when one-fourth of an inch of rain fell; then dry and hot weather until the close of the month.

Solar Halos were seen at Byrness on the 10th.

Thunder was heard, but lightning was not seen, at Byrness on the 22nd; at Otterburn on the 21st and 22nd; at North Shields on the 20th and 30th; at Acklam Hall, near Middlesbro', on the 20th and 20th.

Thunderstorms occurred at Otterburn on the 20th; at Alston on the 21st; at Wallington on the 20th, 21st, and 22nd; at Greta Bridge on the 21st.

The health of the population of the country generally was very satisfactory, and a very low rate of mortality marked the second quarter of 1868 equally with the first quarter of the year.

The prevalence of scarlatina again very seriously affected the number of deaths in the counties of Durham and Northumberland, the estimated population and the death rate being as follows:—

	Estimated Population for middle of 1868.	Deaths.	Annual Rate to 1000 living for second three months 1868.
Newcastle (Borough boundaries) ...	127,701	698	21·94
Sunderland (Municipal boundaries)	108,762	636	23·45
South Shields ditto	62,357	378	24·31
Gateshead ditto	41,500	236	22·81
Tynemouth ditto	39,415	226	23·00

July.—

"A shower in July, when the corn begins to fill,
Is worth a plough of oxen, and all belongs there till."
—*Old Proverb.*

Greenwich.—The month of July was remarkably warm; the temperature on July the 22nd was as high as 96·6°, a higher temperature than was ever before recorded at Greenwich. It reached 92° on two occasions, viz., on July the 16th and 21st, and was 90° on two other days, July the 20th and 28th. In 1859 the temperature once reached 93°; and in 1846 it was once 93·3°.

The mean temperature of the month was 67·5°, or 6·1° higher than the average of the preceding ninety-seven years, and 8·1° higher than July, 1867. In 1859 it was 68·1°; and in the year

1778 was 67°. In all other years back to 1771 it was less than 67°. The month was therefore very remarkable for its high mean temperature, being the highest, except one, of any corresponding month during the preceding ninety-seven years.

At Kew Observatory the highest reading of the barometer was 30·373 inches on the 24th; the lowest was on the 28th, 29·674; the mean reading for the month, 30·029 inches. The days when the amount of aqueous vapour present in the air was least were the 20th, 0·45; the 22nd, 0·48; and the 30th, 0·47: the mean for the month being 0·61; complete saturation being 1·00.

At the end of July the harvest was progressing well in nearly all parts of the British Isles, and in some of the more favoured districts was well-nigh completed. The corn in most cases was well-nigh ready for thrashing and for the miller as soon as carried.

There were many sudden deaths from sunstroke during the month. The want of water was severely felt, and this, combined with the great heat, acted injuriously to a degree probably unprecedented in this country on animal and vegetable life. Pastures and grass lands were almost universally burnt up.

Otterburn.—There was a sharp frost on the 23rd, and ice was formed on shallow pools of water. The thermometer fell to 36° during the night about five feet from the ground. The wind was from the N. The highest readings of the thermometer for the month were 77° on the 3rd, 78° on the 21st and 22nd, and 79° on the 28th. The lowest were 36° on the 23rd, and 38° on the 24th.

Wallington.—The continuous drought has had a most destructive effect on the moles. The ground was dried for a depth of more than two feet. Hundreds of moles were found in the woods and fields, having died in their search for food. Snails and slugs, except in damp places, were almost exterminated;—a circumstance whereat farmers and gardeners may rejoice. On the 24th the temperature at night fell to 32°; on the 25th and 26th to 31°.

Wylam.—An exceedingly fine month, but very dry. Several humming-bird hawk-moths about the garden. Barometer very steady, with a slight tendency downward, from the beginning to the end of the month. Mean height of barometer 30·067 inches.

Mean temperature of month	61·73°.
Ditto of thirteen years	58·84°.
Excess of 1868	2·89°.

Mean direction of wind, E., 33° S.

Rain fell on four days: amount, 0·57 inch.

Mean height of river ·93 foot.

The highest temperature of the year was on the 28th, when the maximum thermometer marked 87°.

Stamfordham.—The highest readings of the thermometer for the month were on the 2nd, 82½°; the 15th, 87¼°; and the 22nd, 87°.

Darlington.—Hot dry weather throughout. On the 16th a heavy fall of more than three-quarters of an inch of rain occurred.

Thunder was heard, but lightning was not seen, at Allenheads on the 22nd; at Alston on the 28th; at Bywell on the 5th; at North Shields on the 15th and 28th; at Seaham on the 28th; at Acklam Hall, near Middlesbro', on the 6th and 22nd.

Thunderstorms occurred at Otterburn on the 28th; at Allenheads on the 28th; at Wallington on the 28th; at Bywell on the 28th; at North Shields on the 5th and 6th; at Seaham Harbour on the 28th; at Acklam Hall, near Middlesbro', on the 28th.

August.—

> "All the tears St. Swithin can cry
> St. Bartlemy's mantle wipes dry."
>
> —*Old Proverb.*

Greenwich.—The beginning of the month of August was of high temperature. On the 5th the maximum temperature was

90½°. The mean temperature for the month (63·6°) was high, but not remarkably so. In the ninety-seven years back to 1771 there were nine other instances of a temperature as high, or higher, viz., 1779, 1780, 1800, 1802, 1807, 1818, 1819, 1842, 1856.

The mean temperature was 2·9° higher than the average of the preceding ninety-seven years, and higher than in any year as far back as 1857.

At Kew Observatory the variations in the readings of the barometer were greater and more numerous than in July. The mean height for the month was 29·877 inches. The days when there was least moisture in the air were the 2nd and 4th; the proportion being 0·47 on each of those days. There was most humidity on the 13th and 17th, when 0·96 and 0·95 were recorded. The mean for the month was 0·73; complete saturation being 1·00.

On the 27th there was a severe snowstorm and violent gale at Braemar, in Scotland. The heat elsewhere was great.

Otterburn.—The month commenced with a high degree of temperature: 78° were registered on the 2nd, and 81° on the 5th.

Wallington.—Owing to the welcome falls of rain which we have had this month the grass made very rapid growth, and so mitigated the fears of the farmers as to winter keep for their stock.

Wylam.—A very fine month; very warm in the beginning and end; with a good deal of wind in the latter part. From May 13th to the 19th instant we never had a fire in the drawing room at Wylam Hall, a longer period than I remember to have passed without one.

Very great abundance of mushrooms and of blackberries this year, the mushrooms selling for 1½d. per quart. The early trains brought baskets of them to Newcastle by trucks full in the mornings. Very few wasps.

Barometer very steady. Mean height of barometer, 29·790 inches.

Mean temperature of month	61·03°.
Ditto of thirteen years..	58·96°.
Excess of 1868	2·07°.

Mean direction of wind, S., 22° W.

Rain on eight days: amount, 2·23 inches.

Mean height of river 1·27 feet.

Stamfordham.—The highest temperatures recorded were 88° on the 2nd, and 85° on the 5th.

Darlington.—The 2nd was the warmest day of the month. On the 6th there was some rain at night; four days of fine weather followed; showery from the 11th to the 15th, then fine to the 22nd; the 23rd, 24th, and 25th showery; then fine to the end of the month.

Solar Halos were seen at Wallington on the 16th.

Lightning was seen, but thunder was not heard, at Alston on the 6th; at Whitley on the 22nd.

Thunder was heard, but lightning was not seen, at Allenheads on the 15th, at North Shields on the 15th; at Whitley on the 15th; at Acklam Hall, near Middlesbro', on the 17th.

Thunderstorms occurred at Allenheads on the 11th; at Alston on the 11th and 15th; at North Sunderland on the 6th and 11th; at Wallington on the 6th and 15th; at Bywell on the 11th; at Horsley, near Wylam, on the 15th; at Newcastle-on-Tyne on the 6th; at Whitley on the 5th and 6th; at North Shields on the 5th; at Seaham on the 5th and 6th; at Acklam, near Middlesbro', on the 6th and 11th.

September.—

"September blow soft till the fruit 's in the loft."

—*Old Proverb.*

Greenwich.—The month of September was warm throughout, particularly at the beginning: on the 7th the maximum temperature reached 92·1°. In 1846 the highest temperature recorded in September was 85·4°; and in the warmest September on record, that of 1865, it was only 86°.

The mean temperature for the month was 60·5°, being 3·4° lower than 1865, and 1·8° lower than in 1815, and nearly the same as in the years 1779, 1795, 1818, 1846, and 1858; whilst in all the other years since 1771 the temperature has been below 60°. The mean temperature was 4° higher than that of the preceding ninety-seven years.

The temperature for the quarter ending September 30th was 63·9°, which is greatly in excess of the average. The average daily excess of temperature was nearly 4°, and for the two hundred and sixty-three days from January the 12th to September the 30th, was 3¼° daily. In no year since 1771 has the excess of temperature been so large and for so long a period. The year 1779, however, closely approximated to it.

At Kew Observatory the highest reading of the barometer for the month was on the 9th, 30·319 inches; the lowest reading was on the 30th, 29·289 inches: the mean for the month was 29·829 inches.

The variations in the humidity of the atmosphere were considerable. The greatest dryness was 0·51 on the 13th; the 25th showed the least, 0·94. The mean for the month was 0·74; complete saturation being 1·00.

Towards the end of the month heavy rain fell in nearly every part of the country. Ponds and wells re-commenced to yield the usual supply of water; rivers and streams were filled.

Wallington.—We had an abundant fall of rain this month, and it penetrated far down into the soil. Grass has made extraordinary progress. On one occasion a growth of an inch was marked in the course of twenty-four hours.

Wylam.—Very warm during the first week; then much cooler, with a good deal of rain, generally falling in the night.

Barometer pretty steady, falling gradually from the middle to the end. Mean height of barometer, 29·831 inches.

Mean temperature of month	56·83°.
Ditto of thirteen years	54·72°.
Excess of 1868	2·11°.

Mean direction of wind, E., 36° S.

Rain on thirteen days: amount, 4·26 inches.

Mean height of river 2·12 feet.

Stamfordham.—During September the following high readings of the thermometer were recorded:—77° on the 4th; 80° on the 5th; 83½° on the 6th; and 85° on the 7th.

Whitley.—The first seven days of the month were very warm. On the 7th the temperature rose to 82° on a north wall under shade. After the 7th a great change took place from that day to the 28th; the weather was cold and strong, winds chiefly from the north and east were prevalent.

Acklam, near Middlesbro'.—On the 6th the thermometer rose to 85° on a north wall. A very fine meteor was seen during the evening of the 8th passing from N.W. to N.E. in a horizontal direction.

Darlington.—Fine to the 8th; showery for next three days; then fine to the 20th; the rest of the month wet throughout.

Auroræ were seen at Wallington on the 5th; at North Shields on the 15th and 18th; at Acklam Hall, near Middlesbro', on the 8th.

Lightning was seen, but thunder was not heard, at Alston on the 26th; at Wallington on the 21st and 26th; at Whitley on the 7th.

Thunder was heard, but lightning was not seen, at Alston on the 18th, 25th, and 29th; at Wallington on the 20th and 29th; at Whitley on the 25th; at Acklam Hall, near Middlesbro', on the 19th, 20th, and 27th.

THUNDERSTORMS occurred at Alston on the 20th; at North Sunderland on the 7th; at North Shields on the 20th and 26th; at Whitley on the 30th; at Acklam Hall, near Middlesbro', on the 11th, 20th, and 29th.

The mortality in the quarter ending with September 30th was, unlike that of the two previous quarters of the year, considerably above the average. The annual rate for country parishes for the summer quarter (July, August, and September) is seventeen; that of the chief town districts is twenty-two to the one thousand living. In 1868 these numbers rose to twenty and twenty-six respectively.

It will be noted how much in excess of these numbers was the rate of mortality in the chief towns of the North.

That the peculiar state of the weather, the causes of which it is the high province of the meteorologist to trace out, was the cause of some of this great increase is not open to dispute.

But after making every allowance on that score, there cannot be the smallest doubt but that a very large number of persons perished from disease induced by causes strictly within the control of the public authorities, but which too often they lack the power to remove.

Diarrhœa was very prevalent throughout the kingdom. Our own locality suffered severely from it. One hundred and twenty-two deaths from that cause were recorded in Newcastle, and sixty-nine in Sunderland. Scarlatina was also very prevalent. Taking the population at the numbers already given, the death-rate for the quarter per thousand living will be for Newcastle-upon-Tyne, 27·44; Sunderland, 27·10; South Shields, 31·30; Gateshead, 31·07; Tynemouth, 25·97.

October.—

> "A good October and a good blast,
> To blow the hog acorn and mask."
>
> —*Old Proverb.*

Greenwich.—A change came o'er the scene with the beginning of October, and we can no longer speak, as in all the previous months of the year, of an excess of temperature. The mean temperature of October was 47·9°, being 1·8° lower than the average of ninety-seven years, and lower than the corresponding temperature of any year as far back as 1852. At Kew Observatory the mean height of the barometer was 29·939 inches. The lowest mean for the month (29·499 inches) was on the 24th; the highest mean reading was 30·291 inches on the 28th. The mean degree of humidity for the month was 0·81. The days of least moisture were the 2nd, 27th, and 29th; the amounts on those days being 0·69, 0·69, and 0·64 respectively. The days of greatest humidity were the 12th and 24th, when 0·98 were recorded; complete saturation, 1·00.

Byrness.—A mock sun was seen on the 23rd.

Wylam.—Very fine month, with barometer steady till the morning of the 24th at 8, when it stood at 29·505, and then fell to 28·670 at 6 P.M., and rose to 29·541 at 8 A.M. of the 25th. This sudden depression was attended by a violent gale almost everywhere; and on the afternoon of the 24th shocks of an earthquake were felt near Mallow, in Ireland.

Mean height of barometer, 29·848 inches.

Mean temperature of month	45·31°.
Ditto of thirteen years....................................	48·06°.
Deficiency of 1868	2·75°.

Mean direction of wind, W., 10° S.

Rain on eleven days: amount, 1·31 inches.

Mean height of river 2·54 feet.

Whitley.—A sharp frost, the first of the season, occurred on the 18th, and lasted until the 20th.

Darlington.—First two days fine; heavy rain on the 3rd. Except some showers on the 6th, 13th, 21st, 24th, and 29th, the rest of the month was fine. A strong gale of wind on the 25th.

North Shields.—A very remarkable and violent outbreak of fever, of a typhoid character, occurred in North Shields about October the 15th, and was very severe by the 17th or 18th. The fever was very local. The whole of the affected district was in the higher part of the town, very much above the sea or river level. The cause does not seem far to find. The table of rainfall will give the key by which it may be discovered. A very long period of drought was followed by sudden falls of heavy rain. On September the 25th there was a fall of nearly an inch (0·96), and again another fall of nearly three-quarters of an inch on October the 3rd; and, as Dr. Bramwell well remarks in a paper read before the Northumberland and Durham Medical Society—"To these falls acting on ground unmoistened for months, and passing through imperfectly sluiced drains, rousing into an active state the excrementitious matters lodging on the ground the outbreak is to be ascribed." The period between the heavy rainfall and the outbreak of the fever would "just leave the necessary time for these putrefactive matters, thus roused into activity, to be carried into the human frame and generate the fever, very possibly the drain poison acting more especially on those persons drinking water to some extent contaminated." It should be added, that from local circumstances the drains in the lowest parts of the town, where the fever did *not* prevail, would always have a larger flow of water through them than those in the high level districts. This will serve to illustrate one of the uses of meteorological observations. A careful study of the rainfall returns will enable the local authorities to guard against a similar calamity for the future, at any rate to a great extent, by ascertaining when it becomes necessary to force a supply of water through the sewers over and beyond that provided in ordinary times. Independently of the suffering occasioned to those who survived the attacks of the fever, probably nearly sixty persons died from that cause from the commencement of the outbreak up to the end of the first week in December.

Auroræ were seen at Wallington on the 19th; at Bywell on the 19th, 21st, and 22nd; at Alston on the 22nd; at Seaham

Harbour on the 22nd; at Acklam, near Middlesbro', on the 19th, 22nd, and 24th.

Lightning was seen, but thunder was not heard, at Wallington on the 16th; at Allenheads on the 16th, 17th, and 23rd; at Alston on the 16th; at Whitley on the 23rd.

Thunder was heard, but lightning was not seen, at Byrness on the 16th; at Otterburn on the 16th; at Wallington on the 16th; at Allenheads on the 16th; at Horsley, near Wylam, on the 16th; at Newcastle-on-Tyne on the 16th; at North Shields on the 16th; at Seaham on the 16th.

Thunderstorm occurred at Whitley on the 16th.

Hail fell at Byrness on the 18th; at Wallington on the 29th; at Alston on the 7th; at Whitley on the 16th; at North Shields on the 16th; at Seaham Harbour on the 17th and 18th; at Seaham on the 16th.

Snow fell at Byrness on the 21st: at Alston on the 11th.

November.—

"November take flail, let ships no more sail."

—*Old Proverb.*

Greenwich.—The mean temperature was 41·5°, being 0·9° lower than the average of ninety-seven years, 0·1° higher that of the preceding year, but 2·8° lower than the corresponding temperature in 1866. For the sixty-one days, October the 1st to November the 30th, the average daily deficiency of temperature was 2°.

Byrness.—A splendid lunar rainbow was seen on the 1st.

Stamfordham.—The thermometer recorded a temperature of 65° on the 1st.

Wylam.—An exceedingly gloomy month; not much wind. The November atmospheric wave was very conspicuous, commencing to rise from 29·266 on the 3rd, till it reached 30·645 (the highest reading of the year) on the 13th, at 9 A.M., then gradually falling to 30·163 on the 20th, and then suddenly to 28·760 on the 22nd, from whence it rose again suddenly for two days and then more gradually. On the day of greatest depression (the 22nd) shocks of an earthquake were felt at Waterloo, near Liverpool.

Mean height of barometer, 29·999 inches.

Mean temperature of month	39·52°.
Ditto of thirteen years	41·10°.
Decrease of 1868	1·58°.

Mean direction of wind, E., 26° N.

Rain on twelve days: amount, 2·46 inches.

Mean height of river 2·91 feet.

Darlington.—A very changeable month. A day or two fine and then rain. The closing days were fine.

LUNAR HALOS were seen at Wallington on the 29th; at North Shields on the 25th and 28th; at Seaham Harbour on the 25th.

SOLAR HALOS were seen at Byrness on the 29th; at Wallington on the 20th.

LIGHTNING was seen, but thunder was not heard, at Wallington on the 5th; at Alston on the 3rd and 13th.

THUNDER was heard, but lightning was not seen, at Greta Bridge on the 10th.

HAIL fell at North Shields on the 4th, 7th, and 9th; at Acklam Hall, near Middlesbro', on the 8th, 9th, and 10th.

SNOW OR SLEET fell at North Sunderland on the 9th; at Wallington on the 6th; at Horsley, near Wylam, on the 6th; at North Shields on the 6th and 9th; at Whitley on the 6th, 7th, and 8th; at Seaham Harbour on the 6th, 7th, and 9th; at Acklam, near Middlesbro', on the 8th, 9th, and 10th; at Greta Bridge on the 7th and 9th.

December.—

"He who sows his land trusts in God."
—*Spanish Proverb.*

Greenwich.—The mean temperature of December was 46·0°, being 6·9° higher than the average of ninety-seven years, and higher than any corresponding temperature in the period 1771 to 1867, with the sole exceptions of 1806 and 1852, when 46·8° and 47·6° were respectively recorded.

The rainfall in December (5½ inches) was the greatest in quantity ever recorded for that month at the Royal Observatory. The mean daily readings of the barometer during December were with one exception below the average, on two occasions being over an inch in defect. On the 24th the reading recorded was 28·53, being the absolute minimum in 1868, and the mean value for this day was as much as 1·22 in defect of the average. The mean reading for the month was 29·38 inches; the average for December is 29·83 inches. The mean reading for December, 1868, were therefore 0·45 inches below the average. The range was 1·64 inches.

The lowest mean reading in any month, back to 1841, was 29·40 inches in January, 1865. The other instances of mean readings below 29·50 inches were 29·44 inches in October, 1841 and 1865; 29·47 inches in November, 1852, and January, 1856; and 28·49 inches in December, 1860.

Violent gales were experienced on the 27th and 28th, and pressures of thirty to the square foot were recorded.

Horsley, near Wylam.—On the 27th the barometer stood at 28·12 in the morning, and fell to 27·98 during the day, the lowest reading observed for seven years.

Wylam.—December was an exceedingly changeable month, one day very fine, the next very coarse, and the next fine again. A great deal of wind. The barometer only on one day (the 19th) rose above 29·97, the mean height at the sea-level, and was throughout the month in a most disturbed condition, its general tendency being downward from the beginning to the end of the month. On the 27th, at 3 P.M., it stood at 28·168, which I believe is the lowest reading I ever took: there were violent gales on that day in the Channel and South of England.

The mean height of the barometer was 29·332, which a glance at the diagram annexed will show to be a remarkable departure from the comparatively even mean height of the year.

Mean temperature of month	41·85°.
Ditto of thirteen years	40·19°.
Excess of 1868	1·66°.

Mean direction of wind, S., 33° W.

Rain on twenty-four days: amount, 3·93 inches.

Mean height of river 3·69 feet.

I subjoin, in a tabular form, the monthly meteorological observations quoted above, and append to them, as the readiest mode of engaging the comprehension, a diagram of the action of the thermometer, barometer, and the wind.

The first, showing a comparison of the monthly temperatures of 1868, with those of the last thirteen years (1868 included) at Wylam, which will be examined with some interest from the exceptionally high temperature of 1868.

The second diagram, that of the barometer, is chiefly remarkable for the great depression during the month of December.

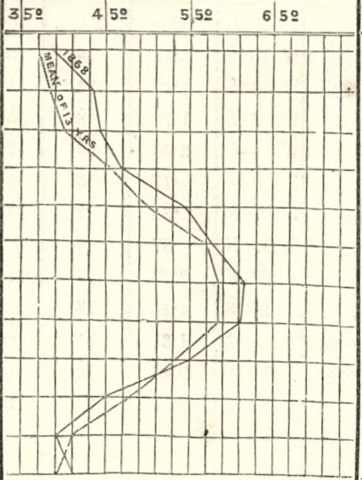
The third diagram, of the wind, is only interesting to a limited extent, the situation of Wylam being by no means favourable for observations on the wind; even the higher clouds from which I generally note its course being, in some measure, I suspect, influenced by the valley and river, while the force is not measured at all, and the amount of each wind, which ought to consist of its direction multiplied by its force, having been assumed to be of equal force, is not correct. I should not have introduced it here but to point out how very valuable a set of wind tables, of somewhat similar design, would be, if framed on observations made on high open ground like Kenton, Earsdon, &c., with an anemometer (Robinson's, e.g.,) to note the amount of each wind, as well as a good vane to indicate its direction. These two quantities multiplied together would give the value of each wind, and the determination of the resultant wind from such data would be highly interesting.

	Barometer.	THERMOMETER (Monthly Means).						WIND, by Clouds overhead.	RAIN.	SNOW.	Height of River Tyne.
	9 A.M.	Min.	Max.	Mean.	Means of 13 years.	Excess of 1868.	Deficiency of 1868.		Amount.	Days.	
									Inches.		feet.
January	29·756	33·51	43·74	38·47	37·04	1·43	......	W. 10° S.	3·15	18	3·06
February......	29·890	36·52	49·76	43·14	38·94	4·20	......	W. 3° S.	1·89	14	4·15
March	29·816	35 90	52·16	44·03	40·67	3·36	......	W. 8° S.	1·72	8	3·95
April	29·919	38·57	54·60	46·58	45·87	·71	......	W. —	3·60	12	2·90
May	29·924	44·61	63·68	54·14	51·34	2·80	......	E. —	·77	5	1·87
June	30·054	47·03	68·93	57·98	57·04	·94	......	W. 7° N.	·54	2	1·22
July............	30·067	51·71	71·76	61·73	58·84	2·89	......	E. 33° N.	·57	4	·93
August	29·790	51·68	70·35	61·03	58·96	2·07	......	S. 22° W.	2·23	8	1·27
September ...	29·831	48·60	65·07	56·83	54·72	2·11	......	E. 36° S.	4·26	13	2·12
October	29·868	35·90	54·71	45·31	48·06	......	2·75	W. 4° S.	1·31	11	2·54
November ...	29·999	34·10	45·13	39·52	41·10	......	1·58	E. 26° N.	2.46	12	2·91
December ...	29·332	35·81	47·90	41·85	40·19	1·66	......	W. 25° S.	3·93	24	3·69
Means and Totals ...	29·854	41·16	57·32	48·80	47·73				26·43	131	2·55

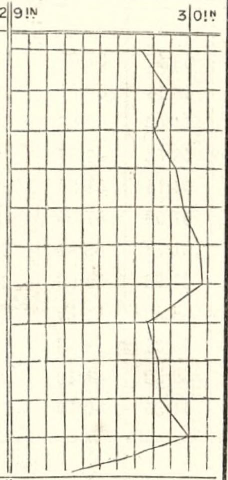
DIAGRAM of Temperature, Pressure, and Direction of the Air, in 1868, showing also the difference of the mean Monthly Temperatures of 1868 from the
Mean Monthly Temperatures of the last 13 years (1868 included) at Wylam.
The mean Monthly Barometric Pressure at 9 a.m. at ditto.
The mean Monthly Direction of the Wind (from clouds overhead) at ditto.

	TEMPERATURE. 1868.	TEMPERATURE. 13 Yrs.	PRESSURE.	DIRECTION. Resultant sum of observations p.c.
Jan. ...	38·47	37·04	29·756	,, $\frac{10}{13}$ W. 10° S.=77
Feb. ...	43·14	38·94	29·890	,, $\frac{21}{22}$ W. 3° S.=96
Mar. ...	44·03	40·67	29·816	,, $\frac{19}{23}$ W. 8° S.=83
Apr. ...	46·58	45·87	29·919	,, $\frac{10}{10}$ W. =100
May ...	54·14	51·34	29·924	,, $\frac{2}{2}$ E. =100
June	57·98	57·04	30·054	,, $\frac{7}{7}$ W. 7° N.=100
July ...	61·73	58·84	30·067	,, $\frac{2}{16}$ W. 33° N.=13
Aug.	61·03	58·96	29·790	,, $\frac{13}{31}$ S. 22° W.=42
Sept.	56·83	54·72	29·831	,, $\frac{5}{6}$ E. 36° S.=83
Oct. ...	45·31	48·06	29·868	,, $\frac{20}{22}$ W. 4° S.=91
Nov.	39·52	41·10	29·999	,, $\frac{4}{8}$ E. 26° N.=50
Dec. ...	41·85	40·19	29·332	,, $\frac{21}{38}$ W. 25° S.=70
Mean	48·80	47·73	29·854	
Total of Resultants...... / Do. Observations				$\frac{134}{100}$ W. 17° S.=70

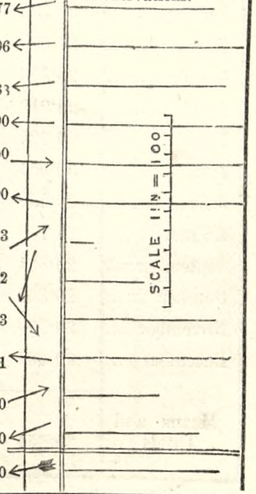
TEMPERATURE.



PRESSURE.



Proportion (p.c.) of the Resultant to the sum of obervations.



Darlington.—December was a wet month; only six days were clear from rain. There was a very heavy fall of snow on the 30th.

Lunar Halos were seen at North Sunderland on the 30th; at Wallington on the 2nd, 21st, 22nd, and 23rd; at North Shields on the 23rd and 27th.

Lightning was seen, but thunder was not heard, at Horsley, near Wylam, on the 14th.

Thunder was heard, but lightning was not seen, at Allenheads on the 29th.

Thunderstorms occurred at Alston on the 29th; at Acklam Hall, near Middlesbro', on the 21st.

Snow fell at Byrness on the 20th, 26th, and 29th.

The annual rate of mortality during the last quarter of 1868 for the country generally was 21·93 for each thousand persons living. For the fourteen great towns it was 26: for Newcastle-on-Tyne it was 27·03; Sunderland 28·31; South Shields 21·82; Gateshead 27·03; and Tynemouth 27·38, the population being estimated as in last quarter. The Registrar General pertinently remarks, "When will the North undertake the noble work of saving the lives of the people? Why should industrious, prosperous, and wealthy communities see their people perish year after year, at these appalling rates, without trying some radical and effectual measures of reform? This is not a question of mere opinion but of life and death; it is not a question of the day only, but of all time. Shall the town breeds of the North degenerate and die out or improve and live? There appears to be no dispute as to the particular measures to be adopted: why should not experiments be at once made with particular blocks of houses?"

RAINFALL RETURNS.

There has again been an addition to the number of places from which rainfall returns have been sent in to the Club for the year 1868; but the editor hopes that the list will be still further extended when the report for 1869 is issued.

There are a few places in the neighbourhood of which it is desirable to establish additional rain guages. The sources of the North Tyne, Falstone, Bellingham, Morpeth, Alnwick, Holy Island, Cheviot, Haydon Bridge, Knaresdale, Blanchland, Medomsley, Middleton-in-Teesdale, Bishop Auckland, Hartlepool, &c, may be mentioned as amongst the localities from which it is desirable to obtain further information. The editor will be very glad to communicate with any one resident in those neighbourhoods, or who may have friends who would be willing to help in the work. The time and trouble taken up by the necessary attention to a rain guage is very small, and as observations accumulate it is almost always found to be a subject of growing interest.

The editor is enabled, through the kindness of a member of the Club much interested in the subject, to offer to supply accurate guages for a very few shillings to any one who will undertake to return the record of the observations at the end of the year to the Club.

The year 1868 was very remarkable for the peculiarity of the distribution of the rainfall. The earlier months of the year were considerably in excess of the average fall, while in the next three months the deficiency was very great.

It will be interesting to compare the quantity of the rainfall at the following places, which have been selected because records are in the possession of the Club from each of those stations since the year 1856, when Meteorology was first practically taken in hand by the TYNESIDE CLUB. The stations have also been chosen with the idea of showing the fall in each part of the counties of Northumberland and Durham.

	Average for Jan., Feb., Mar., April, for 12 years. inches.	1868. Jan., Feb., Mar., April. inches.	Excess in 1868. inches.
NORTH.			
Lilburn	7·92	8·19	0·27
TYNE VALLEY.			
Bywell	8·33	8·96	0·63
Wylam	7·30	10·36	3·06

	Average for Jan., Feb., Mar., April. for 12 years.	1868. Jan., Feb., Mar., April.	Excess in 1868.
COAST.	inches.	inches.	inches.
Howick	5·81	7·66	1·85
SOUTH NORTHUMBERLAND AND DURHAM.			
Allenheads	16·13	23·0	6·20
Whorlton.........	7·27	9·57	2·30

For May, June, and July, the returns present a very different aspect.

	Average for 12 years.	1868.	Deficiency.		Whole of 1868.
NORTH.	inches.	inches.	inches.		inches.
Lilburn	8·96	2·70	6·26	+	8·0
TYNE VALLEY.					
Bywell............	6·88	1·80	5·08	—	0·49
Wylam............	6·46	1·88	4·58	—	0·19
COAST.					
Howick	5·25	1·85	3·30	+	2·31
SOUTH NORTHUMBERLAND AND DURHAM.					
Allenheads	8·96	2·70	6·26	+	8·0
Whorlton.........	6·74	2·25	4·49	+	2·82

In searching for a year with which to compare the rainfall of 1868 we find that of the years 1856–1868, the year 1858 presents the most remarkable features. The drought commenced early in November, 1857, and lasted eight months until July, 1858. It will be interesting to compare the rainfall for the first six months of the year, at a few selected stations, with the corresponding period of 1858.

	1858.	1868.	Excess in 1868.
NORTH.	inches.	inches.	inches.
Lilburn	6·47	10·04	3·57

TYNE VALLEY.	1858. inches.	1868. inches.	Excess in 1868. inches.
Bywell	6·87	12·10	5·23
Wylam............	4·77	11·65	6·88
Newcastle	3·05	9·69	5·64
North Shields ...	7·28	9·49	2·21
SOUTH NORTHUMBERLAND AND DURHAM.			
Sunderland	4·42	7·52	3·10
Durham	4·85	11·26	6·41
Allenheads	15·48	25·10	9·62

The following return of the depth of water in the wells at the Low Lights, North Shields, which has been kindly furnished by J. R. Procter, Esq., will be read with interest, as bearing on the effects of the peculiar rainfall of 1868.

1868.	No. 1. 23ft. deep. Ft.	In.	No. 2. 11ft. deep. Ft.	In.	No. 3. 15ft. deep. Ft.	In.	REMARKS.
January 7	21	8	8	1	13	6	
February ... 4	21	3	8	2	12	1	
March......... 4	20	7	8	2	9	9	
April 1	20	6	8	2	10	1	Lowest in April—20ft. 2in., 7ft. 8in., 8ft. 8in.
May 6	20	5	8	2	9	5	
June 3	20	4	8	2	9	6	
July 1	19	9	7	8	8	3	
August 5	19	7	7	7	8	2	
September ... 2	19	11	8	2	8	6	
,, ... 30	19	3	6	7	8	7	
October 7	19	4	7	3	8	9	
November ... 4	19	3	7	6	8	0	
December ... 2	19	8	8	0	8	8	
,, ... 30	20	0	8	1	10	7	December 9th—20ft. 7in., 8ft. 2in., 13ft. 2in.

THE TYNE SALMON FISHERIES.

The effects of the rainfall on the produce of salmon fisheries was remarked upon in the "*Meteorological Report for* 1867," and it is very probable that the state of the fisheries in the Tyne during the years 1869 and 1870 may throw much light on this subject.

The year 1868 was not a good fishery year for the river fishermen, though very far better than the years before the recent measures for increasing the number of salmon began to take effect.

Mr. George Clayton Atkinson, together with many others, considers that the deficient number of fish was in some degree to be attributed to the want of water in the river, but mainly to the great number of nets at the mouth of the Tyne and in the sea.

The editor, with others who have given great attention to the subject, is decidedly inclined to attribute the short comings of the river fisheries altogether to the paucity of water in the river. The fish were observed again and again to quit the sea and make the attempt to work their way up the river and then to turn back again.

The sea fishery was very productive; and had it not been for the enterprise of the sea fishermen the public would have been deprived of a very large amount of excellent food; and surely this is the right way to look at the question, and not as between the owners of the upper waters and the fishermen at the estuary and sea. It must be remembered, too, that great as were the number of salmon captured, they were not more than some half dozen moderate sized fish which were *capable* of producing. It is to be hoped that ere long the Woodburn Dam will disappear, and other obstructions to the free passage of the salmon to the upper waters will be removed. Then will the Tyne have a fair chance of becoming by far the best salmon river in the United Kingdom.

TEES DISTRICT.

PLACE	DINSDALE RECTORY, near DARLINGTON.		DARLINGTON, SOUTH END.		DARLINGTON, BRINKBURN.	
Height of Guage above sea level	50 Feet.		40 Feet.		40 Feet ?	
Above Ground	1ft. 6in.		4 Feet.			
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·37	23	4·58	...	1·80	14
February	0·83	15	1·83	...	0·80	6
March	1·49	17	1·44	...	0·80	7
April	1·95	16	2·19	...	2·15	10
May	1·25	12	1·62	...	0·80	3
June	0·36	5	0·46	...	0·25	1
July	1·32	7	2·00	...	0·90	3
August	2·33	14	3·13	...	2·60	10
September	3·14	17	5·47	...	3·80	9
October	2·27	16	2·61	...	1·70	6
November	1·85	19	2·11	...	1·50	9
December	5·80	26	10·31	...	4·65	19
1868	24·96	187	37·75	...	21·75	97
1867	26·66	175	40·79	...	......	...
1866	29·25	...	38·71	...	......	...
1865	22·50	...	27·05	...	......	...
1864	......	...	22·11	...	......	...
1863	......	...	19·26	...	......	...
1862	......	...	21·24	...	......	...
1861	......	...	32·83	...	......	...
1860	......	...	31·86	...	......	...
1859	......	...	27·65	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	25·84 4 years.	181 2 years	29·92 10 years.	...	21·75 1 year.	97 1 year.
Difference in 1868 from mean	—0·88 Inches.	+6 Days.	+7·73 Inches.	...	......	...

TEES DISTRICT (Continued).

PLACE	GRETA BRIDGE.		EAGLESCLIFFE, near YARM.		DURHAM COUNTY ASYLUM, SEDGEFIELD.	
Height of Guage above sea level			80 Feet.		160 Feet.	
Above Ground	9 Inches.		1 Foot.		5 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	3·22	...	1·56	18	2·31	22
February	1·13	...	0·68	10	1·10	14
March	1·93	...	0·97	11	1·34	19
April	3·29	...	1·61	17	3·10	18
May	1·10	...	0·89	11	1·17	16
June	0·38	...	0·42	5	0·39	7
July	0·77	...	1·04	5	0·80	9
August	2·79	...	2·71	15	2·57	15
September	5·28	...	2·80	15	4·32	17
October	1·84	...	1·78	18	2·07	16
November	2·25	...	1·58	17	2·21	24
December	4·91	...	4·34	25	5·55	29
1868	28·81	...	20·38	167	26·93	206
1867	22·24	...	23·23	175	25·56	238
1866	29·42	...	26·67	...	30·27	...
1865	26·73	...	......	...	25·57	...
1864	24·26	...	......	...	......	...
1863	26·25	..	......	...	......	...
1862	25·84	...	......	...	......	...
1861	24·54	...	......	...	......	...
1860	30·28	...	......	...	......	...
1859	26·74	...	......	...	......	...
1858	21·56	...	......	...	......	...
1857	23·93	...	......	...	......	...
1856	27·30	...	......	...	......	...
Average of Years ...	25·99 13 years.	...	23·43 3 years.	171 2 years	27·08 4 years.	222 2 years
Difference in 1868 from mean	+2·82 Inches.	...	—3·05 Inches.	—4 Days.	—0·15 Inches.	—16 Days.

WEAR DISTRICT.

PLACE	STANHOPE CASTLE.		ST. JOHN'S, WOLSINGHAM.*			
Height of Guage above sea level	700 Feet.		927 Feet.			
Above Ground	3ft. 6in.		1ft. 1in. Flange Guage.		Bottle Guage.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	4·40	...	5·03	24	4·77	...
February	4·66	...	2·31	18	2·16	...
March	3·38	...	2·60½	19	2·59	...
April	2·00	...	3·32	17	3·27	...
May	1·00	...	1·14	12	1·14	...
June	......	...	0·46	7	0·46	...
July	0·47	...	0·56	6	0·56	...
August	4·75	...	3·48½	12	3·41	...
September	5·27	...	6·38	16	6·33	...
October	2·70	...	2·09½	18	2·10½	...
November	2·50	...	3·75	22	3·65	...
December	8·55	...	7·19½	28	6·88	...
1868	39·68	...	38·33	199	37·32½	...
1867	32·33	...	32·53	192	......	...
1866	41·24	...	36·90	218	......	...
1865	......	...	28·91	199	......	...
1864	......	...	......	...	......	...
1863	......	...	......	...	......	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	37·75 3 years.	...	34·17 4 years.	202 4 years	37·32½ 1 year.	...
Difference in 1868 from mean	+1·83 Inches.	...	+4·16 Inches.	−3 Days.	......	...

* St. John's, Wolsingham. These Guages are not more than two feet apart on the same level. The position in which they are placed was approved by Mr. Glaisher.

WEAR DISTRICT (Continued).

PLACE	USHAW COLLEGE, DURHAM.		DURHAM OBSERVATORY.		SUNDERLAND. THE HALL, BISHOPWEARMOUTH.	
Height of Guage above sea level	600 Feet.		352 Feet.		85 Feet.	
Above Ground	10 Inches.		4ft. 6in.		1ft. 5in.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·42	22	2·64	22	1·61	15
February	0·76	14	2·06	14	0·86	10
March	1·16	14	1·41	16	1·11	9
April	2·94	17	3·65	18	2·23	11
May	0·82	10	1·17	12	1·24	9
June	0·42	5	0·33	5	0·47	7
July	0·70	7	0·97	7	1·01	5
August	2·24	14	2·57	12	2·02	10
September	4·98	14	4·59	18	4·13	16
October	1·81	13	2·27	18	2·18	13
November	2·12	19	2·42	21	2·52	20
December	5·38	25	6·69	28	4·13	29
1868	25·75	174	30·77	191	23·51	154
1867	25·85	159	19·45	...	24·50	134
1866	31·26	190	......	...	......	...
1865	29·73	168	......	...	......	...
1864	24·59	...	......	...	......	...
1863	28·90	...	......	...	......	...
1862	22·95	...	......	...	......	...
1861	26·03	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	26·88 8 years.	173 4 years	25·11 2 years.	191 1 year.	24 2 years.	144 2 years
Difference in 1868 from mean	—1·01 Inches.	+1 Day.	+5·66 Inches.	...	—0·49 Inches.	+10 Days.

WEAR DISTRICT (CONTINUED).

PLACE	SUNDERLAND—HENDON HILL.		SUNDERLAND—WEST HENDON HOUSE.		SEAHAM HALL.	
Height of Guage above sea level	120 Feet.		132 Feet.		100 Feet.	
Above Ground	6 Inches.		1 Foot.		1 Foot.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	1·69	21	1·71	18	1·90	16
February	0·77	13	0·73	11	0·73	7
March	0·99	15	1·09	10	1·14	10
April	1·79	8	2·22	16	2·05	16
May	1·65	...	1·29	10	1·38	10
June	0·18	...	0·36	5	0·66	5
July	0·77	...	0·91	5	0·57	4
August	1·60	...	1·63	10	1·70	9
September	3·70	...	3·77	19	4·44	17
October	1·17	...	1·85	14	1·80	9
November	2·68	...	2·12	20	2·20	18
December	3·85	...	3·61	23	4·09	24
1868	20·84	...	21·29	161	22·66	145
1867	23·34	174	......	...	23·61	151
1866	27·84	190	......	...	28·32	154
1865	25·33	168	......	...	26·07	...
1864	23·30	136	......	...	22·74	...
1863	25·93	...	......	...	26·15	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	24·43 6 years.	167 4 years	21·29 1 year.	161 1 year.	24·92 6 years.	150 3 years
Difference in 1868 from mean	—3·59 Inches.	...	...	...	—2·26 Inches.	— 5 Days.

COAST DISTRICT.

PLACE	NORTH SUNDERLAND.		CRESS-WELL.	WHIT-LEY.	HOWICK.	
Height of Guage above sea level	60 Feet.			82 Feet	120ft. 6in.	
Above Ground	1 Foot.			10 Inches.	10 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Quantity. Inches.	Quantity. Inches.	Days on which Rain fell.
January	1·65	18	1·54	2·07	1·90	13
February	0·81	13	1·07	1·92	1·32	10
March	1·10	10	0·93	1·41	1·59	9
April	2·51	14	2·64	2 99	2·85	13
May	0.81	10	0·34	1·02	0 70	3
June	0·32	7	0·21	0·48	0·37	2
July	0·74	4	0·03	0·38	0·78	6
August	3·08	12	1·89	2·12	3·06	12
September	3·98	17	3·19	4·43	3 85	15
October	2·62	13	2·06	2·35	2·26	12
November	2·03	20	2·11	2 62	2·53	11
December	3·51	24	3·81	3·58	4·01	18
1868	23·23	162	19·82	25·37	25·22	124
1867	24·40	170	19·95	23·45	24·98	159
1866	25·75	189	......	28 35	28·88	168
1865	34·27	...	......	26 99	28·64	...
1864	......	...	......	26·64	22·01	...
1863	......	...	......	......	18·34	...
1862	......	...	......	......	19·30	...
1861	......	...	......	......	18·30	...
1860	......	...	......	......	27·48	...
1859	......	...	......	......	18·84	...
1858	......	...	......	......	22·51	...
1857	......	...	......	......	20·77	...
1856	......	...	......	......	22·58	...
Average of Years	26·91 4 years.	173 3 years	19·58 2 years.	26·16 5 years.	22·91 13 years	150 3 years
Difference in 1868 from mean	—3·68 Inches.	—11 Days.	+·24 Inches.	—·79 Inches.	+2·31 Inches.	—26 Days.

TYNE DISTRICT.

PLACE	BYRNESS.		OTTERBURN.		ALSTON.	
Height of Guage above sea level	700 Feet.		500 Feet.		1150 Feet.	
Above Ground			1 Foot.		2 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	5·02	22	4·14	19	6·08	17
February	3·63	17	3·54	14	2·91	18
March	3·72	18	2·52	15	5·22	21
April	2·68	16	3·23	9	4·46	21
May	1·59	10	1·63	9	0·95	9
June	1·01	10	0·93	4	1·63	10
July	0·36	2	0·73	6	0·71	5
August	3·69	16	3·00	12	5·75	21
September	4·13	16	4·08	16	4·69	19
October	2·80	18	2·38	19	4·30	24
November	2·67	16	2·37	12	3·00	18
December	5·96	26	5·51	10	8·65	28
1868	37·26	187	34·06	145	48·35	211
1867	......	...	31·59	154	39·27	231
1866	......	...	36·02	...	54·76	253
1865	......	..	......	...	......	...
1864	......	...	......	...	......	...
1863	......	...	......	...	......	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	37·26 1 year.	187 1 year.	33·89 3 years.	...	47·46 3 years.	232 3 years
Difference in 1868 from mean	......	...	+ 0·17 Inches.	...	+ 0·89 Inches.	— 21 Days.

TYNE DISTRICT (CONTINUED).

PLACE	ALLENHEADS.		PARK END, HEXHAM.		STAMFORDHAM.	
Height of Guage above sea level	1360 Feet.		276 Feet.		400 Feet.	
Above Ground	5 Inches.		3 Inches.		1 Foot.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	8·60	27	4·08	20	3·05	...
February	4·70	27	6·02	23	2·20	...
March	5·80	23	3 40	20	1·86	...
April	3·90	21	2·75	18	2·23	...
May	1·70	17	1.29	13	0·90	...
June	0·40	13	0·79	10	0·42	...
July	0·60	10	0·47	6	0·52	...
August	5·70	24	2·52	13	2·09	...
September	5·60	21	3·60	16	4·55	...
October	4·10	30	2 43	22	1·84	...
November	5·00	24	2·29	15	2·42	...
December	10·30	29	4·69	27	3·33	...
1868	56·40	266	34·33	203	25·41	...
1867	49·45	268	28·53	216	25·53	...
1866	56·84	287	41·83	228	30·09	...
1865	44·42	248	29·80	...	27·41	...
1864	43·24	259	29·02	...	26·93	...
1863	54·01	...	41·77	...	28·60	...
1862	44·20	291	34·76	...	26·00	...
1861	49·35	282	31·07	...	26·22	...
1860	59·15	297	31 04	...	35·26	...
1859	47·70	259	......	...	27·85	...
1858	37·21	229	26·00	...	29·19	...
1857	41·79	...	25·68	...	28·86	...
1856	45·48	...	45·87	...	35·06	...
Average of Years ...	48·40 13 years	268 10 yrs.	33·14 12 years	...	28·65 13 years.	...
Difference in 1868 from mean	+ 8·0 Inches.	— 2 Days	+ 0·19 Inches.	...	— 3·24 Inches.	...

TYNE DISTRICT (Continued).

PLACE	HALLINGTON VILLAGE.		FAWCETT.		WOODFORD.	
Height of Guage above sea level	469 Feet.		563 Feet.			
Above Ground	6 Inches.		6 Inches.		6 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·75	...	2·77	...	2·67	...
February	3·57	...	3·23	...	3·39	...
March	2·63	...	2·32	...	2·52	...
April	3·56	...	3·24	...	3·75	...
May	1·04	...	0·96	...	1·22	...
June	0·40	...	0·39	...	0·55	...
July	0·41	...	0·37	...	0·50	...
August	1·02	...	1·07	...	1·30	...
September	1·41	...	1·31	...	1·51	...
October	4·91	...	4·86	...	4·99	...
November	2·44	...	2·28	...	2·30	...
December	4·55	...	4·28	...	4·47	...
1868	28·69	...	27·08	...	29·17	...
1867	25·07	...	25·66	...	29·65	...
1866	33·42	...	31·35	...	33·84	...
1865	......	...	......	...	......	...
1864	......	...	......	...	......	...
1863	......	...	......	...	......	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	29·06 3 years.	...	28·03 3 years.	...	30·89 3 years.	...
Difference in 1868 from mean	—0·37 Inches.	...	—0·95 Inches.	...	—1·72 Inches.	...

TYNE DISTRICT (CONTINUED).

PLACE	CAMPHILL.		GREEN CRAG.		VALLEY OF NORTH TYNE.	
Height of Guage above sea level	676 Feet.		800 Feet.			
Above Ground	6 Inches.		6 Inches.			
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·90	...	2·69	...	2·72	...
February	3·78	...	3·69	...	4·19	...
March	2·71	...	2·85	...	3·14	...
April	3·84	...	3·66	...	3·60	...
May	1·18	...	1·15	...	0·95	...
June	0·68	...	0·50	...	0·81	...
July	0·39	...	0·54	...	0 33	...
August	1·45	...	1·62	...	1·50	...
September	1·59	...	1·59	...	1·76	...
October	5·15	...	5·14	...	5·20	...
November	2·14	...	1·88	...	1·66	...
December	4·79	...	4·58	...	4·25	...
1868	30·60	...	29·89	...	30·11	...
1867	29·95	...	28·49	...	26·97	...
1866	34·18	...	34·28	...	33·45	...
1865	......	...	......	...	......	...
1864	......	...	......	...	......	...
1863	......	...	......	...	......	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	31·57 3 years.	...	30·88 3 years.	...	30·18 3 years.	...
Difference in 1868 from mean	—0·97 Inches.	...	—0·99 Inches.	...	—0·07 Inches.	...

TYNE DISTRICT (Continued).

PLACE	HORSLEY, NEAR BYWELL.			BYWELL.		WYLAM.	
Height of Guage above sea level...............				86ft. 6in		96 Feet.	
Above Ground	6 Inches. *	*		6 Inches.		5 Feet.	
MONTH.	Quantity. Inches.	Quantity. Inches.	Dys. on w. Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	1·75	1·76	11	4·20	23	3·15	18
February.........	2·46	2·35	14	1·50	17	1·89	14
March	2·15	1·93	11	2·10	17	1·72	8
April	3·25	3·36	13	3·20	19	3·60	12
May...............	0·99	0·94	14	0·90	11	0·77	5
June	0·44	0·44	9	0·20	6	0·54	2
July	0·54	0·58	7	0·90	8	0·57	4
August	1·67	1·76	15	2·10	12	2·23	8
September	2·57	2·97	17	4·00	16	4·26	13
October	2·54	2·51	16	1·60	19	1·31	11
November	1·92	2·21	15	2·70	23	2·46	12
December	3·49	3·29	18	4·30	28	3·93	24
1868.........	23·77	24·10	160	27·70	199	26·43	131
1867.........	23·39	......	...	27·55	227	22·38	144
1866.........	......	......	...	29·19	230	29·81	173
1865.........	......	......	...	29·82	186	29·67	156
1864.........	......	......	...	28·81	188	27·57	206
1863.........	......	......	...	28·49	198	28·39	185
1862.........	......	......	...	26·49	199	24·68	211
1861.........	......	......	...	23·80	213	23·54	...
1860.........	......	......	...	38·00	259	31·38	...
1859.........	......	......	...	27·34	182	25·15	...
1858.........	......	......	...	21·88	165	18·20	...
1857.........	......	......	...	27·55	...	24·47	...
1856.........	......	......	...	29·82	...	29·25	...
Average of Years	23·58 2 years.	24·10 1 year.	...	28·19 13 years.	204 11 yrs.	26·24 13 years.	172 7 years
Difference in 1868 from mean	+0·19 Inches.	......	...	−0·49 Inches.	−5 Days.	−0·19 Inches.	−41 Days.

* These Guages are under the charge of the same observer. They are placed on the same level, and are 18 feet apart from each other. They are both bottle Guages with funnels 5 inches in diameter. A similar difference has been remarked in previous years.

TYNE DISTRICT (Continued).

PLACE	NEWCASTLE Deaf and Dumb Institution.		NEWCASTLE Lit. and Phil. Institution.		WALLSEND.	
Height of Guage above sea level			105 Feet.		90 Feet.	
Above Ground	6 Inches.		1ft. 5in.		6 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·87	15	2·32	19	2·10	11
February	1·54	13	1·78	13	2·23	8
March	1·29	17	1·15	17	1·25	12
April	3·63	16	3·71	17	3·68	13
May	0·58	5	0·52	7	0·97	10
June	0·24	2	0·21	2	0·29	4
July	0·33	3	0·64	5	0·35	6
August	2·07	12	2·22	11	1·75	12
September	3·63	18	3·72	14	3·75	15
October	1·98	12	2·69	22	2·09	10
November	2·45	19	2·58	24	2·13	...
December	3·90	22	4·71	24	3·90	12
1868	24·51	154	26·25	175	24·49	113
1867	......	...	22·29	134	25·24	...
1866	......	...	22·19	169	26·65	...
1865	......	...	21·24	124	27·29	...
1864	......	...	......	...	27·82	...
1863	......	...	......	...	26·24	...
1862	......	...	......	...	25·68	...
1861	......	...	19·58	...	24·62	...
1860	......	...	27·40	...	34·12	...
1859	......	...	18·41	...	23·51	...
1858	......	...	13·29	...	......	...
1857	......	...	16·43	...	......	...
1856	......	..	21·22	...	......	...
Average of Years	24·51 1 year.	154 1 year.	*20·83 10 years.	150 1 year.	26·56 10 years.	113 1 year.
Difference in 1868 from mean	......	...	+5·42 Inches.	+25 Days.	—2·07 Inches.	...

* Owing to the peculiarity of the Rain Guage in use previously to 1868, about 10 per cent., it is stated, should be added to the quantities published as above.

TYNE DISTRICT (Continued).

PLACE	NORTH SHIELDS—Rosella Place.		NORTH SHIELDS—Clementhorpe.		NORTH SHIELDS—Low Lights.		TYNE-MOUTH—Pier Works.	
Height of Guage above sea level	124 Feet.		150 Feet.		12 Feet.		61·88 Feet.	
Above Ground ...	1 Foot.		1 Foot.		3ft. 1in.		14¼ Inches.	
MONTH.	Quantity. Inches.	Days on wh. Rain fell.	Quantity. Inches.	Days on wh. Rain fell.	Quantity. Inches.	Days on wh. Rain fell.	Quantity. Inches.	Days on wh. Rain fell.
January	2·03	20	1·56	20	1·86	20	1·65	20
February	1·82	12	1·40	12	1·39	13	1·05	12
March	1·14	13	0·97	11	1·05	12	1·08	11
April...........	3·04	18	2·71	15	2·79	13	2·20	14
May	1·03	10	0·79	11	0·87	10	0·88	11
June...........	0·43	5	0·41	5	0 44	6	0·38	5
July	0·48	6	0·53	5	0·42	6	0·42	5
August.........	1·88	12	1·77	12	1·87	12	1·80	10
September ...	3·58	18	3 72	19	3 79	18	3·89	19
October	2·09	12	1·99	17	2·20	16	2·12	17
November ...	2·23	22	1·89	22	2·30	20	2 16	21
December......	3·60	25	3·18	25	3·48	25	3·42	25
1868......	23·35	173	20·92	174	22 46	171	21·05	170
1867......	23 61	163	......	...	22·49	175	24·22	...
1866......	26·39	188	......	...	26·62	192	23·68	...
1865......	26·89	130	......	...	25·56	142	23·47	...
1864......	26·00	...	......	...	27·60	...	......	...
1863......	24·74	...	......	...	24 74	224	......	...
1862......	28·01	...	......	...	28·01	260	......	...
1861......	24·76	...	......	...	24·76	264	......	...
1860......	32·19	...	......	...	32·18	290	......	...
1859......	......	...	......	...	......	...	......	...
1858......	......	...	......	...	......	...	......	...
1857......	......	...	......	...	......	...	......	...
1856......	......	...	......	...	......	...	......	...
Av. of Years	26·22 9 years.	163 4 yrs.	20·92 1 year.	174 1 yr.	26·05 9 years.	215 8 yrs.	23 10 4 years.	170 1 yr.
Difference in 1868 from mean	— 2·87 Inches.	+10 Days.	......	...	— 3·59	— 44 Days.	— 2·05 Inches.	...

COQUET, WANSBECK, AND ALNE DISTRICT.

PLACE	WALLINGTON.		CRAGSIDE, ROTHBURY.		LILBURN TOWER.	
Height of Guage above sea level	398ft. 6in.		400 Feet.		300 Feet.	
Above Ground	1 Foot.				6 Feet.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	4·05	23	1·33	9?	3·02	...
February	3·48	20	1·97	8?	1·20	...
March	1·59	18	1·20	4?	1·12	...
April	3·49	19	4·00	9?	2·85	...
May	1·03	12	0·26	3?	1·35	...
June	0·42	8	0·24	2?	0·50	...
July	0·54	5	0·50	2?	0·58	...
August	2·27	13	3·31	7?	3·61	...
September	4·25	19	3·82	9?	3·76	...
October	2·21	24	1·32	4?	1·56	...
November	2·83	22	2·14	6?	3·32	...
December	5·31	26	5·45	16?	4·55	...
1868	31·47	209	25·54	79?	27·42	...
1867	28·99	198	16·25 } 8 Mos.	...	26·61	...
1866	......	...		...	30·02	...
1865	......	...	......	...	30·39	...
1864	......	...	......	...	31·97	...
1863	......	...	......	...	25·86	...
1862	......	...	......	...	30·04	...
1861	......	...	......	...	26·17	...
1860	......	...	......	...	......	...
1859	......	...	......	...	25·98	...
1858	......	...	......	...	24·27	...
1857	......	...	......	...	27·11	...
1856	......	...	......	...	32·90	...
Average of Years	30·20 2 years.	203 2 years	20·89 1⅔ years.	79? 1 year.	28·23 12 years.	...
Difference in 1868 from mean	+ 1·27 Inches.	+ 6 Days.	......	...	— 0·81 Inches.	...

COQUET, WANSBECK, AND ALNE DISTRICT (CONTINUED).

PLACE	GLANTON PIKE		BRINKBURN PRIORY.		MILFIELD, NEAR WOOLER.	
Height of Guage above sea level	534 Feet.		200 Feet.		200 Feet.	
Above Ground	4ft. 3½in.		5 Inches.		4 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	3·26	...	2·28	...	3·14	...
February	2·06	...	2·76	...	1·82	...
March	1·43	...	1·31	...	2·27	...
April	3·72	...	3·77	...	3·53	...
May	0·93	...	0·48	...	1·10	...
June	0·59	...	0·55	...	0·42	...
July	0·68	...	0·46	...	0·65	...
August	4·09	...	4·25	...	2·70	...
September	4·27	...	3·61	...	4·17	...
October	1·91	...	2·01	...	1·68	...
November	2·99	...	2·84	...	2·39	...
December	4·22	...	5·37	...	3·64	...
1868	30·15	...	29·69	...	27·51	...
1867	27·82	...	33·68	111	28·45	...
1866	35·06	...	33·87	147	32·18	...
1865	34·26	...	32·45	133	28·65	...
1864	28·69	...	29·54	146	......	...
1863	30·09	...	......	...	......	...
1862	27·12	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	30·45 7 years.	...	31·84 5 years.	134 4 years	29·19 4 years.	...
Difference in 1868 from mean	—0·30 Inches.	...	—2·15 Inches.	...	—1·68 Inches.	...

TEMPERATURE.

The remarkably high temperature of the summer of 1868 has naturally lead to many speculations as to the cause. As usual in such cases, the one which seemed to be nearest at hand was that to which everything was attributed, and the popular belief was that some alteration had taken place in the course and direction of the Gulf stream, possibly resulting from an alteration effected in the level of the ocean bottom by the effects of the earthquake which devastated the Island of St. Thomas, in the West Indies, in the autumn of 1867. But there does not seem to be the very slightest evidence in proof of any such alteration having taken place at all. The course of the Gulf stream is so clearly defined and so well known that any deviation more than ordinary would at once have been recognized by the intelligent officers of the various Trans-Atlantic steamers, who are daily passing between Europe and America. Many of the captains of those steamers, it must be remembered, are engaged in taking observations of every kind of phenomena which comes under their notice, and are amply provided with instruments for that purpose.

But in order to obtain as decisive an opinion on the subject as possible, G. C. Atkinson, Esq., of Wylam Hall, wrote to the authorities of the Smithsonian Institution, at Washington, to ask for any information the American Government might have in their possession, and he received the following reply dated February the 21st, 1869:—"Enquiry has been made as to the reported changes in the Gulf stream during the last year, but we have obtained no trustworthy information on the subject. Nothing has been observed by the officers of the coast survey to warrant the statements which have been made, and the changes, which would necessarily have been of so marked a character as to have attracted the attention of ordinary navigators, would scarcely fail to have been detected by them. The velocity and direction of the Gulf stream must necessarily be much affected by the direction and intensity of the wind. The waters are not alone impelled westwardly in the tropical regions by the action of the Trade winds, but also driven easterly by the prevalent westerly winds of the return Trades. The variations thus caused in the direction and velocity of the northern part of the Gulf stream must be a cause of fluctuation of the weather on the western coast of Europe, and especially in Norway, Sweden, and Denmark, which will perhaps be more immediately influenced than the coasts of Great Britain, France, and Spain."

The southerly winds which have prevailed to so remarkable an extent are no doubt the proximate cause of the high temperature of 1868. Coming freighted with the warmth gathered in their passage over the plains of Africa, and the warm currents of the equatorial ocean, they have given us the almost tropical summer we had in nearly every part of England. But the question then naturally arises, what has caused this set of atmospheric currents from the South? and a satisfactory answer to that question has yet to be found.

Whatever may have been the cause of the great heat there is no doubt as to the disastrous effects which it produced in many parts of the country. The heather on the moors was frequently on fire, and great numbers of grouse, rabbits, and other game were destroyed. The grass was everywhere burnt up; the hay crops were consequently very scanty, and there was no pasture for the sheep or cattle before the rains came towards autumn, and stock might have been bought on almost any terms. Very much damage was done to the crops growing alongside of the railways from the readiness with which the straw took fire when a spark from the engine fell amongst the corn. Some of the railway companies have had to pay very large amounts in compensation. But against this must be set the splendid wheat harvest which was not only good in quality, but housed at little expense and in the very best condition.

The editor would be glad to find more of his fellow-labourers making use of the hygrometer. A somewhat enthusiastic meteorologist* says of it—"No single weather instrument is sufficient of itself, even for ordinary indications, unless it be the hygrometer..........Armed with the hygrometer, no farmer will ever

* Steinmetz' "Sunshine and Showers;" a very interesting work.

be surprised with showers, and it will enable him to count upon the continuance of sunshine on almost every occasion of such indications. We say almost, for there are occasions, rare, it must be admitted, when the hygrometer fails to announce the coming change; but this unavoidable defect may easily be supplied by what should always be its companion instrument—the evaporation guage.

"For our own part, we may state, that since we have set up these instruments, and studied them, we have never been 'caught in a shower' without an umbrella, nor have we been inconvenienced by carrying an umbrella without having to use it. This is rather important; for a good umbrella costs more than a good hygrometer, and it is quite certain that umbrellas are more injured by carrying than by use as a shelter from showers. Of course, to the farmer at haymaking time, and during harvest, the use of such a monitor would be invaluable." The hygrometer, it will be as well to remark, *must* for this purpose be placed out of doors; hence the almost uselessness of all attached to what are called farmers' barometers. As regards other uses of the hygrometer Mr. Glaisher makes some valuable suggestions in his Hygrometrical Tables*

"The use of the instrument in the requirements of the SICK CHAMBER are scarcely to be over-rated, and will be at once obvious to all who know that the comfort of the patient is dependent, not so much on the temperature, as on the hygrometric condition of the air..........

"If the air be too dry, that is to say, if the difference of the readings of the thermometer is very considerable, it will be necessary to expose water in some shallow vessel, so that the evaporation from it, mixing with the air, will cause a greater degree of humidity.

"If, on the contrary, the air be too moist, or should be required to be remarkably dry, all water must be covered over or removed, and the required degree of dryness obtained, either by raising the temperature, or by placing in the room sulphuric acid,

* Hygrometrical Tables adapted to the use of dry and wet bulb thermometer, price 2s. 6d. Taylor and Francis, London.

or any other medium which has the property of rapidly absorbing watery vapour. By these simple means an artificial locality may be produced, and invalids, whose circumstances or avocations prevent them from seeking a climate suited to their peculiar constitution, may to a great extent, by the aid of this instrument, obviate the necessity of doing so."

The instrument in use should be placed in a part of the room away from the fire and not exposed to a draught. A recess in the same side of the room as the fire is generally the best place. A difference of from 6° to 8° between the readings of the two thermometers will generally be found to give a pleasant degree of humidity. To gardeners, especially those who have the care of vineries and stoves, the hygrometer is of the greatest use and importance. Every one at all conversant with such matters knows that in "Greenhouses plants become shrivelled or otherwise injured before there is any suspicion of an alteration in the humidity of the air; and when suspected a quantity of water, without any guide as to the amount required, is thrown on the plants and walls..........A dry and wet bulb thermometer, properly used, and its indications attended to, may be made the means of preserving many valuable plants which might otherwise perish in an ill-regulated atmosphere.

"To make the instrument properly available for this purpose, a knowledge is required of the climatic conditions of the countries in which the plants naturally have their growth. For example, suppose the temperature of the climate to be 70°, and its mean state of humidity about sixty or seventy per cent. of the quantity of aqueous vapour which the air would contain if saturated, it is necessary then that the reading of the dry thermomemeter should be maintained at 70°, and the reading of the wet between 60° and 64°. These last numbers are found by looking in the table at division 70° of the dry bulb, and under degree of humidity for 60° or 70°, which gives corresponding ranges between 60° and 65°."

It is to be regretted that many persons, who do not hesitate to spend large sums of money on their gardens, yet often refuse to spend a trifling sum in comparison on the purchase of a few instruments which would enable their skilful gardeners to do their work with far more certainty, and often produce results alike gratifying to themselves and their employers which they now fail to do.

	NORTH SUNDERLAND.			WALLINGTON.		
Height above Sea	125 Feet.			398 Feet.		
	Min.	Max.	Mean.	Min.	Max.	Mean.
January	35·8	43·3	39·5	32·3	39·6	35·9
February	35·4	48·1	41·7	36·4	43·0	39·7
March	37·1	49·9	43·5	33·1	47·6	40·3
April	41·5	52·4	46·9	35·7	51·4	43·5
May	45·4	58·4	51·9	39·7	61·9	50·8
June	51·2	63·8	57·5	42·6	63·0	52·8
July	55·0	65·0	60·0	45·4	67·9	56·6
August	54·9	64·3	59·6	44·2	62·8	53·5
September	52·5	60·4	56·4	37·7	57·3	47·5
October	42·1	52·0	47·0	31·0	44·1	37·5
November	39·4	46·3	42·8	39·0	38·0	33·5
December	38·3	46·9	42·6	29·8	37·9	33·9
Average—1868	44·0	54·2	49·1	36·4	51·2	43·8
1867	......	......	......	37·5	51·41	44·5
1866	......	......	......	......	......	......

	CRAGSIDE, (ROTHBURY).					
Height above Sea	400 Feet.					
	Min.	Max.	Mean.	Dew Point.	Elastic Force. Inches.	Humidity Saturation = 100.
January	32·00	41·35	36·67	25·08	·130	60
February	33·57	41·00	37·28	34·75	·202	90
March	34·77	50·90	42·83	39·66	·244	88
April	36·46	52·96	44·71	40·82	·255	86
May	44·25	63·25	53·75	49·48	·353	85
June	45·20	67·13	56·16	52·96	·401	89
July	49·77	72·09	60·93	56·11	·451	84
August	49·54	69·06	59·30	54·56	·425	84
September	47·23	57·20	52·21	51·57	·381	97
October	34·83	53·71	44·27	40·46	·251	86
November	33·33	44·80	39·06	36·42	·215	89
December	34·80	46·80	40·82	38.68	·235	92
Average—1868	39·64	55·02	47·33	43·38	·295	86
1867	......	......	......	......	......	......
1866	......	......	......	......	......	......

	BYWELL.					
Height above Sea	86½ Feet.					
	Mean of all the highest.	Mean of all the lowest.	Mean temperature of Air.	Dew Point.	Elastic force of Vapour.	Humidity Saturation = 100.
January	44·6	33·1	38·5	34·3	·198	86
February	50·3	37·1	43·2	36·6	·217	78
March	53·1	36·1	43·5	36·7	·218	77
April	56·9	39·1	46·5	40·5	·252	81
May	65·8	46·5	54·4	44·7	·296	70
June	70·1	50·3	58·1	45·4	·304	63
July	74·7	55·4	62·8	50·2	·364	64
August	73·0	54·4	61·0	49·8	·358	67
September	65·2	50·6	56·4	47 5	·329	74
October	56·0	38·9	46·2	39·4	·241	78
November	45·8	34·9	39·9	34·2	·197	80
December	48·0	37·0	42·7	37·2	·222	82
Average—1868	58 62	42·8	49·43	41·37	·266	75
1867	......	......	......	......	......	......
1866	......	......	......	......	......	......

	WYLAM.			SEAHAM.		
Height above Sea	96 Feet.			100 Feet.		
	Min.	Max.	Mean.	Min.	Max.	Mean.
January	33·51	43·74	38·47	33·64	43·51	38·58
February	36·52	49·76	43·14	36·13	48·44	42·28
March	35·90	52·16	44·03	33·35	52·03	42·69
April	38·57	54·60	46·58	37·90	54·83	46·36
May	44·61	63·68	54·14	42·58	64·38	53·48
June	47·03	68·93	57·98	45·90	69·53	57·71
July	51·71	71·76	61·73	52·25	71·87	62·06
August	51·85	70·35	61·03	50·19	69·25	59·72
September	48·60	65·07	51·83	49·03	63·46	56·24
October	35·90	54·71	45·31	38·35	51·67	45·01
November	34·10	45·13	39·52	35·53	45·83	40·68
December	35·81	47·90	41·85	34·67	45·25	39·96
Average—1868	41·16	57·32	48·80	40·79	56·67	48·73
1867	39·99	54·32	47·15	54·15	37·38	45·76
1866	40·40	55·20	47·80	53·30	39·40	46·30

	NORTH SHIELDS.					
Height above Sea	124 Feet.					
	Mean of all the highest.	Mean of all the lowest.	Mean temperature of Air.	Dew Point.	Elastic Force of Vapour.	Humidity Saturation = 100.
January	43·5	35·2	39·0	34·9	·203	86
February	46·8	37·5	42·0	35·5	·208	79
March	46·4	36·6	41·5	34·8	·202	78
April	52·1	39·8	44·8	39·2	·239	81
May	61·3	46·3	52·5	45·3	·303	77
June	66·0	50·2	56·5	45·3	·303	67
July	66·0	54·2	59·3	48·9	·346	69
August	67·5	53·3	59·0	50·3	·365	73
September........................	62·9	50·9	55·2	48·9	·346	80
October........................	53·5	39·7	45·0	40·7	·253	85
November........................	47·6	37·5	41·5	36·3	·214	83
December	48·8	38·0	43·2	38·8	·236	84
Average—1868	55·2	43·26	48·3	41·5	·268	78
1867	51·77	41·59	46·7	41·2	·266	85
1866	51·88	41·80	46·8	......	......	......

	ALLENHEADS.					
Height above Sea	1360 Feet.					
	Mean of all the highest.	Mean of all the lowest.	Mean temperature of Air.	Dew Point.	Elastic force of Vapour.	Humidity Saturation = 100.
January	38·6	30·3	34·2	32·0	·181	91
February	43·2	34·2	37·8	35·0	·204	90
March	46·1	33·4	38·6	35·8	·210	90
April	51·2	36·6	42·1	37·4	·224	84
May	60·6	43·7	50·1	42·5	·273	76
June	63·4	46·2	53·1	45 9	·309	77
July	64·0	50·8	57·3	49·1	·349	74
August	63·4	49·8	55·7	47·9	·334	76
September........................	58·8	47·0	51·5	47·5	·329	87
October........................	49·5	36·2	41·6	38·7	·235	90
November........................	41·4	32·2	37·2	28·3	·155	70
December	43·7	34·9	39·0	36·7	·218	92
Average—1868..........	52·0	39·6	44·85	39·73	·251	83
1867.................	49·65	36·66	43·15	37·50	·238	84
1866.................	50 70	37·70	44·20	......	......	......

	DURHAM OBSERVATORY.					
Height above Sea	352·4 Feet.					
	(1)	(2)	(3)	(4)	(5)	(6)
	Mean Max.	Mean Min.	Mean temperature of month.	Mean temperature of Air.	Mean temper. of evaporation.	Dew Point.
January	40·90	33·45	37·18	38·10	36·06	33·29
February	47·02	37·61	42·32	42·63	40·19	37·24
March	50·20	35 30	42·75	43 19	40·96	38·30
April	54·12	38 17	46·14	45·68	43·68	41·38
May	64·06	44·13	54·10	52·95	50·59	48·23
June	69 28	47 16	58·22	56 84	52·57	48·63
July	72·67	50·98	61·83	60·85	56·03	51·83
August	69·85	49·65	59·75	59·99	55·72	51·96
September	62·89	48·45	55·67	55·14	52·03	49·04
October	52·49	38·18	45·33	45·15	42·89	40·27
November	43·30	35·68	39 49	40·52	38·84	36·75
December	44·70	36·75	40·73	41·50	39·72	37·50
Mean for Year	......	......	48·63	48 55	45·77	42·87

	DURHAM OBSERVATORY (Continued)				
Height above Sea	352·4 Feet.				
	(7)	(8)	(9)	(10)	(11)
	Relative Humidity Saturation = 100.	Weight of Vapour in a cubic foot of Air.	Additional weight required for Saturation.	Mean Elastic force of Vapour.	Weight of cubic foot of Air.
		Grains.	Grains.	Inches.	Grains.
January	83	2·21	0·46	0·190	547·8
February	82	2·58	0·58	0·222	544·6
March	80	2·67	0·55	0·231	542·3
April	86	2 97	0·57	0·261	540·3
May	84	3·79	0 61	0·333	534·4
June	74	3·82	1·36	0·343	532·0
July	72	4·27	1·67	0·385	527·3
August	75	4·31	1·46	0·388	524·0
September	81	3·94	0·95	0·348	529·9
October	85	2 95	0·51	0·250	540·4
November	87	2·54	0·38	0·218	548·0
December	86	2·61	0·41	0·225	536·0
Mean for Year	81	3·22	0·79	0·283	537·2

Columns 1, 2, and 3, give the means of the daily readings of the maximum and minimum thermometers, and the mean temperature of the month as deduced from them. Columns 4—11, give the mean temperature of the air and of evaporation, as deduced from observations of the dry and wet bulb thermometers, at 10 a.m., and 10 p.m., together with the hygrometrical results deducible from these.

	SEDGEFIELD.					
Height above Sea	160 Feet.					
	Min.	Max.	Mean of Max & Min.	Dew Point.	Elastic force of Vapour. Inches.	Humidity Saturation = 100.
January	32·88	40·5	36·7	35·20	·205	94
February	36·7	46·2	38·8	37·28	·222	94
March	34·3	50·1	42 6	37 76	·227	83
April	37·3	52 9	45·1	40·82	·255	85
May	43·4	63 1	53 3	46·35	·314	76
June	45·2	68 3	55·9	57·06	·465	96
July	51·2	70·6	60·8	51·38	·378	71
August	50 6	69·0	60·0	52·05	·388	75
September........................	48·7	63 3	55·9	50·14	·362	81
October........................	38 6	52·4	45·3	41·70	·264	87
November........................	37·0	44·4	40·5	36·54	·216	82
December	37·4	45·2	41 2	39·10	·239	92
Average—1868..................	41·1	55·5	48·0	43·78	·294	84
1867..................	40·5	51·03	45·7	41·6	·269	85
1866..................	......	......	......	......	......	......

	ALSTON.		
Height above Sea	1150 Feet.		
	Min.	Max.	Mean.
January	27·87	39·06	33·46
February	31·41	45·20	38·30
March	29·77	49·87	39·82
April	31·86	56·23	44·04
May	38·12	68·12	53·12
June	43·86	73·96	58·91
July	45·61	78·58	62 09
August	47·45	72·77	60·11
September........................	44·23	65·20	54·71
October........................	33·90	52·54	43·22
November........................	31·26	43·83	37·54
December	32·61	45·12	38·86
Average—1868..................	36·49	57 54	47·01
1867..................	34·74	56·00	45·37
1866..................	34·42	55·93	45·17

BAROMETER.

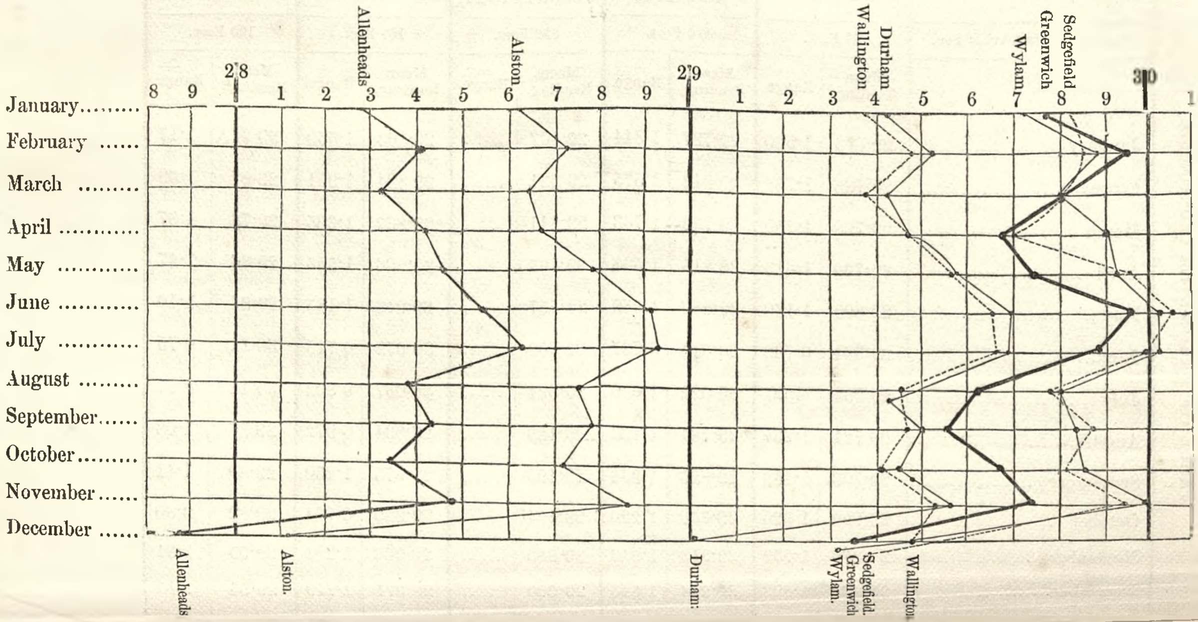
MEAN READINGS FOR 1868.

Feet above the level of Sea.	ALLENHEADS. 1360 Feet.		ALSTON. 1145 Feet.		WALLINGTON. 398 Feet.		NORTH SUNDERLAND. 60 Feet.		WYLAM. 96 Feet.	
	Mean Readings.	Range.	Mean Readings.	Range.	Mean Reading.	Range.	Mean Reading.	Range.	Mean Reading.	Range.
January	28·288	1·665	28·611	1·850	29·39	1·48	29·235	1 66	29·756	......
February	28·431	1·576	28·755	1·797	29·49	1·60	29·630	1·64	29·890	......
March	28·335	1·648	28·650	1·767	29·39	1·51	29·620	1·69	29·816	......
April	28·401	1·572	28·687	1·710	29·46	1·40	29·680	1·50	29·919	......
May	28·461	1·081	28·784	1·063	29·53	0.88	29·690	0·92	29·924	......
June	28·618	0·733	28·915	0·797	29·65	0·70	29·90	0·73	30·054	......
July	28·617	0·920	28·923	0·955	29·68	0·90	30·34	1·53	30·067	......
August	28·396	1·151	28·665	0·984	29·45	0·76	29·68	1·02	29·790	......
September	28·423	1·390	28·696	1·290	29·48	0·95	29·72	1·17	29·831	......
October	28·357	1·268	28·622	0·911	29·41	0·75	29·63	0·79	29·865	......
November	28·488	1·632	28·803	1·632	29·55	1·17	29·79	1·68	29·999	......
December	27·894	1·686	28·066	1·768	29·49	1·40	20·12	1·73	29·332	......

TABLE OF BAROMETER (CONTINUED.)

Feet above the level of Sea.	BYWELL. 86 Feet.		NORTH SHIELDS. 124 Feet.		DURHAM OBSERVATORY. 352 Feet.		SEDGEFIELD. 160 Feet.		SEAHAM. 100 Feet.	
	Mean Reading.	Range.	Mean Reading.	Range.	Mean Reading.	Range.	Mean Reading.	Range.	Mean Reading.	Range.
January	29·675	1·550	29·727	1·844	29·407	......	29·803	1·559	29·74	1·17
February	29·793	1·738	29·843	1·575	29·521	......	29·884	1·951	29·87	1·69
March	29·703	1·750	29·752	1·763	29·441	......	29·832	1·665	29·78	1·67
April	29·766	1·618	28·815	1·588	29·485	......	29·866	1·585	29·86	1·67
May	29·809	1·130	29·880	1·089	29·557	......	29·946	1·185	29·94	1·10
June	29·964	0·760	30·014	0·787	29·709	......	30·072	0·745	30·11	0·75
July	29·954	1·00	30·022	1·000	29·691	......	30·057	0·892	30·11	0·84
August	29·721	1·137	29·764	1·132	29·453	......	29·834	0·972	29·87	1·03
September	29·753	1·456	29·820	1·336	29·493	......	29·875	1·259	29·89	1·41
October	29·720	1·320	29·750	1·226	29·454	......	29·833	0·774	29·82	0·80
November	29·876	1·752	29·912	1·812	29·586	......	29·966	1·281	29·95	1·51
December	29·264	1·822	29·274	1·845	29·000	......	29·371	1·719	29·34	1·45

DIAGRAM showing the variations of the Barometer during the year 1868, at Greenwich and six different stations in the North of England.



APPROXIMATE RESULTANT DIRECTION AND DURATION OF WIND, IN EACH M[illegible]TH, IN 1868, THE DURATION RECKONED IN DA[illegible]S.

STATIONS.............	NORTH SUNDERLAND.		ROTHBURY.		WHITLEY.		SEAHAM HALL.		SEAHAM.		DURHAM OBSERVATORY.	
MONTHS.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.
January	S. 4½° W.	10	N. 20° E.	4½	W. 10° S.	10½	S. 29° W.	6½	S. 1° E.	11	W. 44° S.	7½
February	W. 11° S.	21	W. 18° N.	14½	W. 15° S.	14	W. 6½° S.	18	W. 24° S.	17½	W. 22° S.	22
March..................	W. 22° S.	23	W. 2° N.	21½	W. 21° S.	16	W. 1° S.	14	W. 22° S.	22	W. 26° S.	17½
April	W. 21° S.	12	W. 16° N.	12	W. 17° S.	6	N. 23° W.	5	S. 7½° W.	3	S. 33° W.	8
May	S. 38° W.	17	S. 29° W.	4	S. 20° W.	14	S. 6° E.	12	S. 12° W.	17	S. 6½° W.	14½
June	W. 25° S.	17	W. 10° S.	18	W. 40° S.	5	W. 7° N.	12½	W. 32° S.	11½	W. 33½° S.	13½
July	W. 21° N.	8	W. 11½° N.	10½	S. 43° W.	5	N. 14° W.	6½	E. 41° S.	2	N. 38° W.	5¼
August	W. 25° S.	13	W. 4° N.	17½	W. 10° S.	20	W. 18° S.	7	W. 38° S.	12½	W. 36° S.	6½
September	E. 31° N.	1½	N. 41° W.	10	E. 27° N.	9½	N. 35° E.	10	E. 43° N.	4½	E. 21° N.	8
October	W. 29° S.	20½	W. 29° N.	17	W. 5° N.	17	W. 15° N.	24	W. 8° S.	15½	S. 44° W.	14
November	W. 31° N.	2	W. 16° S.	10½	W. 8° N.	8	N. 15° E.	8	West.	3	N. 31° W.	7½
December	S. 35° W.	18	S. 2° W.*	8½	S. 20° W.	15½	W. 30° S.	8	S. 40° W.	16	S. 36° W.*	12½
Whole Year	W. 29° S.	147	W. 11½° N.	122	W. 24° S.	108	W. 6° N.	80	W. 40½° S.	111½	W. 36° S.	102

STATIONS.............	SEDGEFIELD.		DARLINGTON.		[illegible]KLAM HALL.		ALSTON.		ALLENHEADS.	
MONTHS.	Direction.	Duration.	Direction.	Duration.	[illegible]ction.	Duration.	Direction.	Duration.	Direction.	Duration.
January	S. 12° W.	5	W. 36° S.	4	W[illegible]° S.*	5	S. 10° W.*	4	S. 14° W.	4
February	W. 40° S.	26	W. 5° S.	22	[illegible]6° S.	24	W. 13° S.	25	W. 17° S.	17
March	W. 37° S.	24	W. 24° S.	18½	W[illegible]3° S.	22½	W. 7° N.	14	W. 12° S.	14½
April	S. 10° W.	13½	W. 19° S.	9	[illegible]2° N.	6	W. 28° N.	9	West.	12
May	S. 27° W.	20½	S. 37° W.	24½	S[illegible] W.	17	W. 40° S.	18	S. 27° W.	15½
June	S. 44° W.	19½	W. 31° S.	22½	[illegible]2° S.	7½	W. 4° S.	19	W. 11° S.	15½
July	S. 4° E.	5½	N. 19° W.	7	[illegible]° W.	9½	S. 29° W.	6	N. 34° W.	3½
August	S. 19½° W.	14	S. 44° W.	18½	S[illegible]0° W.	9	S. 28° W.	6	W. 32° S.	9½
September	E. 18° N.	7	North.	4½	N[illegible]4° W.	11½	S. 5° E.	6½	E. 18° S.	6½
October	S. 40½° W.	18½	W. 22° S.	15	W[illegible]24° S.	19	W. 15° N.	20½	W. 7° S.	17
November	S. 33° W.	7½	N. 10° E.	14	N[illegible]4° W.	6	E. 20° S.	3	N. 45° E.	3
December	S. 14° W.	22	S. 23° W.	12½	S[illegible]° W.	24½	S. 21° W.	19½	S. 35° W.	13½
Whole Year	S. 31° W.	162½	W. 24° S.	127	W[illegible]9° S.	110	W. 23½° S.	118½	W. 25½° S.	102

BYWELL.		WYLA[illegible].		NEWCASTLE. †		NORTH SHIELDS.		SOUTH SHIELDS. †		.........STATIONS.
[illegible]irection.	Duration.	Direction.	[illegible]uration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	MONTHS.
[illegible] 14° W.	4	W. 10° S.	10	S. 22° W.	6	W. 34° S.	3½	S. 5° E.	6½	January.
[illegible] 17° N.	17	W. 3° S.	21	W. 4° S.	22	W. 9° N.	13	W. 29° S.	17½	February.
[illegible] 12° N.	14½	W. 8° S.	19	W. 13° S.	18½	W. 12° N.	14½	W. 38° S.	17	March.
[illegible] 18° W.	3	West.	10	W. 35° S.	9	N. 45° W.	8½	W. 31° S.	4½	April.
[illegible] 40° S.	8	East.	2	S. 30° W.	12	W. 33° S.	11	S. 19° W.	13	May.
[illegible] 24° N.	12	W. 7° N.	7	W. 12° S.	15	W. 8° N.	7	S. 45° W.	10½	June.
[illegible] 21° N.	5½	E. 33° N.	2	W. 29° N.	5	N. 34° W.	3½	N. 44° W.	1	July.
*		S. 22° W.	13	W. 22° S.	9½	W. 17° S.	10½	W. 39° S.	10	August.
[illegible] 11° S.	5	E. 36° S.	5	N. 15° W.	3½	S. 45° E.	3	E. 34° N.	6	September.
[illegible] 4° N.	16	W. 4° S.	20	W. 44° S.	13	W. 20° N.	11½	W. 43° S.	14½	October.
[illegible] 18° W.	3	E. 26° N.	4	E. 23° N.	3½	N. 11° E.	5	N. 10° E.	3	November.
[illegible] 40½° S.	9	W. 25° S.	21	S. 18° W.	13	W. 27° S.	11	S. 14° W.	12	December.
5½° N.	63	W. 17° S.	134	W. 27° S.	108	W. 4° N.	82	S. 41° W.	92	Whole Year.

* Imperfect. † Sundays uniformly le[illegible]t; also a few other days.

AVERAGE ESTIMATED FORCE OF WIND, IN EACH MONTH, IN 1868, AND MEAN VELOCITY, PER HOUR, IN MILES.

STATIONS	DURHAM OBSERVATORY.		SEDGEFIELD	ALLEN-HEADS.	BYWELL.	NORTH SHIELDS.	.........STATIONS.
MONTHS.	Velocity.	Force.	Force.	Force.	Force.	Force.	MONTHS.
January	16·03	2·2	2·1	2·3	1·4	1·8	January.
February..............	20·62	3·0	2·8	2·8	1·7	2·4	February.
March	15·82	2·2	2·1	2·1	1·4	1·7	March.
April	12·52	2·1	1·9	1·6	1·3	1·8	April.
May......................	10·48	1·6	1·3	1·8	1·2	1·4	May.
June	9·52	1·4	1·6	2·0	1·2	1·5	June.
July......................	7·47	1·0	1·2	1·5	1·1	1·4	July.
August	10·10	1·6	1·8	2·2	1·5	1·8	August.
September	7·67	1·3	1·4	1·3	1·1	1·3	September.
October	10·55	1·7	1·6	1·6	1·3	1·9	October.
November	10·08	1·6	1·7	1·4	1·2	1·7	November.
December	11·87	1·8	1·4	1·9	1·4	1·7	December.
Whole Year	11·89	1·8	1·7	1·9	1·3	1·7	Whole Year.

RELATIVE PREVALENCE OF WINDS FRO[illegible] DIFFERENT QUARTERS, I[illegible]N 1868, RECKONED IN DAYS.

STATIONS	NORTH SUNDER-LAND.	ROT[illegible] BUR[illegible]	WHITLEY.	SEAHAM HALL.	SEAHAM.	DURHAM OBSERVA-TORY.*	SEDGE-FIELD.	DARLING-TON.	ACKLAM HALL.*
QUARTERS.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
North	40	41	33	62	31	26	7	12	30
North-East	16	24	18	34	33	34	19	61	40
North-West	18	30	46	16	13	34	6	35	28
South	88	18	29	61	37	81	93	32	35
South-East	12	34	50	11	36	15	16	27	15
South-West	56	18	82	28	104	59	84	114	96
East	20	36	26	37	31	23	48	6	22
West	116	163	82	117	81	74	93	79	77
Days recorded ...	366	364	366	366	366	346†	366	366	343

STATIONS	AL[illegible]TON. *	ALLEN-HEADS.	BYWELL. *	NEWCAS-TLE-ON-TYNE.*	NORTH SHIELDS.	SOUTH SHIELDS.*	......STATIONS.
QUARTERS.	[illegible]ays.	Days.	Days.	Days.	Days.	Days.	QUARTERS.
North	[illegible]5	60	62	15	90	26	North.
North-East	[illegible]5	§	§	25	§	10	North-East.
North-West	[illegible]4	§	§	11	§	19	North-West.
South	[illegible]1	104	56	47	84	48	South.
South-East	[illegible]5	§	§	25	§	14	South-East.
South-West	[illegible]8	§	§	34	§	40	South-West.
East	[illegible]9	55	77	24	55	34	East.
West	1[illegible]8	147	140	124	137	92	West.
Days recorded	3[illegible]5	366	335	305	366	283	Days recorded.

* Imperfect. The last line of the [illegible]e, giving the number of days recorded, indicates the amount of imperfe[illegible]n in each case.

† At Durham Observatory 16 da[illegible] were registered as calm, in additio[illegible] to the above.

§ At Al[illegible]heads, Bywell, and North Shields, all winds were referred to the four cardinal points only.

WIND RETURNS.

(Edited by the Rev. R. E. Hooppell, LL.D., F.R.A.S.)

It is gratifying to be able to acknowledge a very considerable increase in the number of the returns respecting wind sent in to the Club.

The study of the wind has long been one of the most important departments ot Meteorology. It is rapidly, however, acquiring greatly increased prominence. To enable the Club to do its part worthily, towards elucidating the phenomena connected with wind in this district, it is desirable that the returns for the current and future years should be even still more numerous.

It would be especially valuable, also, if all who kindly furnish reports of the daily *direction* of the wind would record also the *force* at the same time. This should be done according to the scale, from 0 to 6, printed inside the cover of the "Meteorological Register" issued by the Club. The Club would be very glad also to have, from as many of its members as could make it convenient to supply them, detailed accounts of any very high winds or storms that visit their respective localities.

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APPROXIMATE RESULTANT DIRECTION AND DURATION OF WIND, IN EACH MONTH, IN 1868, THE DURATION RECKONED IN DAYS.

STATIONS	NORTH SUNDERLAND.		ROTHBURY.		WHITLEY.		SEAHAM HALL.		SEAHAM.	
MONTHS.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.
January	S. 4½° W.	10	N. 20° E.	4½	W. 10° S.	10½	S. 29° W.	6½	S. 1° E.	11
February	W. 11° S.	21	W. 18° N.	14½	W. 15° S.	14	W. 6½° S.	18	W. 24° S.	17½
March	W. 22° S.	23	W. 2° N.	21½	W. 21° S.	16	W. 1° S.	14	W. 22° S.	22
April	W. 21° S.	12	W. 16° N.	12	W. 17° S.	6	N. 23° W.	5	S. 7½° W.	3
May	S. 38° W.	17	S. 29° W.	4	S. 20° W.	14	S. 6° E.	12	S. 12° W.	17
June	W. 25° S.	17	W. 10° S.	18	W. 40° S.	5	W. 7° N.	12½	W. 32° S.	11½
July	W. 21° N.	8	W. 11½° N.	10½	S. 43° W.	5	N. 14° W.	6½	E. 41° S.	2
August	W. 25° S.	13	W. 4° N.	17½	W. 10° S.	20	W. 18° S.	7	W. 38° S.	12½
September	E. 31° N.	1½	N. 41° W.	10	E. 27° N.	9½	N. 35° E.	10	E. 43° N.	4½
October	W. 29° S.	20½	W. 29° N.	17	W. 5° N.	17	W. 15° N.	24	W. 8° S.	15½
November	W. 31° N.	2	W. 16° S.	10½	W. 8° N.	8	N. 15° E.	8	West.	3
December	S. 35° W.	18	S. 2° W.*	8½	S. 20° W.	15½	W. 30° S.	8	S. 40° W.	16
Whole Year	W. 29° S.	147	W. 11½° N.	122	W. 24° S.	108	W. 6° N.	80	W. 40½° S.	111½

STATIONS	DURHAM OBSERVATORY.		SEDGEFIELD.		DARLINGTON.		ACKLAM HALL.		ALSTON.	
MONTHS.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.
January	W. 44° S.	7½	S. 12° W.	5	W. 36° S.	4	W. [illegible]° S.*	5	S. 10° W.*	4
February	W. 22° S.	22	W. 40° S.	26	W. 5° S.	22	W. 6° S.	24	W. 13° S.	25
March	W. 26° S.	17½	W. 37° S.	24	W. 24° S.	18½	W. 13° S.	22½	W. 7° N.	14
April	S. 33° W.	8	S. 10° W.	13½	W. 19° S.	9	W. 2° N.	6	W. 28° N.	9
May	S. 6½° W.	14½	S. 27° W.	20½	S. 37° W.	24½	S. 24° W.	17	W. 40° S.	18
June	W. 33½° S.	13½	S. 44° W.	19½	W. 31° S.	22½	W. 2° S.	7½	W. 4° S.	19
July	N. 38° W.	5¼	S. 4° E.	5½	N. 19° W.	7	N. 4° W.	9½	S. 29° W.	6
August	W. 36° S.	6½	S. 19½° W.	14	S. 44° W.	18½	S. 20° W.	9	S. 28° W.	6
September	E. 21° N.	8	E. 18° N.	7	North.	4½	N. 44° W.	11½	S. 5° E.	6½
October	S. 44° W.	14	S. 40½° W.	18½	W. 22° S.	15	W. 24° S.	19	W. 15° N.	20½
November	N. 31° W.	7½	S. 33° W.	7½	N. 10° E.	14	N. 24° W.	6	E. 20° S.	3
December	S. 36° W.*	12½	S. 14° W.	22	S. 23° W.	12½	S. 34° W.	24½	S. 21° W.	19½
Whole Year	W. 36° S.	102	S. 31° W.	162½	W. 24° S.	127	W. 19° S.	110	W. 23½° S.	118½

STATIONS	ALLENHEADS.		BYWELL.		WYLAM.		NEWCASTLE. †		NORTH SHIELDS.		SOUTH SHIELDS. †		………STATIONS.
MONTHS.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	Direction.	Duration.	MONTHS.
January	S. [illegible] W.	4	S. 14° W.	4	W. 10° S.	10	S. 22° W.	6	W. 34° S.	3½	S. 5° E.	6½	January.
February	W. [illegible] S.	17	W. 17° N.	17	W. 3° S.	21	W. 4° S.	22	W. 9° N.	13	W. 29° S.	17½	February.
March	W. [illegible] S.	14½	W. 12° N.	14½	W. 8° S.	19	W. 13° S.	18½	W. 12° N.	14½	W. 38° S.	17	March.
April	West.	12	N. 18° W.	3	West.	10	W. 35° S.	9	N. 45° W.	8½	W. 31° S.	4½	April.
May	S. [illegible] W.	15½	W. 40° S.	8	East.	2	S. 30° W.	12	W. 33° S.	11	S. 19° W.	13	May.
June	W. [illegible] S.	15½	W. 24° N.	12	W. 7° N.	7	W. 12° S.	15	W. 8° N.	7	S. 45° W.	10½	June.
July	N. [illegible] W.	3½	E. 21° N.	5½	E. 33° N.	2	W. 29° N.	5	N. 34° W.	3½	N. 44° W.	1	July.
August	W. [illegible] S.	9½	*		S. 22° W.	13	W. 22° S.	9½	W. 17° S.	10½	W. 39° S.	10	August.
September	E. [illegible] S.	6½	E. 11° S.	5	E. 36° S.	5	N. 15° W.	3½	S. 45° E.	3	E. 34° N.	6	September.
October	W. [illegible] S.	17	W. 4° N.	16	W. 4° S.	20	W. 44° S.	13	W. 20° N.	11½	W. 43° S.	14½	October.
November	N. [illegible] E.	3	N. 18° W.	3	E. 26° N.	4	E. 23° N.	3½	N. 11° E.	5	N. 10° E.	3	November.
December	S. [illegible] W.	13½	W. 40½° S.	9	W. 25° S.	21	S. 18° W.	13	W. 27° S.	11	S. 14° W.	12	December.
Whole Year	W. [illegible]½° S.	102	W. 5½° N.	63	W. 17° S.	134	W. 27° S.	108	W. 4° N.	82	S. 41° W.	92	Whole Year.

* Imperfect. † Sundays uniformly left out; also a few other days.

AVERAGE ESTIMATED FORCE OF WIND, IN EACH MONTH, IN 1868, AND MEAN VELOCITY, PER HOUR, IN MILES.

STATIONS	DURHAM OBSERVATORY.		SEDGEFIELD	ALLEN-HEADS.	BYWELL.	NORTH SHIELDS.	………STATIONS.
MONTHS.	Velocity.	Force.	Force.	Force.	Force.	Force.	MONTHS.
January	16·03	2·2	2·1	2·3	1·4	1·8	January.
February	20·62	3·0	2·8	2·8	1·7	2·4	February.
March	15·82	2·2	2·1	2·1	1·4	1·7	March.
April	12·52	2·1	1·9	1·6	1·3	1·8	April.
May	10·48	1·6	1·3	1·8	1·2	1·4	May.
June	9·52	1·4	1·6	2·0	1·2	1·5	June.
July	7·47	1·0	1·2	1·5	1·1	1·4	July.
August	10·10	1·6	1·8	2·2	1·5	1·8	August.
September	7·67	1·3	1·4	1·3	1·1	1·3	September.
October	10·55	1·7	1·6	1·6	1·3	1·9	October.
November	10·08	1·6	1·7	1·4	1·2	1·7	November.
December	11·87	1·8	1·4	1·9	1·4	1·7	December.
Whole Year	11·89	1·8	1·7	1·9	1·3	1·7	Whole Year.

RELATIVE PREVALENCE OF WINDS FROM DIFFERENT QUARTERS, IN 1868, RECKONED IN DAYS.

STATIONS	NORTH SUNDER-LAND.	ROTH-BURY.*	WHITLEY.	SEAHAM HALL.	SEAHAM.	DURHAM OBSERVATORY.*	SEDGE-FIELD.	DARLING-TON.	ACKLAM HALL.*
QUARTERS.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
North	40	41	33	62	31	26	7	12	30
North-East	16	24	18	34	33	34	19	61	40
North-West	18	30	46	16	13	34	6	35	28
South	88	18	29	61	37	81	93	32	35
South-East	12	34	50	11	36	15	16	27	15
South-West	56	18	82	28	104	59	84	114	96
East	20	36	26	37	31	23	48	6	22
West	116	163	82	117	81	74	93	79	77
Days recorded	366	364	366	366	366	[illegible]46†	366	366	343

STATIONS	ALSTON.*	ALLEN-HEADS.	BYWELL.*	NEWCAS-TLE-ON-TYNE.*	NORTH SHIELDS.	SOUTH SHIELDS.*	……STATIONS.
QUARTERS.	Days.	Days.	Days.	Days.	Days.	Days.	QUARTERS.
North	[illegible]5	60	62	15	90	26	North.
North-East	[illegible]5	§	§	25	§	10	North-East.
North-West	34	§	§	11	§	19	North-West.
South	31	104	56	47	84	48	South.
South-East	[illegible]5	§	§	25	§	14	South-East.
South-West	[illegible]8	§	§	34	§	40	South-West.
East	49	55	77	24	55	34	East.
West	128	147	140	124	137	92	West.
Days recorded	3[illegible]5	366	335	305	366	283	Days recorded.

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In recording the direction of the wind it should always be given according to the true points of the horizon, and not according to the compass points, since the compass needle, in this country, does not point to the north, and its error is perpetually altering. The cardinal points, also, fixed under vanes, are rarely correct; frequently they are very far indeed from the truth. Vanes, too, themselves are of little use; for, unless they are frequently attended to, they grow stiff, and require a considerable amount of wind to move them. For all these reasons, and for others, it is far better in all cases to take the direction of the wind, whenever practicable, from the clouds, the lower stratum being regarded when different currents are prevailing in the upper regions of the atmosphere, and to refer their motion to fixed points on the surface of the earth, the bearings of which from each other the observer has previously settled for himself. The easiest way to do this is by observing the shadow of the sun at noon, that is to say, at the instant when the sun is on the meridian of the place of observation. That will rarely be at noon by Greenwich Mean Time. The longitude, and the equation of time, must both be allowed for.

The importance of the preceding remarks will probably be felt upon a careful scrutiny of the annexed tables, reduced from the copious returns furnished to the Club. Though, in many cases, the striking agreement of the results is most remarkable, in other cases there are anomalies which, in all probability, have arisen from some or other of the causes just indicated.

NOTES ON THE FLOWERING OF PLANTS, &c.

Seaham.—There was a remarkable absence of honey dew during 1868, and very little blight on either trees or shrubs. The ash suffered least from the dry summer, and the trees retained their green foliage to the last. The elm and maple shed their leaves early; and the oak, the alder, the willow, and the beech quickly put on a brown appearance.

North Sunderland.—The larch was much damaged by the great drought this summer. It made a second growth in October in Chathill and Swinhoe woods.

Lilburn Tower.—The fruit crops were generally good; apples were, however, an exception. The crop was destroyed by frost on May the 6th. The fruit bushes were never so free from insects as in 1868. Carrots escaped the ravages of the wire worm. This is the first year in which Mr. Deas has succeeded in getting a crop. He attributes it to the extreme dryness of the summer.

Byrness.—Hay was cut on July the 10th: very light crop.

Wallington.—*May.*—A very severe frost on the 6th nearly destroyed all the plums and pears which were set on the wall trees. Standard apples and damsons which were in blossom were sadly injured: the later trees, however, escaped, and bore a crop. The greater part of the cherries, which were nicely set, fell off a few days after.

June.—The hay crops suffered from want of rain and were below an average. The later sown turnips were a complete failure: in many places the seed remained for many weeks in the ground and only sprouted when the drought gave way.

North Shields.—Snowdrops were in flower on February the 27th.

Grass was cut on June the 13th. The white rose was in flower on the 15th. Cabbage rose on the 18th. Wheat was in ear on June the 22nd, and cut on July the 31st. Apples were ripe on August the 25th, and pears on the 30th.

Whitley.—Harvest general first week in August. New north-country wheat was sold in Newcastle market on August the 8th; weight, nine stone eight pounds to the boll.

Acklam, near Middlesbro'.—*Ulex europea* in bloom on December the 27th.

John Coppin, Esq., has again very kindly furnished the Club with the result of his observations on the flowering of plants, &c., in the neighbourhood of Tynemouth.

The list is not combined with the general table, in order that it may the more readily be compared with those supplied by the same able and careful observer in former years.

WILD PLANTS GROWING WITHIN THREE MILES OF TYNEMOUTH, 1868.

	Date of Flowering.		Date of Flowering.
Lamium purpureum ...	Jan 8.	Viola canina	Mar. 20.
Lamium album	Jan. 16.	Prunus spinosus.........	Mar. 21.
Tussilago farfara	Feb. 4.	Ranunculus arvensis ...	April 5.
Ranunculus ficaria......	Feb. 7.	Veronica chamædrys ...	April 24.
Veronica hederifolia ...	Feb. 28.	Potentilla anserina......	May 1.
Glechoma hederacea ...	Mar. 9.	Trifolium pratense......	May 1.
Taraxacum officinale...	Mar. 13.	Cratægus oxyacantha	May 4.
Primula veris	Mar. 13.	Broom	May 7.
Ribes grossularia	Mar. 14.	Mountain Ash...........	May 9.
Primula vulgaris	Mar. 16.	Elder	June 4.

PLANTS GROWING IN GARDENS NEAR NORTH SHIELDS, 1868.

	Date of Flowering.		Date of Flowering.
Snowdrop	Feb. 2	Strawberry..............	Mar. 24
Crocus—yellow	Feb. 10	Jargonelle Pear	April 4
Crocus—white	Feb. 12	Cherry....................	April 4
Crocus—purple	Feb. 26	Black Currant	April 7
Red Flowering Currant against a wall	Feb. 17	Blue Hyacinth	April 15
Red Flowering Currant standard	Mar. 4	Apple Tree (Keswick Codling)..............	April 19
Daffodil	Mar. 14	London Pride	April 28
Yellow Auricula.........	Mar. 16	Lily of the Valley	April 30
Gooseberry	Mar. 20	Purple Lilac	April 30
Red Currant	Mar. 22	Laburnum	May 6
		Raspberry	May 23

5.—STANDARD FRUIT TREES, &c.

STANDARD FRUIT TREES, &c.	MIDDLESBRO'.—Acklam Hall. In Blossom.	MIDDLESBRO'.—Acklam Hall. Yield.	SEAHAM. In Blossom.	SEAHAM. Yield.	GRETA BRIDGE, Barnard Castle. In Blossom.	GRETA BRIDGE, Barnard Castle. Crop Gathered.	WALLINGTON. In Blossom.	WALLINGTON. Yield.	NORTH SUNDERLAND. In Blossom.	NORTH SUNDERLAND. Yield.
Apple	April 26	Good Crops.	April 26	Good.	May 10	Sept. 4	May 1	⅓ of Crop.	....	....
Cherry	April 18	Good Crops.	April 15	Fair average.	....	....	April 18	Scarcely an average.	May 8	Very heavy Crop.
Pear	April 14	Moderate.	April 4	Fair average.	....	....	April 18	Half a Crop.	....	....
Plum	March 28	Rather short.	April 26	Scarce.	April	July 30	April 4	Failure.	....	....
Currant	April 18	Fine Crops.	April 6	Good.	April 20	July 8	April 10	Crop good.	....	....
Gooseberry	March 28	Good Crops.	March 10	Good.	April 20	June 20	March 30	Crop good.	March 21	....
Raspberry	May 22	Very good Crops.	May 18	Good.	April 1	....	May 24	Very abundant.	....	Large Crop. 1st green, May 20; 1st ripe, July 9
Strawberry	May 2	Plenty of Fruit. Small from drought.	May 12	Good.	May	June 30	May 8	Plentiful, flavour good. June 22, first dish.	....	Ripe June 11.

6.—GRAIN CROPS.

GRAIN, ROOT CROPS, &c.	MIDDLESBRO'.—Acklam Hall. Sown.	MIDDLESBRO'.—Acklam Hall. Cut or Gathered.	MIDDLESBRO'.—Acklam Hall. Yield.	SEAHAM. Cut or Gathered.	SEAHAM. Yield.	WALLINGTON. Sown.	WALLINGTON. Cut or Gathered.	WALLINGTON. Yield.	NORTH SUNDERLAND. Sown.	NORTH SUNDERLAND. Cut or Gathered.	NORTH SUNDERLAND. Yield.	NORTH SHIELDS. Cut or Gathered.	WHITLEY. Sown.	WHITLEY. Cut or Gathered.	WHITLEY. Yield.
Barley	April 1	Aug. 10	Good.	......	Various.	....	....	....	Shot-June 11.	....	Good.	July 27	....	....	....
Beans	Feb. 26	Aug. 18	Light Crop.	......	Various.	....	....	....	....	Cutng. July 31.	Short.	....	....	....	....
Hay	......	June 15.	Very light.	......	Good.	....	June 22	Average.	Old Land	began to cut July 6.	Very light stacked, July 16.	....	April 15	July 3	2 Tons an Acre.
Mangold	April 12	Oct. 19	Moderate.	......	Bad.	....	....	....	....	....	....	....	....	....	....
Oats	March 16	Aug. 12	Light Crop.	......	Not Superior.	May 2	Aug. 10	Average.	....	Cutng. July 31.	Small.	July 30	March 15	Aug. 12	32 Bolls an Acre.
Pease	March 10	July 24	Fair Crop.	......	Bad.	....	....	....	....	....	....	....	....	....	....
Potatoes	April 10	Sept. 20	Good Crop.	......	Good.	May 8	Oct. 15	Large & good Crop.-heavy.	....	....	Good Crop, no disease.	....	April 11	Oct. 12	4 Tons an Acre.
Turnips	May 20	A failure here.		......	Very bad.	May 22	Aug. 21	The early sown were a good Crop.	....	....	....	....	May 4	Oct. 6	16 ditto.
Wheat	April 1 Spring sown.	Aug. 10	Good.	......	Good.	....	....	....	Generally shot—June 18.	began to cut July 30.	Short in straw excellent quality.	Aug. 3.	Oct. 15, 1867.	Aug. 2	26 Bolls an Acre.

1.—FOREST TREES AND SHRUBS.

FOREST TREES, SHRUBS, &c.	MIDDLESBRO'.—ACKLAM HALL.				SEAHAM.		
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	In Bud.	In Leaf.	In Blossom.
Alder	April 1	April 27	April 16	Oct. 18	April 10	April 26	Feb. 25
Ash	April 29	May 18	April 7	Oct. 14	May 15	May 10	April 5
Barberry	March 15	April 22	May 28	Oct. 21	March 4	April 24	April 10
Beech	April 25	May 10	May 24	Oct. 1	April 20	May 3	....
Birch	March 20	May 1	March 12	Nov. 4	April 19	April 26	....
Black Thorn	March 23	April 24	March 30	Oct. 24	April 20	April 24	April 3
Bramble	March 14	April 10	June 10	Nov. 26	April 10	April 25	July 4
Broom	March 16	April 18	April 30	....	....	....	....
Elder	March 2	April 15	May 30	Oct. 18	March 10	April 3	....
Elm	March 14	April 27	March 2	Oct. 28	April 10	April 24	March 3
Flowering Currant	Feb. 18	April 10	March 9	Nov. 4	Feb. 20	April 30	Feb. 29
Hawthorn	March 2	April 12	May 1	Nov. 10	March 1	May 16	May 15
Hazel	March 25	April 16	Jan. 22	Oct. 19	April 10	April 24	Feb. 22
Holly	April 30	May 24	May 12	....	....	....	May 18
Honeysuckle	Feb. 3	March 18	June 3	Oct. 30	March 2	March 10	May 12
Laburnum	March 10	April 29	May 6	Oct. 20	April 6	April 22	May 6
Larch	March 6	April 14	March 23	Nov. 10	March 10	March 10	....
Lilac	March 12	April 20	May 4	Nov. 2	April 12	April 10	May 4
Lime	March 27	April 26	June 29	Oct. 20	April 12	May 4	....
Mountain Ash	March 30	April 28	May 10	Oct. 25	April 12	April 26	May 16
Oak	April 16	May 5	May 12	Nov. 4	April 20	May 12	....
Poplar	March 18	April 30	March 2	Oct. 24	Feb. 29	March 16	March 3
Privet	March 28	April 21	June 10	Nov. 12	April 10	April 23	July 12
Rose	March 17	April 12	June 3	Oct. 30	....	April 20	June 10
Sallow	March 26	April 9	March 9	Oct. 20	....	April 10	Feb. 23
Sycamore	March 28	April 22	April 28	Nov. 1	March 20	April 20	May 2
Whin	March 31	April 25	Jan. 10	....	....	....	Feb. 22

FOREST TREES, SHRUBS, &c.	GRETA BRIDGE.—BARNARD CASTLE.				ALSTON.		WALLINGTON.				NORTH SUNDERLAND.	
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	In Bud.	In Blossom.	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	In Leaf.	In Blossom.
Alder	....	....	....	....	....	....	March 7	April 16	....	Oct. 30	....	....
Ash	....	May 30	....	Oct. 14	....	....	April 26	May 28	May 1	Oct. 19	May 29	....
Barberry	....	....	....	....	....	....	Feb. 10	March 30	May 20	Oct. 31	....	....
Beech	....	April 24	April 24	....	....	....	April 1	April 22	May 12	Oct. 20	....	....
Birch	....	....	....	Oct. 7	....	....	March 18	May 1	....	Nov. 4	....	....
Black Thorn	....	April 13	April 3	....	....	....	March 1	April 4	....	Nov. 12	....	....
Bramble	....	July 20	July 20	....	....	....	March 4	April 2	Aug. 1	....	....	....
Broom	May 2	....	July 12	Sept. 30	....	....	March 22	April 30	May 4	....	....	....
Elder	....	....	....	....	....	....	Feb. 1	March 18	June 5	Nov. 10	....	....
Elm	April 1	....	....	....	....	....	April 5	May 16	March 24	Nov. 16	May 20	....
Flowering Currant	....	....	....	....	March 1	April 18	Jan. 16	March 14	March 18	Nov. 10	....	....
Hawthorn	....	....	June 17	....	....	....	Feb. 25	March 24	May 18	Nov. 2	March 18	May 2
Hazel	Feb. 26	....	....	....	....	....	Feb. 4	April 21	Feb. 24	Nov. 12	....	....
Holly	....	....	....	....	....	....	April 3	June 4	May 22	Sept. 20	....	....
Honeysuckle	....	....	June 30	....	....	....	Jan. 4	Feb. 18	May 21	Oct. 28	March 6	....
Laburnum	....	....	May 31	Oct. 20	....	....	Feb. 28	April 24	May 20	Oct. 28	....	....
Larch	March 6	April 4	....	Oct. 21	....	....	Feb. 20	March 6	None	Nov. 16	March 27	
Lilac	March 2	April 7	June 6	....	....	....	Feb. 7	March 30	May 20	Oct. 28	....	....
Lime	....	....	....	....	April 24	....	March 20	May 1	died in buds	Oct. 24	....	....
Mountain Ash	....	....	Sept. 19	....	....	....	March 6	April 12	May 16	Nov. 16	....	....
Oak	April 27	May 27	....	....	....	....	April 15	May 20	May 28	Dec. 4	May 26	....
Poplar	....	....	....	....	....	....	Feb. 20	April 1	....	Oct. 14	....	....
Privet	....	....	....	....	....	....	Feb. 22	April 13	June 23	....	....	....
Rose	....	....	June 16	....	March 10	....	Feb. 14	March 12	June 20	Dec. 4	....	June 8
Sallow	....	....	....	....	....	....	March 2	April 14	March 10	Nov. 30	....	....
Sycamore	March 18	March 29	....	Oct. 29	....	....	March 18	April 6	May 1	Nov. 2	April 21	Mar. 2
Whin	March 20	....	April 2	....	....	....	March 20	May 14	March 28	....	....	....

3.—MIGRATORY BIRDS.

MIGRATORY BIRDS.	MIDDLESBRO'.—ACKLAM HALL.			SEAHAM.			NORTH SHIELDS.
	Arrival.	Departure.	Prevalence.	Arrival.	Departure.	Prevalence.	Arrival.
Black Cap	March 20	July 18	Not many.	....	....	....	....
Chiff Chaff	....	....	....	....	....	....	....
Corncrake	May 15	June 30	Little heard.	May 4	....	....	April 29
Cuckoo	May 2	June 20	Not much heard here.	May 2	....	....	April 24
Fieldfare	....	....	....	Nov. 4	May 10 / April 20	.... /	....
Fly Catcher	....	....	....	....	....	....	....
Martin	....	....	....	May 23	....	....	....
Redstart	....	....	....	May 3	Sept. 1	....	....
Redwing	....	....	....	....	....	....	Sept. 9
Sand Martin	....	....	....	May 1	....	....	....
Sedge Warbler	....	....	....	May 4	....	....	....
Snow Bunting	....	....	....	Not	seen this	Winter.	....
Swift	....	....	....	May 6	Aug. 24	None bred here.	May 23
Swallow	April 25	Sept. 12	Great number.	April 25	Oct. 22	Not common.	April 28
Wheatear	....	....	....	May 3	....	Not common.	....
Whitethroat	....	....	....	May 1	....	....	....
Whinchat	....	....	....	May 1	....	Not common.	April 4
Willow Wren	....	....	....	April 23	Sept. 1	....	....
Woodcock	....	....	....	....	May 2	Scarce.	Oct. 10
Yellow Wagtail	....	....	....	....	....	....	April 4

MIGRATORY BIRDS.	STAMFORDHAM.		WALLINGTON			NORTH SUNDERLAND.			BYRNESS.	OTTER-BURN.
	Arrival.	Departure.	Arrival.	Departure.	Prevalence.	Arrival.	Departure.	Prevalence	Arrival.	Arrival.
Black Cap	....	....	....	....	....	....	....	....	....	....
Chiff Chaff	....	....	....	....	....	....	....	....	....	....
Corncrake	....	....	May 27	....	Numerous.	April 27	....	....	May 24	....
Cuckoo	May 3	....	May 6	July 4	Gay in note, and often heard.	May 16	....	....	May 4	April 27
Fieldfare	....	....	....	April 1	....	....	....	....	....	....
Fly Catcher	....	....	....	....	....	May 22	....	....	....	....
Martin	....	....	May 14	Sept. 8	Scarce.	....	....	....	April 23	....
Redstart	....	....	April 25	....	....	....	....	....	May 3	....
Redwing	....	....	....	....	....	Sept. 21	....	....	....	....
Sand Martin	....	....	May 8	Sept. 8	Numerous.	....	....	....	....	....
Sedge Warbler	....	....	....	....	....	....	....	....	....	....
Snow Bunting	....	....	....	....	....	....	....	....	....	....
Swift	....	....	....	....	....	....	....	....	....	....
Swallow	April 5	Sept. 20	April 28	Sept. 12, & a few seen on 23rd.	Numerous.	April 25	Aug. 26 to Sept.	Scarce.	May 24	April 27
Wheatear	....	....	....	....	....	....	....	....	April 5	....
Whitethroat	....	....	....	....	....	....	....	....	....	....
Whinchat	....	....	May 18	....	Scarce.	May 1	....	....	....	....
Willow Wren	....	....	April 25	....	Numerous.	....	....	....	....	....
Woodcock	....	....	....	....	....	Sept. 22	....	Very few.	....	....
Yellow Wagtail	....	....	....	....	....	....	....	....	....	....

2.—WILD PLANTS.

WILD FLOWERS.	MIDDLESBRO'. ACKLAM HALL.	SEAHAM.	GRETA BRIDGE, BARNARD CASTLE.	ALSTON.	WALLINGTON.	NORTH SUNDERLAND.	NORTH SHIELDS. J. COPPIN, ESQ.	NORTH SHIELDS. R. SPENCE, ESQ.
	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	
Anemone	April 18	March 20	March 6	....	April 1	....	....	....
Bulbous Crowfoot	May 20	May 4	....	....	April 29	....	....	....
Coltsfoot	March 14	Feb. 10	....	Feb. 29	March 10	....	Feb. 4	....
Cowslip	April 12	May 2	April 2	....	March 29	....	....	....
Dandelion	Feb. 19	Feb. 28	April 4	....	March 17	....	March 13	....
Forget-me-not	May 6	May 4	April 17	....	June 10	....	....	....
Garlic	May 25	May 2	May 2	....	Aug. 15	....	....	....
Hyacinth	May 12	May 3	May 6	....	May 9	....	....	....
Lily of Valley	April 28	May 14	....	....	May 10	....	April 30	....
Marsh Marigold	April 20	April 20	....	....	April 10	....	....	....
Pilewort	March 6	Feb. 20	....	....	March 15	....	....	....
Primrose	March 6	Feb. 3	March 2	Feb. 23	Jan. 19	Feb. 7	March 16	....
Red Poppy	June 20	May 10	....	....	....	....	....	....
Stitchwort	March 27	April 10	....	....	May 15	....	....	....
Snowdrop	Jan. 21	Feb. 7	Feb. 6	Feb. 11	Feb. 1	Feb. 7	Feb. 2	Feb. 7
Strawberry	May 6	May 20	May 9	....	March 24	March 22	March 24	....
Veronica chamædrys	April 28	May 3	....	....	May 4	....	April 24	....
Violet	March 6	March 10	March 1	....	Feb. 26	Feb. 20	....	....

4.—INSECTS.

INSECTS.	MIDDLESBRO'.—ACKLAM HALL.		SEAHAM.		WALLINGTON.		NORTH SUNDERLAND.		BYRNESS.
	Appearance.	Prevalence.	Appearance.	Prevalence.	Appearance.	Prevalence.	Appearance.	Prevalence.	Appearance.
Sm. W. Bu erfly	April 15	Plentiful.	....	Common.	April 16, & May 3 one	Plentiful.	April 24	Very numerous.	May 16
Holly Blue tto	Aug. 12	Scarce.	....	Common.	June 21	Scarce.	June 4	....	....
Orange tip tto	May 14	Moderate.	....	Rare.	May 16	Plentiful.	....	....	....
Painted La ditto	....	....	....	Rare.	Aug. 16	Plentiful.	May 6	Plentiful later on	....
Red Admi ditto	....	....	....	Common.	June 5	Not many seen.	May 27	More than usual.	March 27
Tortoise sh ditto	July 20	Plentiful.	....	Numerous.	March 17	Plentiful.	April 4	Plentiful.	....
Brimstone oth	May 27	Not many.	....	Several seen.	May 19	Scarce.	....	....	....
Currant di	....	....	....	....	July 17	Scarce.	....	....	....
Ghost ditt	....	....	....	....	June 18	Not very abundant.	....	....	....
Sm. Dagge litto	....	....	....	....	....	None seen.	....	....	....
Cockchafer	....	....		....	....	....	....	....	....
Hive Bee	Feb. 12	Rather Scarce.	March 28	Good Honey Season.	Feb. 5	Swarm on June 5.	....	....	Feb. 17
Humble B	March 10	Abundant.	March 28	....	March 15	Plentiful.	March 26	Numerous.	March 27
Wasp	March 12	Numerous in early spring, not many in the summer, rather more numerous in the autumn.	April 26	Very rare; only one seen all through the summer.	April 2	Scarcely seen.	May 1	About average.	May 3

NOTES ON BIRDS AND INSECTS.

North Sunderland.—The mountain sparrow was observed on March the 10th, and one was captured in the garden on December the 24th. The woodpecker put in an appearance on September the 23rd, and a middle-spotted one was shot in a garden south of the village.

Alston.—Swallows were seen on April the 24th.

Greta Bridge.—The cuckoo was heard on May the 2nd. Hive bees swarmed on the 19th.

Wallington.—*January.*—Hive bees were flying about on the 14th. On the 19th a few starlings were seen.

February.—Large flocks of field-fares and starlings were seen hovering about on the 13th. On the 29th bees were observed feeding on the crocus flowers.

April.—A nest of young thrushes was discovered on April the 4th; and young blackbirds were on the wing on April the 18th.

May.—Young partridges were seen on the 3rd; and game of all kinds was three weeks earlier than usual.

June.—The humming-bird hawk-moth was seen on the 25th; they were plentiful throughout the season.

July.—The continued dry weather has not been favourable for the swarming of bees. Many bee keepers had no swarms at all, while in the case of others only half their stocks swarmed. Still, bees were plentiful. Queen bees were scarce. Honey was also scantily produced this month.

August.—Four sphinx convolvulus moths were caught feeding on *Œnothera acaulis:* the first on August the 26th, and the others during the first week in September. They were very large and fine specimens.

September.—Bees have made a fair average collection of honey

1.—FOREST TREES AND SHRUBS.

	MIDDLESBRO'.—ACKLAM HALL.				SEAHAM.			GRETA BRIDGE.—BARNARD CASTLE.				ALSTON.		WALLINGTON.				NORTH SUNDERLAND.	
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	In Bud.	In Leaf.	In Blossom.	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	In Bud.	In Blossom.	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.	In Leaf.	In Blossom.
......	April 1	April 27	April 16	Oct. 18	April 10	April 26	Feb. 25	......	......	......	......	......	......	March 7	April 16	......	Oct. 30	......	......
......	April 29	May 18	April 7	Oct. 14	May 15	May 10	April 5	......	May 30	......	Oct. 14	......	......	April 26	May 28	May 1	Oct. 19	May 29	......
......	March 15	April 22	May 28	Oct. 21	March 4	April 24	April 10	......	......	......	......	......	......	Feb. 10	March 30	May 20	Oct. 31	......	......
......	April 25	May 10	May 24	Oct. 1	April 20	May 3	......	......	April 24	April 24	......	......	......	April 1	April 22	May 12	Oct. 20	......	......
......	March 20	May 1	March 12	Nov. 4	April 19	April 26	......	......	......	......	Oct. 7	......	......	March 18	May 1	......	Nov. 4	......	......
......	March 23	April 24	March 30	Oct. 24	April 20	April 24	April 3	......	April 13	April 3	......	......	......	March 1	April 4	......	Nov. 12	......	......
......	March 14	April 10	June 10	Nov. 26	April 10	April 25	July 4	......	July 20	July 20	......	......	......	March 4	April 2	Aug. 1	......	......	......
......	March 16	April 18	April 30	......	......	......	......	May 2	......	July 12	Sept. 30	......	......	March 22	April 30	May 4	......	......	......
......	March 2	April 15	May 30	Oct. 18	March 10	April 3	......	......	......	......	......	......	......	Feb. 1	March 18	June 5	Nov. 10	......	......
......	March 14	April 27	March 2	Oct. 28	April 10	April 24	March 3	April 1	......	......	......	......	......	April 5	May 16	March 24	Nov. 16	May 20	......
......	Feb. 18	April 10	March 9	Nov. 4	Feb. 20	April 30	Feb. 29	......	......	......	......	March 1	April 18	Jan. 16	March 14	March 18	Nov. 10	......	......
......	March 2	April 12	May 1	Nov. 10	March 1	May 16	May 15	......	......	June 17	......	......	......	Feb. 25	March 24	May 18	Nov. 2	March 18	May 2
......	March 25	April 16	Jan. 22	Oct. 19	April 10	April 24	Feb. 22	Feb. 26	......	......	......	......	......	Feb. 4	April 21	Feb. 24	Nov. 12	......	......
......	April 30	May 24	May 12	......	......	......	May 18	......	......	......	......	......	......	April 3	June 4	May 22	Sept. 20	......	......
......	Feb. 3	March 18	June 3	Oct. 30	March 2	March 10	May 12	......	......	June 30	......	......	......	Jan. 4	Feb. 18	May 21	Oct. 28	March 6	......
......	March 10	April 29	May 6	Oct. 20	April 6	April 22	May 6	......	......	May 31	Oct. 20	......	......	Feb. 28	April 24	May 20	Oct. 28	......	......
......	March 6	April 14	March 23	Nov. 10	March 10	March 10	......	March 6	April 4	......	Oct. 21	......	......	Feb. 20	March 6	None	Nov. 16	March 27	
......	March 12	April 20	May 4	Nov. 2	April 12	April 10	May 4	March 2	April 7	June 6	......	......	......	Feb. 7	March 30	May 20	Oct. 28	......	......
......	March 27	April 26	June 29	Oct. 20	April 12	May 4	......	......	......	......	......	April 24	......	March 20	May 1	died in buds	Oct. 24	......	......
......	March 30	April 28	May 10	Oct. 25	April 12	April 26	May 16	......	......	Sept. 19	......	......	......	March 6	April 12	May 16	Nov. 16	......	......
......	April 16	May 5	May 12	Nov. 4	April 20	May 12	......	April 27	May 27	......	......	......	......	April 15	May 20	May 28	Dec. 4	May 26	......
......	March 18	April 30	March 2	Oct. 24	Feb. 29	March 16	March 3	......	......	......	......	......	......	Feb. 20	April 1	......	Oct. 14	......	......
......	March 28	April 21	June 10	Nov. 12	April 10	April 23	July 12	......	......	......	......	......	......	Feb. 22	April 13	June 23	......	......	......
......	March 17	April 12	June 3	Oct. 30	......	April 20	June 10	......	......	June 16	......	March 10	......	Feb. 14	March 12	June 20	Dec. 4	......	June 8
......	March 26	April 9	March 9	Oct. 20	......	April 10	Feb. 23	......	......	......	......	......	......	March 2	April 14	March 10	Nov. 30	......	......
......	March 28	April 22	April 28	Nov. 1	March 20	April 20	May 2	March 18	March 29	......	Oct. 29	......	......	March 18	April 6	May 1	Nov. 2	April 21	Mar. 2
......	March 31	April 25	Jan. 10	......	......	......	Feb. 22	March 20	......	April 2	......	......	......	March 20	May 14	March 28	......	......	......

3.—MIGRATORY BIRDS.

MIDDLESBRO'.—ACKLAM HALL.			SEAHAM.			NORTH SHIELDS.	STAMFORDHAM.		WALLINGTON.			NORTH SUNDERLAND.			BYRNESS.	OTTERBURN.
Arrival.	Departure.	Prevalence.	Arrival.	Departure.	Prevalence.	Arrival.	Arrival.	Departure.	Arrival.	Departure.	Prevalence.	Arrival.	Departure.	Prevalence.	Arrival.	Arrival.
March 20	July 18	Not many.	......	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
May 15	June 30	Little heard.	May 4	......	......	April 29	......	......	May 27	......	Numerous.	April 27	......	......	May 24	......
May 2	June 20	Not much heard here.	May 2	......	......	April 24	May 3	......	May 6	July 4	Gay in note, and often heard.	May 16	......	......	May 4	April 27
......	......	......	Nov. 4	May 10 April 20	....	......	......	......	......	April 1	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	May 22	......	......	......	......
......	......	......	May 23	......	......	......	......	......	May 14	Sept. 8	Scarce.	......	......	......	April 23	......
......	......	......	May 3	Sept. 1	......	......	......	......	April 25	......	......	......	......	......	May 3	......
......	......	......	......	......	......	Sept. 9	......	......	......	......	......	Sept. 21	......	......	......	......
......	......	......	May 1	......	......	......	......	......	May 8	Sept. 8	Numerous.	......	......	......	......	......
......	......	......	May 4	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	Not	seen this	Winter.	......	......	......	......	......	......	......	......	......	......	......
......	......	......	May 6	Aug. 24	None bred here.	May 23	......	......	......	......	......	......	......	......	......	......
April 25	Sept. 12	Great number.	April 25	Oct. 22	Not common.	April 28	April 5	Sept. 20	April 28	Sept. 12, & a few seen on 23rd.	Numerous.	April 25	Aug. 26 to Sept.	Scarce.	May 24	April 27
......	......	......	May 3	......	Not common.	......	......	......	......	......	......	......	......	......	April 5	......
......	......	......	May 1	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	May 1	......	Not common.	April 4	......	......	May 18	......	Scarce.	May 1	......	......	......	......
......	......	......	April 23	Sept. 1	......	......	......	......	April 25	......	Numerous.	......	......	......	......	......
......	......	......	......	May 2	Scarce.	Oct. 10	......	......	......	......	......	Sept. 22	......	Very few.	......	......
......	......	......	......	......	......	April 4	......	......	......	......	......	......	......	......	......	......

2.—WILD PLANTS.

WILD FLOWERS.	MIDDLESBRO'. ACKLAM HALL.	SEAHAM.	GRETA BRIDGE, BARNARD CASTLE.	ALSTON.	WALLINGTON.	NORTH SUNDERLAND.	NORTH SHIELDS. J. COPPIN, ESQ.	NORTH SHIELDS. R. SPENCE, ESQ.
	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	In Blossom.	
Anemone	April 18	March 20	March 6	......	April 1	......	......	......
Bulbous Crowfoot	May 20	May 4	......	......	April 29	......	......	......
Coltsfoot	March 14	Feb. 10	......	Feb. 29	March 10	......	Feb. 4	......
Cowslip......	April 12	May 2	April 2	......	March 29	......	......	......
Dandelion......	Feb. 19	Feb. 28	April 4	......	March 17	......	March 13	......
Forget-me-not	May 6	May 4	April 17	......	June 10	......	......	......
Garlic	May 25	May 2	May 2	......	Aug. 15	......	......	......
Hyacinth	May 12	May 3	May 6	......	May 9	......	......	......
Lily of Valley	April 28	May 14	......	......	May 10	......	April 30	......
Marsh Marigold	April 20	April 20	......	......	April 10	......	......	......
Pilewort	March 6	Feb. 20	......	......	March 15	......	......	......
Primrose	March 6	Feb. 3	March 2	Feb. 23	Jan. 19	Feb. 7	March 16	......
Red Poppy	June 20	May 10	......	......	......	......	......	......
Stitchwort	March 27	April 10	......	......	May 15	......	......	......
Snowdrop	Jan. 21	Feb. 7	Feb. 6	Feb. 11	Feb. 1	Feb. 7	Feb. 2	Feb. 7
Strawberry	May 6	May 20	May 9	......	March 24	March 22	March 24	......
Veronica chamaedrys	April 28	May 3	......	......	May 4	......	April 24	......
Violet	March 6	March 10	March 1	......	Feb. 26	Feb. 20	......	......

4.—INSECTS.

INSECTS.	MIDDLESBRO'.—ACKLAM HALL.		SEAHAM.		WALLINGTON.		NORTH SUNDERLAND.		BYRNESS.
	Appearance.	Prevalence.	Appearance.	Prevalence.	Appearance.	Prevalence.	Appearance.	Prevalence.	Appearance.
Sm. W. Butterfly......	April 15	Plentiful.	......	Common.	April 16, & May 3 one	Plentiful.	April 24	Very numerous.	May 16
Holly Blue ditto	Aug. 12	Scarce.	......	Common.	June 21	Scarce.	June 4	......	......
Orange tip ditto	May 14	Moderate.	......	Rare.	May 16	Plentiful.	......	......	......
Painted Lady ditto	......	......	......	Rare.	Aug. 16	Plentiful.	May 6	Plentiful later on	......
Red Admiral ditto	......	......	......	Common.	June 5	Not many seen.	May 27	More than usual.	March 27
Tortoise shell ditto	July 20	Plentiful.	......	Numerous.	March 17	Plentiful.	April 4	Plentiful.	......
Brimstone Moth	May 27	Not many.	......	Several seen.	May 19	Scarce.	......	......	......
Currant ditto	......	......	......	......	July 17	Scarce.	......	......	......
Ghost ditto	......	......	......	......	June 18	Not very abundant.	......	......	......
Sm. Dagger ditto......	......	......	......	......	......	None seen.	......	......	......
Cockchafer	......	......		......	......	......	......	......	......
Hive Bee	Feb. 12	Rather Scarce.	March 28	Good Honey Season.	Feb. 5	Swarm on June 5.	......	......	Feb. 17
Humble Bee	March 10	Abundant.	March 28	......	March 15	Plentiful.	March 26	Numerous.	March 27
Wasp	March 12	Numerous in early spring, not many in the summer, rather more numerous in the autumn.	April 26	Very rare; only one seen all through the summer.	April 2	Scarcely seen.	May 1	About average.	May 3

NOTES ON BIRDS AND INSECTS.

North Sunderland.—The mountain sparrow was observed on March the 10th, and one was captured in the garden on December the 24th. The woodpecker put in an appearance on September the 23rd, and a middle-spotted one was shot in a garden south of the village.

Alston.—Swallows were seen on April the 24th.

Greta Bridge.—The cuckoo was heard on May the 2nd. Hive bees swarmed on the 19th.

Wallington.—*January*.—Hive bees were flying about on the 14th. On the 19th a few starlings were seen.

February.—Large flocks of field-fares and starlings were seen hovering about on the 13th. On the 29th bees were observed feeding on the crocus flowers.

April.—A nest of young thrushes was discovered on April the 4th; and young blackbirds were on the wing on April the 18th.

May.—Young partridges were seen on the 3rd; and game of all kinds was three weeks earlier than usual.

June.—The humming-bird hawk-moth was seen on the 25th; they were plentiful throughout the season.

July.—The continued dry weather has not been favourable for the swarming of bees. Many bee keepers had no swarms at all, while in the case of others only half their stocks swarmed. Still, bees were plentiful. Queen bees were scarce. Honey was also scantily produced this month.

August.—Four sphinx convolvulus moths were caught feeding on *Œnothera acaulis:* the first on August the 26th, and the others during the first week in September. They were very large and fine specimens.

September.—Bees have made a fair average collection of honey on the moors. Wasps have suffered from the season. They were very rarely seen this month, and not a nest is to be found though queens were abundant in May and June.

December.—Thrushes and starlings were in song on the 18th.

Wylam.—Game was not abundant, excepting partridges and pheasants. Grouse, from the effects of the disease so severely felt on the Northumberland moors last year, were very scarce, and seldom sold for less than 7/ a brace. Black grouse, though not so scarce, the same price. Partridges 3/ to 4/; and pheasants about 6/ a brace. Woodcocks were very scarce, and sold for 7/ to 10/ a brace.

Horsley, near Wylam.—*October.*—A very large flock of wild geese passed over this neighbourhood on the 11th.

Otterburn.—*February.*—The thrush began to sing on the 17th.

North Shields.—Hive bees were seen on March the 29th; humble bees on March the 31st. Beetle (*Geotropes*) on March the 24th. Small white butterfly on April the 10th.

Whitley.—*July.*—The humming-bird hawk-moth was seen on the 20th.

August.—Two wild swans were seen flying about the Tyne, and one was shot by Robert Cooper at Redheugh.

Acklam, near Middlesbro'.—*October.*—A woodcock was shot on the 29th.

Seaham.—The season of 1868 has been a very good one for hive bees notwithstanding its dryness. Wasps have been rarely seen, although further inland they have been numerous. Mr. Draper thinks that they do not like this part of the coast.

With regard to the hive bees Mr. Draper has often remarked, that they partly stop work if the wind changes to the east.

Swallows were not common or martins either. Willow wrens were plentiful in the spring.

The following notes of rare birds have been kindly supplied by Mr. John Hancock:—

The Honey Buzzard was seen at Cresswell on September the 24th, 1868; the Rose-coloured Paston at Cresswell in August, 1868; the Roller at Eslington in September, 1868; and several specimens of the Little Gull were got on the Durham coast.

Some further interesting details about insects, in 1868, will be found in Mr. Bold's paper in an earlier page of this volume of Transactions.

CONCLUSION.

In drawing this report to a conclusion, the editor cannot but feel that his fellow-labourers in this department of the labours of the Tyneside Naturalists' Field Club will rejoice with him in the steady and rapid advance which Meteorology is making year by year. The more multiplied the observations are, the sooner will the science become of that great practical utility in the affairs of every-day life which it is destined to be. The efforts of Captain Maury, the late Admiral Fitzroy, Reid, and others, have given an impulse to the study and observation of atmospheric phenomena, and the kindred subject of the theory of ocean currents, which has been productive of the greatest good.

Before the publication of Captain Maury's charts the average time occupied in a voyage from England to Australia was one hundred and twenty-four days, and the return journey occupied about the same time. A very great reduction in the time occupied in the voyage has since taken place, and the editor understands that what used to take one hundred and twenty-four days now only occupies ninety-seven on the average, and this passage has been made under canvas alone in sixty-three days. Part of this saving in time may no doubt be due to improved ship building, but most unquestionably the greater part of the gain arises from the reduction to practical use of long continued observations made on the wind and weather. The average passage to California, one of the most trying to the skill of the sailor, has been reduced from one hundred and eighty-three days to one hundred and thirty-five. The saving on the voyage to China has not been so great, but even there ten days have been gained. At the meeting of the British Association in 1853 it was stated, that the merchants of Bombay estimated the annual saving which would accrue to British commerce, from the use of properly constructed wind and weather charts, would be from two hundred to four hundred thousand pounds!

The English Government has hitherto been amongst the foremost in Europe in promoting and encouraging meteorological observations. On the death of Admiral Fitzroy a Committee of the members of the Royal Society and others was appointed, to consider the subject of the continuance and organization of the meteorological department of the Board of Trade, over which the late admiral had presided. The report of that Committee was presented to Parliament in 1866. In the autumn of 1866 the Board of Trade stated that they and the Admiralty were prepared to support the course proposed in that report. The Meteorological Committee consequently appointed met for the first time on January the 3rd, and to Mr. R. R. Scott was entrusted the office of director of the work. The Committee have divided their operations into three great branches. First—Ocean Meteorology. The object is to deduce the Meteorology of all parts of the ocean from observations made by ships. Many members of our Club who are interested in shipping, and who have influence with the captains of our foreign-going merchant ships, might render the most essential service in this part of the work. The Meteorological Committee of the Royal Society are prepared *to lend* to captains of the mercantile marine instruments which have been tested at Kew, and also to allow captains to purchase any of those instruments at cost price. The complete set of instruments consists of a barometer (Kew pattern), six thermometers, one thermometer screen, four hydrometers, and, in exceptional cases, an Azimuth compass.*

The observations taken are to be sent in to the committee on the return of the vessel to England for reduction.

It may not be travelling too far out of the way of this report to bring before the members of the TYNESIDE CLUB, especially those whose fortunes are more or less dependant on shipping, a few of the results already obtained. This cannot be better done than by a brief extract from the last report issued by the Meteorological Committee.

A plan for reducing the observations which had already been collected under Admiral Fitzroy's management having been determined on, the next step was "to choose the district on which operations should be commenced. The region chosen was that part of the Atlantic which lies between the parallels of 20° N. and 10° S. Its northern limit is permanently within the region of the north-east, and its southern of the south-east trade. Between these Trade winds is included the belt familiarly known as the 'Equatorial Doldrums,' whose annual oscillation in position extends from the neighbourhood of the equator to about the parallel of 15° N.

"It is evident that the periodical changes which take place in this part of this ocean could not be traced, unless the observations were subjected to such a minute examination as is requisite in order to obtain monthly means for single square degrees.

"It is hoped that, by means of this investigation, a solution may be furnished to the question so frequently asked by commanders who have kept registers for the meteorological department, viz., what is the best route for crossing the equator in each month? The registers of one month abound with bitter complaints against the westerly route, while those of another month are full of its praise.

* The prices at which captains can be supplied from the office of the Meteorological Committee in Victoria Street, London, are for the barometer £3 15s., six thermometers £2 2s., one thermometer screen 10s., four hydrometers £1 1s., including the charges for the verification of the instruments. Register forms are also issued in duplicate. One copy for the captain's own use, the other to be returned to the Committee at the end of the voyage.

"Again—there seems to be a space lying to the westward of the 'S. W. monsoon of the line,' on the coast of Africa, which at certain seasons should be avoided, as it is found that ships in this space have been doing little or nothing, while those further to the eastward have made good way to the southward.

"A very cursory examination of the registers is sufficient to show that at certain seasons of the year ships, bound to the southward, should avoid the coast of South America, or else their passage will be prolonged quite as much as it would be at other seasons by their keeping too close to the African coast.

"It seems also probable that by investigating the region lying to the eastward of the West India Islands, it may be possible to trace the origin of the hurricanes with which those islands are so frequently visited. They make their first appearance at the Windward Islands as cyclones completely developed, and therefore must have taken their rise somewhere within the district under discussion.

"During the hurricane season it has been found at times that ships passing to the westward of the Cape Verde Islands have felt a S. E. gale, which may turn out to have been the N. E. quarter of one of these storms, which are seldom noticed until they travel many degrees to the westward of the meridian of the Cape Verdes.

"Lastly, much has to be learnt with reference to the currents of this part of the sea, especially in the Gulf of Guinea.

"We find the Guinea current, with a temperature of 80° or 90°, running to the eastward, while in close proximity to it, on its southern edge, we meet the equatorial current running to the westward with a temperature of 70° or even lower. One very careful observer has recorded a temperature of only 66° in the Guinea current itself, showing that variations in surface temperature, similar to those known to exist in the Gulf stream, are traceable in this current so close to the equator.

"The question of the surface temperature of the sea, the discussion of which throws such an important light on the course of ocean currents, has also attracted the attention of the

Committee in a special way.........It is hoped that by the aid of the commanders of the principal lines of Trans-Atlantic steamers, who have met the Committee's appeal with the utmost readiness, that within a brief period of time a mass of material will have been obtained which will be beyond comparison more complete than any which has yet been collected.............

"In order that the whole of the work which has already been done in the office, in the direction of sea temperature, should be rendered available to the public, and at the same time the results already obtained in Holland should be published in a form acceptable to English readers, it was resolved to prepare for the South Atlantic Ocean monthly charts, containing all the information contained in the Dutch charts reduced to the Fahrenheit scale, together with the means for five degree squares obtained from the discussion of the Board of Trade registers. These charts are being lithographed, and are supplemented by copious notes, consisting of extracts from registers of any captains who have recorded sudden changes of temperature or other remarkable phenomena bearing on the question under discussion."

The second department of the Committee's work is that relating to Telegraphic Weather information. As is well known the system of storm warnings, introduced by the late Admiral Fitzroy, has been discontinued. The Meteorological Committee, while distinctly declining "to prognosticate weather, or to transmit storm warnings, are collecting information which will enable them, sooner or later, to frame rules by which such prognostications can be made, and that one of the main objects which they propose to themselves is the advancement of meteorological science in this important practical direction."

The third department is that of the Land Meteorology of the British Isles, and with the view of carrying out their part of the work, observatories have been established at several places in the United Kingdom.

Meteorology has made a very considerable advance not only in England but throughout the civilized world during the past year. In France, the magnificent series of charts "Atlas Mouvements Generaux de l'Atmosphère 1864, June to December," have been issued by M. Le Verrier. The series consist of daily synoptic charts of the Atlantic Ocean from the equator to latitude 70° N., including, in addition, Europe and a few stations on the S. and E. coasts of the Mediterranean, and on the Atlantic sea board of America. They give for 8 A.M. every day the conditions of pressure, wind, sea disturbances, and character of the sky which have been obtained from ships' logs and land observations. The materials are procured by a system of international co-operation.

In addition to the atlas there has also been published under the same direction two other works—the "Atlas des Orages 1865" and "Atlas Meteorologique 1866." These have reference almost exclusively to the distribution of thunderstorms and of hail over France during the year to which they refer. The Governments of Holland, Prussia, Norway, Russia, Austria, Italy, and Denmark have each and all obtained and published much valuable information in reference to Meteorology during the last year or two.

In the United States the work, suspended during the war, has again been resumed; and we may hope ere long to see some fresh proof that the energy and zeal of the days when Maury was the moving spirit are as active as ever. Such publications as the beautiful and elaborate charts of rainfall and temperature of the United States, given in the "Army Meteorological Register for 1855," are worthy of all imitation.

In our Colonies the subject, even amongst the many demands of a more pressing nature upon the energies of young communities, has not been forgotten. In India the Government of Bengal has established a meteorological office at Calcutta, and a system of storm warnings has been set on foot. But foremost in this part of the work stands the Meteorological Society of the Mauritius, whose secretary, Mr. Meldrum, is now in England engaged in the preparation of synoptic weather charts of the Indian Ocean.

The more widely extended meteorological observations are, the sooner shall we be enabled to arrive at those grand laws which govern the atmosphere and its manifold changes. Hence, insignificant as the labours of our Club may appear to be to those who have taken no active interest in the science of Meteorology, they contribute their full share towards this much to be desired end. The Tyneside Club now numbers, as the editor believes, a much larger number of effective meteorological observers than any other body in the kingdom which does not profess to make Meteorology its sole work.

It is now ten years and more since our old and valued friends, Mr. Sopwith and Mr. Glaisher, in two admirable addresses, urged upon the members of the Club the practical utility of this study, especially to farmers and to those who "go down to the sea in ships, that do business in great waters." There needs no argument to prove that the seed then sown has indeed borne fruit.

The editor cannot draw this report to a close without expressing his hope that each succeeding year's report may become more valuable and more interesting than its predecessor. Still less can he do so without expressing his thanks for the hearty assistance rendered to him by the numerous friends and members of the Club, who take the very great trouble to record the observations which are summarised in the yearly Meteorological Report. It would be invidious to name any particular helpers; but amongst the returns received are some which would do credit, even to professional observers, for both accuracy and fulness of detail. Others which, though not so full, are so not from any lack of will or ability, but simply for want of the necessary time to render them more complete, and, in some instances, the lack of the necessary instruments. The cost of meteorological instruments is very high, and quite beyond the means of some who desire and are able to render the Club true and good service in this department of its work.

Attention has been publicly called by Mr. Allnatt, the well-known observer, to this subject. There cannot be any doubt that the sums charged for many instruments are altogether beyond any ordinary profit on the cost of construction, but at the same time it must be remembered that the demand is but small. It is to be hoped that as time rolls onward, and the number of observers increases, the manufacturers will be enabled to reduce their charges.

The editor cannot allow this opportunity to pass without strongly urging upon all persons, who may contemplate purchasing any meteorological instruments, the necessity of having a thorough guarantee as to their accuracy. They should always stipulate that the instruments should have been actually tested at Kew, and not be content with the simple assurance that they have been compared with some standard instrument. The editor will always be very glad to assist any one in this matter.

The observations recorded in the Meteorological Report and Climatological Tables have this year been forwarded by the following contributors:—

Allenheads and Bywell	Mr. M. Varty, Haydon Bridge.
Alston	Joseph Dickenson, jun., Esq., Alston.
Howick (Earl Grey) Mr. F. Moore Glanton Pike (F. W. Collingwood, Esq.)	Communicated by the Rev. J. F. Bigge.
Brinkburn	C. H. Cadogan, Esq.
Cresswell	Rev. J. E. Leefe.
Darlington	Mr. John Richardson, Southend. Mr. Henry Ward, Brinkburn Gardens.
Dinsdale Rectory, near Darlington,	Rev. J. W. Smith, M.A.
Durham	Rev. Dr. Gillow, Ushaw College.
Durham Observatory	John J. Plummer, Esq.
Eaglescliffe, near Yarm	Rev. Canon Hull.
Greenwich	James Glaisher, Esq.
Horsley, near Wylam	Mr. John Bew.
Lilburn Tower	Mr. John Deas.
Middlesbro' (Acklam Hall)	Mr. Hebblethwaite.
Millfield, near Wooler	G. A. Grey, Esq.
Newcastle-on-Tyne	G. Lyall, Esq., Lit. & Phil. Society. Mr. W. Neill, Deaf & Dumb Institution.
North Shields	J. R. Procter, Esq. R. Spence, Esq. John Coppin, Esq. Dr. Bramwell.
Otterburn	Rev. T. Wearing.
Park End	M. A. Ridley, Esq.

North Sunderland	Rev. F. R. Simpson.
Rothbury	Sir W. G. Armstrong.
Seaham	Mr. R. Draper, Seaham Hall Gardens. Mr. Kitts, Londonderry Office.
Sedgefield, Durham....................	Robert Smith, Esq.
South Shields	Rev. R. E. Hooppell. Mr. R. Kerr.
Stamfordham	Rev. J. F. Bigge, M.A.
Stanhope	Mr. Thomas Surtees, Stanhope Castle.
Sunderland	T. W. Backhouse, Esq., West Hendon House. J. W. Mounsey, Esq., Hendon Hill. Rev. George Iliff, The Hall.
Thorpe Grange, Greta Bridge	T. Dodgson, Esq.
Wallington	Mr. Hedley, Wallington Hall Gardens.
Wallsend	J. W. Dees, Esq.
Whitley....................................	Rev. R. F. Wheeler, M.A.
Whittle Dene Company's Reservoirs,	D. D Main, Esq.
Wolsingham.............................	The late W. Backhouse, Esq.
Wylam	G. C. Atkinson, Esq., Wylam Hall.

ADDRESS TO THE MEMBERS OF THE TYNESIDE NATURALISTS' FIELD CLUB,

READ BY THE PRESIDENT, E. J. J. BROWELL, ESQ., AT THE TWENTY-THIRD ANNIVERSARY MEETING, HELD IN THE MUSEUM OF THE NATURAL HISTORY SOCIETY, NEWCASTLE-UPON-TYNE, ON THURSDAY, APRIL 8TH, 1869.

OUR last year's season commenced with a meeting at Sheepwash and Bothal, on Wednesday, the 20th of May, and, as usual with the first of the Season, was arranged as an afternoon excursion. It would be difficult to find a more suitable place than this for a Spring Meeting, the sheltered river banks tempting the vegetation to an early growth. Leaving Newcastle at 1·20 P.M. by railway we went to Choppington Station and walked from thence to Sheepwash. The scenery about this pretty place was peculiarly beautiful on this occasion, the sun shone brilliantly on the varied colours of the trees, from the deep bluish green of the Scotch firs to the full verdure of the sycamores and the delicate tints of the larches. We followed the river banks to Morpeth, passing Bothal Church, unpretending in its architecture, containing an altar tomb in memory of some of the former lords of Bothal; Bothal Castle on a fine situation, and, before the days of improved artillery, of considerable strength. The portion now remaining probably gives an inadequate idea of what it was once, in stateliness and importance, when the residence of the Bertrams, descendants of the Baliols: it was in their possession in the twelfth century, if not earlier, passing afterwards by marriage to the Ogles and then to the ducal house of Portland, in whose possession it still remains, together with the patronage of the valuable living. Under the sheltered bank of the river, a a little higher up, are the nearly obliterated remains of a chapel dedicated to the Virgin Mary. Near at hand is a spring of water where we, like many pilgrims of an earlier day, quenched our thirst. After a beautiful walk we arrived at Morpeth, and mustered about eighty in number, and very appetising the walk seemed to have been, as those who had arrived first had been unable to await the arrival of the remainder of the party, or the appointed hour, for the substantial meal which awaited us at the "Black Bull."

The SECOND MEETING was held on the 18th of June, on "the Derwent above Shotley," conveniently reached by the recently-opened Derwent Valley Railway. We left Newcastle at 10·20 P.M. in number about fifty. We proceeded some distance up the course of the river from Shotley, when we divided, the larger number diverging to the Healey Field Lead Mine under the guidance of Mr. Muschamp, one of the proprietors, who afforded them all facilities for seeing the mine, and hospitably entertained them at luncheon. The other division walked on to the beautiful scenery of the Sneap. During the walk we had a fine view of the Houndsgill Viaduct, and more than enough of the ugly chimneys and furnaces of the ironworks, which seem to do their utmost to spoil the country by the hideous volumes of black smoke which they belch forth. In the river bed we saw in many places circular holes in the Millstone Grit where millstones had been cut out, many of which are yet lying in a partly finished state, some flaw having been most likely discovered in them. Mr. Booth, of Shotley, informed us that in examining some old records of the manor he found notices, how, from time to time, certain millers had been brought before the lord's court and fined for taking millstones without the proper payment or permission. Between Shotley and Allansford, within a few yards of the water's edge, are what are said to be the remains of some ancient ironworks; a portion of the walls of a furnace is well preserved, showing the vitrified inner surface. There were heaps of scoria lying close by, and near at hand are workings whence the ore may have been obtained. They are said to have been established early in the thirteenth century by a colony of Germans, who settled and remained here for a long period, during which time the place obtained a great reputation for its sword blades, which was retained until quite recently. In the older part of Shotley some houses yet remain with German inscriptions on them, such as are commonly met with in the present day in Germany. Some of the descendants of these people are, or were lately, still living in the valley. Some of the party availed themselves of the courteous permission of Mr. Thomas Wilson, of Shotley Hall, to visit his grounds. Some landscape gardening has been very effectively carried out here by Mr. John Hancock. There are a great variety of shrubs and trees, amongst which the Wellingtonea thrives well and promises to attain a goodly size. The Messrs. Annandale kindly gave permission to see through their paper mills. We dined at the Commercial Inn and afterwards Mr. Thompson, one of the Hon. Secretaries, read a "*Notice of the Occurrence of Glow-worms in considerable numbers in the Valley of the Derwent;*" also a paper "*On the Aculeate Hymenoptera of Northumberland,*" by Mr. T. J. Bold.

The Third Field Meeting was held at Richmond on the 15th of July. This meeting was, strictly speaking, out of our country, but we have precedents for it on former occasions; and making a foray occasionally on our southern neighbours is only keeping up the old custom of the borders, to which we are sufficiently near to make participation in their habits natural if not right. Moreover, this expedition was not for the purpose of thieving, but was a friendly one, being held on the invitation of Mr. Wood, of Richmond, who kindly volunteered to make all the necessary arrangements and to act as our guide.

We went by the 8 A.M. train, and by special favour were set down close to Easby Abbey, amidst the beautiful scenery of which we lingered for some time. The ruins are very extensive, and indicate what we know to be the fact, that there was a very large monastic establishment here. Following the course of the river we proceeded to Richmond to Mr. Wood's house, and he being on a visit to Scarbrough his servants were, by his orders, prepared to receive us, and wines, &c., were in readiness for those who wished for them. We were deprived of Mr. Wood's promised guidance as he did not arrive during the day, and we were sorry to learn afterwards that his absence was occasioned by an attack of illness; fortunately Dr. Tristram, who was of our party, was well acquainted with his Geological Museum, which is the great attraction of his residence, and kindly pointed out the most interesting of its contents on the spot, and at my request gave a short verbal account of it after dinner. He has also kindly supplied me with the following note on it:—

"Mr. Wood's Museum is important on account of its careful arrangement, and for the perfection of the fossils it contains. It is strictly *Palæontological*, and all the specimens, without exception, are British, and are in admirably planned wall and centre cases with large sheets of plate glass. The tablets form multiples of each other, thus enabling more economy of room and more success in arrangement. The plans were drawn by the *savants* of the British Museum, but all made in Richmond. Every tablet and loose specimen is properly labelled, and as the *chiefs* of nearly each department have, at some time since its formation, been Mr. Wood's guests, the arrangement is so good that it is quite a type series, particularly rich in *Brachiopoda*, all named under the faultless eye of Mr. Davidson. The Silurian

Trilobites, Crinoids, and Corals, are of great beauty, as are the old red fish from the collection of poor Hugh Miller; but the gems of the series are a large set of Carboniferous Crinoids discovered by the owner, and named by Professor De Koninck, *Woodocrinus*. These beautiful remains are new to science, and in the discoverer's opinion were not attached, but free-swimming. A noble series forms a conspicuous object in one of the large wall cases. A very good case full of Coal plants is amongst the attractive portion, as well as the Lias and Chalk fossils."

We spent some time in Mr. Wood's garden, where there were many things worthy of notice—amongst others a very fine collection of British ferns growing in great luxuriance. The luxuriance of the garden seemed to show a kindly climate, but we thought there were indications in the appearance of some mosses, lichens, &c., of a good deal of humidity.

After spending a little time in seeing the lions of the town, and having procured all the vehicles we could, we started to follow the remainder of the programme laid down for us, and had a delightful drive over the high lying moors of Hudswell and Downholme, with beautiful and extensive views of the country; and, returning by the Reeth Road, we reached Richmond in numbers between sixty and seventy.

The Fourth Meeting was at Bambro', on the 21st August. About a dozen of us went over on the afternoon previous, to Belford Station, whence we had a pleasant walk to Bambro'.

The castle, seeming to grow out of the living rock, so firmly does it seem to be planted on its basaltic throne, always grand and impressive, was beautiful as we saw it on this evening bathed in a flood of golden light from the setting sun: its natural position is a very strong one, and is said to have been occupied and fortified by the Romans in Agricola's time; its history, civil and military, is very interesting. Occupied and fortified in 550 by Ida, first Anglo-Saxon King of Northumbria, it fell afterwards into the hands of the Danes, was again fortified by the Saxons, afterwards for a long time a stronghold of the Norman Earls of Northumberland. It must have witnessed many a wild and martial scene in those stormy times. Later it became a Royal castle and was governed by an officer appointed by the Crown, until, in the reign of James I., it was granted to Claudius Forster, and remained in the possession of the family until the political disturbances of 1715, when, on account of the part General Forster took, it was forfeited. It was afterwards purchased of the Government Commissioners for forfeited estates (together with the rest of the estates of the Forsters) by Lord Crewe, Bishop of Durham, whose wife was aunt to the General. The Bishop died on the 18th of September, 1722, without children, and left his large property in the hands of trustees for certain pious and charitable uses which he specified, and directed that the surplus should be applied to such charitable purposes as the trustees should from time to time direct. In the exercise of this power, besides the sums applied in different parts of the country to church and educational uses, there is a large sum applied in the neighbourhood of Bambro' itself, in affording to the poor, under judicious regulations, education, clothing, food, medical attendance, coals, &c., in giving warning, by various means, to ships in bad weather, enabling them often to avoid the risks of this dangerous neighbourhood, and in succouring those who have been wrecked; and, notwithstanding the outcry which in the fashion of the day has been raised against the trustees, they appear on the whole to have fulfilled their trust well and to have carried out satisfactorily what it may be presumed would have been in harmony with the wishes of the benevolent founder of this noble charity.

Until recently certain apartments of the castle were occupied as a residence during part of the year by the trustees in turn; the means of partly keeping in repair and restoring the building were provided by Dr. Sharp (an early trustee), who for this purpose invested a certain sum out of his private property. There are various objects of interest in the castle, some portraits, a valuable library, a collection of arms, formerly used by the retainers, and a curious well one hundred and fifty feet deep, passing through the basaltic rock and into the sandstone below. The view from the roof of the keep is magnificent in its extent and beauty, taking in the range of the Cheviots and some of the more distant Scottish hills, sweeping round over a great extent of country to Tynemouth in the south; to the east the eye ranges over a great expanse of sea the Farne Islands lying as it were at our feet, with all their memories of saints and anchorites and sad histories of shipwrecks. To these, the great feature of the excursion to naturalists, we went by boat from Bambro' on the morning of the 21st, having sent a special messenger to North Sunderland to bespeak a boat for those who might come direct from Newcastle thither.

The nearest of the Farnes is distant from Bambro' Castle about two miles, the most distant some six or seven. They number from fifteen to twenty-five (each having its distinctive name) according to the height of the tide, several of these being submerged at high water, and others, which at low water appear as one island, becoming a little group at certain heights of the tide. They are composed of basalt, similar to the rock on which Bambro' Castle stands. The largest is the inner Farne or House Island, in extent about sixteen acres, the larger portion being rock. There is a scanty vegetation on the part covered with soil, which is of a peaty nature. There is a lighthouse, a small chapel restored a few years ago by the late Archdeacon Thorp, the remains of an old building called "Prior Castle's Tower," in which Archdeacon Thorp made a few rooms habitable for occasional residence. The south and west faces of this island have cliffs of basalt seventy or eighty feet in height; on the eastern side there is a sloping shore, affording a convenient landing place for boats. On some islands to the east, called the "Wide-opens," are some of the breeding places of the birds, viz., the Terns and the Eider or St. Cuthbert's Ducks. The Staple and Brownsman, forming one island, but divided at high water, are the great breeding places for the sea-fowl; and the "Pinnacles," high basaltic columns rising abruptly from the water, separated by a narrow channel from the island, are very curious, every ledge occupied by the Guillemots and other fowl. On some of the narrow unprotected ledges of stone the birds lay their eggs in apparently the most insecure positions, with nothing to protect them from being blown over into the sea; but the form of the eggs causes them, when disturbed, to describe a very small circle instead of rolling to any distance, and thus they are preserved. On this island the man lives who watches to protect the birds, the family of the late Archdeacon Thorp continuing to hold the lease of the islands, which he obtained for the purpose of protecting the birds and their nests from indiscriminate slaughter and plunder. On some of the outer islands is a colony of the Great Seal (*Halichœrus griseus* of Nilsson): they were formerly in much greater numbers than at present. The Common Seal (*Phoca vitulina*) is also seen here frequently, though Holy Island is its more favourite resort.

Mr. John Hancock has kindly furnished me with the following list of sea-birds, which he found breeding here some years ago:—

Herring Gull, *Larus argentatus*; Lesser Black-backed Gull, *Larus fuscus;* Kittiwake, *Larus tridactylus;* Common Tern, *Sterna hirunda;* Arctic Tern, *Sterna arctica;* Roseate Tern, *Sterna dougallii*; Puffin, *Mormon fratercula;* Cormorant, *Carbo cormoranus;* Eider Duck, *Anas mollissima;* Guillemot, *Uria troile;* Oyster Catcher, *Haematopus ostralegos;* Shag or Razor Bill (occasionally). The Ring Dotterel, *Charadrius hiaticula*, was also found by Mr. Hancock. The Sandwich Tern, *Sterna boysii*, at the time of Mr. Hancock's visit, had deserted the Farnes, and was breeding on Coquet Island.

On one of the outer islands (the Longstone) is the light-house where Grace Darling lived, whose history and brave deed, on the occasion of the wreck of the Forfarshire steamer on the 8th of September, 1838, is perhaps the chief source of general interest in the Farnes. This island, a mere rock, is only very little elevated above high-water mark, and in stormy weather the spray is driven completely over it, and sometimes, during winter storms, the light keepers and their families have to resort for refuge to the upper apartments of the light-house. On this occasion we did not go out to the Longstone, but contented ourselves with visiting first the Staple and Brownsman (having written authority from Mrs. Thorp), where we saw large numbers of birds. The breeding season was over, but there were still some young Gulls unable to fly, as well as Cormorants. We next visited the inner Farne, and in rowing along saw several young Eiders. We were told by the light keeper on this island that in the season they generally get twenty or thirty Woodcocks which alight here, wearied with their long over-sea flight. We arrived back at Bambro' after a delightful excursion, though, owing to the wind being against us, a little later than we expected, still in time to see through the castle before dinner. We sat down to dinner about forty in number, and did ample justice to the excellent repast prepared for us by the landlord of the "Lord Crewe Arms." We were joined by Dr. Acland (Professor of Medicine in the university of Oxford), who with his family was occupying the rooms in the keep which are now let as lodgings.

The Fifth Meeting was held at Simonburn, or rather that portion of the beautiful North Tyne Valley lying between that village and Chollerford, we left Newcastle by the 6·35 a.m. train. On our arrival at Chollerford we were received by Dr. Bruce, who kindly acted as our guide to the Roman antiquities of the neighbourhood: it was a great addition to the enjoyment of the day's proceedings to have the objects of interest pointed out and explained by the learned author of the "*The Roman Wall.*" We first went to see the remains of the Roman bridge which at one time crossed the river at Chesters. The extensive and interesting remains now visible on the eastern side were only discovered in 1860, in the course of some excavations undertaken by Mr. Clayton. They had been covered up by beds of sand and gravel, and a plantation of fir trees was growing on them. The river in the course of time had gradually shifted its course further to the west, at the same time covering up the works on the eastern and laying bare those on the western side. Crossing the river here by means of a boat provided by Mr. Clayton, who here met us and accompanied us, we proceeded to the beautiful site of the Roman burial ground now included in the park of Chesters, and to the extensive town or station of Cilurnum, the figure of which is plainly enough visible, enclosing an extent of upwards of five acres: by means of the extensive excavations and explorations carried out by Mr. Clayton, and the explanations afforded us, we were enabled to understand a good deal of the arrangements and comforts provided by the Romans during their lengthened occupation. Having seen the extensive collection of antiquities in and about the mansion, the gardens, and other objects of interest, and having partaken of a luncheon, hospitably provided for us by Mr. Clayton, we started on our further journey, glad that so large a portion of the great work of the Roman occupation had been acquired by one so well able to appreciate, and so willing to explore and conserve it. Passing hence along the military road, interesting both from the beautiful scenery and remains of the Roman works everywhere visible, we arrived at the top of the "Limestone Bank" so called. Here Dr. Bruce bid us farewell, and Mr. Hall, Vicar of Birtley, took us under his charge and led us to the Tecket Burn, and by its beautiful fern-fringed banks to Tecket Linn, a pretty little waterfall even in this dry season, but which we have seen on former occasions with a very respectable body of water. The stream at a point some distance below the fall loses itself in its stony bed, and after pursuing a subterranean course for upwards of two miles reappears in Nunwick Park in volume sufficient to turn a water mill. We visited Nunwick (the seat of Mr. Allgood) where we were courteously shown various objects of interest. Our course hence lay through the pleasantly situated village of Simonburn to Haughton Castle: a considerable portion of the mediæval structure remains in good preservation: some additions have been made to it by the present proprietor, Mr. Crawshay, who acquired it a few years ago by purchase: its situation, overhanging one of the most beautiful portions of the North Tyne, is very fine. On our arrival we found here again refreshments hospitably provided for us, which, notwithstanding the near approach of the dinner hour, the hot walk rendered not unacceptable. A short additional walk brought us to Chollerford where we dined in number about forty.

The Club had for the last few years departed from its original rule and practice of having five Field Meetings, and had met in addition in the autumn at Marsden. The inducements for this were that as it was accessible both from Shields and Sunderland, as well as from Cleadon Lane railway station by a moderate walk, and was easily within the compass of an afternoon's holiday, it afforded to many an opportunity of being present who otherwise probably might be unable to be at any of the Field Meetings; while the coast scenery and the geology, as well as the other sources of interest, must always make it a delightful place to meet at: however, at our last Anniversary Meeting it was decided to substitute St. Mary's Island for Marsden. The Club accordingly met there on the 9th of October. I was unable to be present, but I find that forty-five members attended, and had, notwithstanding the somewhat unfavourable weather, a pleasant day under the able guidance of Mr. Wheeler, Vicar of Whitley, proceeding *via* Blyth and Tyne Railway to Backworth, thence by Earsdon and Holywell Dene to Seaton Sluice and the village of Hartley to St. Mary's Island. Some of the party availed themselves of the courtesy of the proprietors to see over the extensive Hartley Bottle Works. Tea was provided at the inn on the island; after discussing which an interesting paper was read "*On the Discovery and Description of Climaxodus linguaeformis*," by Mr. Thomas Atthey, who is justly regarded by all good naturalists as a sort of Lord of the Manor of the Coal Seams of this neighbourhood.

We have had only one Evening Meeting during the winter, viz., on the 3rd of December, when a notice was read from the Right Hon. Lord Ravensworth of some rare birds observed recently. One of them, a fine Roller, shot at Eslington, and preserved by Mr. Duncan, was exhibited. The following were also read:—"*Notes on the Fossils of the Marl Slate*," by Joseph Wright, jun.; "*Description of a new Entomostracan inhabiting a Coal-Mine*," by G. S. Brady, C.M.Z.S., &c.; "*Entomological Notes*," by T. J. Bold. Some curious earth-worms were sent for exhibition by Mr. R. Draper, of Seaham. They had been taken in the gardens of Earl Vane in Wales. They were sent for examination to Dr. Baird of the British Museum, and there seems reason to believe that they are a new species of a genus, all the species of which hitherto known are natives of Ceylon. I believe Mr. Draper will communicate a full account of them to the Club.

Such is the record of our Meetings for the past year: the more solid work of our Society is to be found in our Transactions; and we have to congratulate ourselves on the appearance of the long anticipated new Flora of our district by Mr. J. G. Baker, a valuable addition to our archives. I would also draw your attention to a criticism in the "Meteorological Magazine" on the Reports which form part of our published Transactions: it is there pronounced to be "the most complete, most interesting, and in all respects the best local Meteorological Report we have seen." This cannot fail to gratify Mr. Wheeler who undertakes the onerous duty of preparing the Reports, and the gentlemen who make the observations, as coming from those well qualified to form a judgment. The Reports for the year 1868, though they will probably not show much if any deficiency in the rainfall for the year will most likely show a great deficiency for several of the summer months, notably so (judging from an inspection of the observations at the Literary and Philosophical Society, Newcastle,) for May, June, and July. During these months most parts of the kingdom wore a sadly parched and withered appearance: if, however, we missed the green luxuriance of summer at our Field Meetings, we at any rate escaped the wettings which so often befall us in ordinary seasons.

We may congratulate ourselves on the prosperous condition of the Club as judged of by the number of members on the list and consequent revenue at the disposal of the Committee for publishing Transactions. The attendance, too, at the Field Meetings is now generally very large; indeed, frequently too large for the accommodation to be obtained; and although we may sometimes think with regret of the pleasant meetings of former days, when over the little sociable dinner we discussed our day's ramble and compared notes as to what we had each seen and done, let us hope that our large numbers, while they lessen comfort, indicate a more widely spread interest in the study of nature. Unfortunately in a neighbourhood such as is a large portion of our Club district, where there is much manufacturing enterprize, nature suffers in many respects; the smoke from many manufactories, and the noxious gases from others, much injure the vegetation, and the large population brings much persecution to the animal kingdom, especially to the birds, the continual shooting about the lanes and sea-coast, and indeed wherever there is no game preservation, especially at such times as Christmas and New-year when the numbers of idle men and careless boys with guns renders a walk a matter of some peril; and although the bill at present before Parliament, for the preservation of the sea fowl, is in most respects worthy of support, especially when relieved of the unnecessary clause about the eggs, I cannot help thinking that a tax levied on every one carrying a gun would go a long way to abate the evil, and at all events if it failed in this, it would raise a respectable sum for the revenue. It is no doubt true that gamekeepers do sometimes shoot harmless birds from ignorance and nearly exterminate some kinds, such as hawks, ravens, &c., yet the naturalist should remember that the preservation of game does indirectly extend protection to a number of other birds. In conclusion, I have to apologize for not having brought anything before you in the shape of new discoveries or views of my own: I cannot lay any claim to be an authority on any branch of Natural History, but my studies for many years lay amongst sciences having more or less direct bearing on it, and I had intended to have brought some subject before you which might have possessed an interest for naturalists, but I must honestly confess that I put off until circumstances prevented its execution in time for this meeting.

The Field Meetings for 1869 were arranged to be held as follows:—

May	Beamish.
June....................	Staward Peel.
July	High Force (Two Days' Meeting.)
August..................	Newbiggen.
September	Crag Lough.
October	St. Mary's Island.

The Treasurer's report (see p. 301) was read and adopted.

The following gentlemen were elected officers of the Club for the year 1869–70:—

President.

The Rev. R. F. Wheeler, M.A.

Vice-Presidents.

Albany Hancock, Esq., F.L.S.
E. C. Robson, Esq.
Rev. W. Featherstonhaugh, B.A.
George S. Brady, Esq.

Ralph Carr, Esq.
Rev. J. F. Bigge, M.A.
D. Embleton, Esq., M.D.
R. Ingham, Esq.
Sir W. C. Trevelyan, Bart.
T. Sopwith, Esq., F.R.S.
Rowland Burdon, Esq.
J. Hogg, Esq., F.R.S.
Rev. H. B. Tristram, LL.D.
George Wailes, Esq.
Rev. W. Greenwell, M.A.
Edward Charlton, Esq., M.D.
Rev. G. C. Abbes, M.A.
Rev. A. M. Norman, M.A.
Rev. J. C. Bruce, LL.D.
Rev. A. Bethune, M.A.
E. J. J. Browell, Esq.

Treasurer.

Robert Y. Green.

Secretaries.

Thomas Thompson. | G. H. Philipson, M.D.

Local Secretaries.

Shields, W. H. Brown. | *Hexham*, Rev. W. T. Shields.
Durham, John Booth. | *Morpeth*, W. Creighton.

Committee.

Thomas Atthey.	D. O. Drewett.
Joseph Blacklock.	John Hancock.
R. B. Bowman.	R. Howse.
H. B. Brady.	John Coppin.
James Clephan.	T. J. Bold.
William Dinning.	A. F. Marecco.

Auditors.

J. S. Foster. | T. P. Barkas.

The following gentlemen were elected members of the Tyneside Naturalists' Field Club during the year 1868–9:—

At the Anniversary Meeting, 1868:—Messrs. J. P. Gibson and W. W. Gibson, Hexham; B. C. Crawford, Walker; Chas. Carr, Cramlington Hall; George Rowell and John Mein, Newcastle.

Mr. J. G. Baker, Kew Gardens, was elected an honorary member.

At the First Field Meeting:—Messrs. T. E. Gauntlett, Wm. Smithson, R. O. Heslop, J. W. Mole, and William Easten, Newcastle; W. Sykes, Bishop Auckland; Rev. E. Jenkins and Thos. T. Clark, North Shields; J. H. Straker, Tynemouth; John Morland and Thomas Morland, Gateshead.

At the Second Field Meeting:—Messrs. Douglas Forster, Henry Dunn, L. Drizinger, and Alfred Legge, Newcastle; Thos. Angus, Ravensworth Villa; Dr. Meggett, Winlaton; Henry Clapham, Gateshead.

At the THIRD FIELD MEETING:—Messrs. G. S. Lawson, Thos. Ritson, R. A. Smith, and M. Wiener, Sunderland; J. A. Bush, Newcastle; Rev. G. R. Bulman, Durham; Thomas Luke, Tynemouth; George Bell, jun., and William Soppett, North Shields.

At the FOURTH FIELD MEETING:—Messrs. F. Corder, Sunderland; David Robertson, Glasgow.

At the FIFTH FIELD MEETING:—Messrs. Percy Westmacott, Benwell Villa; E. Pruddah, Hexham.

At the SIXTH FIELD MEETING:—Mr. J. C. Porrett, Sunderland.

At the EVENING MEETING:—Messrs. Robert Modlin, Sunderland; Joseph Brown, Forest Hall; Rev. John Jones, Dunston; William Dunn and W. H. Ryder, South Shields.

THE TREASURER IN ACCOUNT WITH THE TYNESIDE NATURALISTS' FIELD CLUB.

Dr.

April 8, 1869.	£	s.	d.
To Balance brought forward	66	19	6
" Subscriptions	130	15	0
" Sale of "Transactions"	1	7	6
" Natural History Society, 150 Copies of Portrait of Mr. Alder	2	15	0
" Ditto, 150 Copies of "Flora"	18	0	0
" Half Expense Author's Papers	1	15	0
" Ditto Evening Meetings	3	12	2
	£225	4	2

Cr.

	£	s.	d.
By Printing "Transactions"	101	16	0
" Commission on collecting Subscriptions	6	0	0
" Printing	7	19	0
" Lithographing	12	4	6
" Postage and Sundries	9	17	3
" Balance in hand	87	7	5
	£225	4	2

Examined and found correct,

J. S. FOSTER,
T. P. BARKAS, } AUDITORS.

THE TREASURER IN ACCOUNT WITH THE TYNESIDE NATURALISTS' FIELD CLUB.

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Cr.

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J. S. FOSTER, }
T. P. BARKAS, } AUDITORS.

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XII.—*A List of Fresh-water Algæ collected in Northumberland and Durham.* By George Stewardson Brady, C.M.Z.S.

The preparation of a complete catalogue of the fresh-water Algæ of our district—a work which I at one time hoped to accomplish—circumstances have compelled me to give up; but it is perhaps desirable to place on record some few memoranda made during the time when I studied these organisms. Localities for several species are given in Winch's "Flora," and notices of the occurrence of others, chiefly by Professor Oliver, may be found in the Transactions of the Tyneside Field Club. Beyond these I know of no local literature of the subject. My own collection of specimens—both marine and fresh-water—has been for some years in the herbarium of our Natural History Society, and I believe comprises specimens of most, if not all, of the species mentioned in my lists.

The subject presents a wide field for study. There is much to be done in working out the life-history of the various forms; it being beyond dispute that many of those hitherto classed as distinct species are merely stages in the existence of Lichens, Fungi, or other Algæ. Until problems of this nature are more fully solved the mere collecting and naming of specimens is a dreary and perhaps a useless task, there being no means of appreciating the meaning of facts of habitat and distribution.

The following list embraces neither Diatomaceæ nor Desmidiæ.

Vaucheria.

Many of the varieties to which distinct specific names are usually given occur abundantly in our district, chiefly in ditches, salt-marshes, and on the surface of damp rocks; but I do not myself believe in the existence of more than a very few well-marked fresh-water species. Hassall counts thirteen British species.

Batrachospermum moniliforme, *Hass.*

This beautiful species is probably of pretty frequent occurrence. I have found it abundantly in a mill-stream in Wark

Burn; also in a pool near Hedworth, and in a stone trough in Seaham Hall Avenue.

Batrachospermum atrum, *Harv.*

In the stells at Sedgefield (Morden Carr).

Draparnaldia glomerata, *Ag.*

Very common.

Draparnaldia plumosa. *Ag.*

In a spring on bank side near Ryton Station, September, 1860.

Draparnaldia tenuis, *Ag.*

Southwick, near Sunderland.

Draparnaldia cruciata, *Hicks.*

In a moss-pool south of Crag Lake, May, 1860.

Chætophora endiviæfolia, *Ag.*

Pools near Hedworth and Brockley Whins; Smalesmouth, Seaham Hall Avenue, Morden Carr.

Chætophora elegans, *Ag.*

Common on decaying plants, shells, &c.

Zygnema nitidum, *Ag.*

Common.

Zygnema quininum, *Ag.*

Common.

Tyndaridea.

Many species (so called) of this and the preceding genus, as well as of *Vesiculifera*, are common, but the majority of those given by Hassall appear to be founded on totally insufficient characters.

ZYGOGONIUM ERICETORUM, *Kütz.*

Mosses about Crag Lake and Haltwhistle.

VESICULIFERA ROTHII, *Hass.*

Very common.

BULBOCHETÆ SETIGERA, *Ag.*

Pools near Crag Lake, &c.

CLADOPHORA GLOMERATA.

Common, chiefly in streams.

CLADOPHORA BROWNII, *Dillw.*

A plant, which I believe to be referable to this species, occurs on damp rocks at the side of Hareshaw Burn.

CLADOPHORA FLAVESCENS, *Roth.*

Brockley Whins.

CLADOPHORA FRACTA, *Fl. Dan.*

Frequent.

COLEOCHÆTE SCUTATA, *Breb.*

On submerged leaves, &c., Crag Lake, August, 1863.

LYNGBYA ZONATA, (*Web & Morh.*)

Ditch south of Crag Lake.

LYNGBYA MURALIS, *Ag.*

Common everywhere.

TOLYPOTHRIX DISTORTA, *Kütz.*

Abundant in the "stells" on Morden Carr.

OSCILLATORIA TENUIS, *Ag.*

Ashburn and Hylton: Hareshaw. Probably common.

Oscillatoria thermalis, *Hass.*

In a hot-water stream at Monkwearmouth Colliery.

Oscillatoria splendida (?), *Grev.*

Stream in Hylton Dene; abundant.

Oscillatoria muscorum, *Ag.*

On Algæ in stream above Bardon Mill.

Oscillatoria nigra, *Vauch.*

Ashburn and Hedworth.

Oscillatoria contexta, *Carm.*

On footpaths, &c., round Sunderland; common.

Oscillatoria terebriformis, *Ag.*

Ditches near Sunderland, and in streams near Hartlepool.

Oscillatoria decorticans, *Grev.*

On sluice at Bardon Mill.
Var. B. on timber near Sunderland.

Microcoleus repens, *Harv.*

Side of stream at Monkton.

Raphidia viridis, *Hass.*

Covering stones on the margin of a deep pond near Brockley Whins Station, in small circular patches of a dark green or blackish colour.

Spirillum minutissimum, *Hass.*

In pools above high-water mark near Byers' Quarry.

Sphærozyga elastica, *Ag.*

At Ryton Willows and Cullercoats.

Ulva bullosa, *Roth.*

Brackish ditches at Hartlepool.

ULVA CRISPA, *Light.*

On a thatched roof at Bardon Mill.

TETRASPORA LUBRICA, *Ag.*

In stream at Ryhope Point.

TETRASPORA GELATINOSA, *Desv.*

Pool near Charlton, North Tyne, and near Bishopwearmouth Cemetery.

ENTEROMORPHA INTESTINALIS, *Link.*

Hylton Burn; ditches on Holy Island and at Hartlepool; pond near Pensher Station, &c.

PALMELLA CRUENTA, *Ag.*

Very common on footpaths and at the base of damp walls round Sunderland.

CYLINDROSPERMUM SPIRALE.

Ryton Willows, September, 1861.

PHYSACTIS PARVULA, *Kutz.*

Moat at Raby; collected by the Rev. A. M. Norman.

CLATHROCYSTIS ÆRUGINOSA, *Henfrey.*

Moat at Raby; collected by the Rev. A. M. Norman.

XIII.—*On the Occurrence of the Palatal Teeth of a Fish belonging to the Genus Climaxodus,* M'Coy, *in the Low Main Shale of Newsham.* By THOMAS ATTHEY.

(Read October 9th, 1868.)

IN this communication I wish to make known the discovery of some palatal teeth which have occurred to me during the investigations I have made in the black shale of the Low-Main Seam of Newsham. Some of these have been in my possession more than eight years, others have been found recently. In the hope of obtaining more perfect information relative to these curious teeth, a notice of their occurrence in this locality has hitherto been delayed; but it seems desirable to give a short notice of their discovery at the present time, preparatory to a more lengthened and careful description of them.

Fourteen specimens, of various sizes, have occurred to me during the above-named period. Some of these are isolated palatal teeth; but on one slab of shale, about four inches long, and $2\frac{1}{2}$ inches broad, there are remains of not less than eight teeth; and from the manner in which they are imbedded, and the presence of great numbers of minute dermal tubercles in connexion with them, there can be no doubt that they all belonged to one individual.

The general form of the upper surface of the tooth is ovate. This upper surface is supported by a bony process, which springs from the under surface, and projects beyond the smaller extremity. The narrow portion of the upper surface is crossed by from four to six transverse imbricating ridges. In the larger specimens these ridges are strongly undulated, with the upper edge roughly broken up into coarse granulations. The broader portion of this surface is occupied by a very wide furrow or hollow bounded at the broad end by a sharp, slightly denticulated margin. The narrow portion of the surface is ornamented with minute granulations; the broad furrow is striated in the direction of the length of the tooth. Three of the teeth are somewhat shorter than the rest; or, in other words, they have a more circular form.

The largest tooth measures, including the projecting bony process, an inch and a quarter in length, and is about $\frac{7}{8}$ths of an inch wide in the broadest part. The smallest tooth is rather more than $\frac{3}{8}$ths of an inch long, and very nearly the same in the broadest part. In the small specimens the groove at the broad end is nearly as large as the remaining portion of the tooth.

On comparing these teeth with the figure given by M'Coy (British Palæozoic Fossils, pl. 3 G. f. 5) of his *Climaxodus imbricatus*, they are found to agree in having the narrow portion of the tooth ornamented with transverse ridges; but a further comparison cannot at present be made, as the figure given by M'Coy was from a specimen broken at both ends.

As it appears to be advisable to attach some name to this interesting fossil, and seeing that it agrees in some essential points with the genus *Climaxodus*, M'Coy, I propose to refer it provisionally to that genus, and, further, to distinguish the species which I have found at Newsham by the name of *Climaxodus linguæformis*.

Also I avail myself of the present occasion to announce that, in addition to *Climaxodus* and the species already described in former communications to the "Annals," several other interesting forms have been obtained from the shale of the Low-Main Seam, of which no notice has been given, the most important of these being the following:—

Cœlacanthus lepturus, *Ag.*

Several entire specimens have occurred, but usually in a much disturbed state. Separate scales are not uncommon.

Strepsodus sauroides, *Huxl.*

Two or three jaws of this species, with the teeth attached, have been obtained, and numerous separate teeth.

Gyrolepis Rankinii, *Ag.*

Several specimens have occurred in a more or less complete state of preservation.

Platysomus parvulus, *Young* (?).

A few entire specimens have occurred.

Amphĭcentrum, sp. indet.

Three nearly perfect specimens have been found, and numerous mandibles exhibiting tuberculated plates.

PLEURACANTHUS LÆVISSIMUS, *Ag.*

Several fine interesting spines, in a good state of preservation, have occurred.

ORTHACANTHUS CYLINDRICUS, *Ag.*

Numerous large well-preserved specimens of this fish-spine have been obtained.

CTENACANTHUS HYBODIOIDES, *Ag.*

Five specimens have occurred, in a nearly perfect state of preservation; one specimen is eight inches long.

LEPTACANTHUS, sp. indet.

A spine or two, apparently belonging to this genus, have occurred at Newsham.

CLADODUS MIRABILIS, *Ag.*

Numerous specimens of the teeth, frequently associated with patches of dermal granules, have been found in several distant localities.

PLEURODUS RANKINII, *Ag.*

Numerous specimens of the teeth have occurred.

PŒCILODUS, sp. indet.

Numerous specimens belonging to this genus have been found.

PETALODUS, sp. indet.

Several teeth have been procured from the Low-Main Shale.

Gosforth, October 7th, 1868.

XIV.—*On a new Labyrinthodont Amphibian from the Northumberland Coal Field, and on the Occurrence in the same Locality of Anthracosaurus Russelli.* By Albany Hancock, F.L.S., and Thomas Atthey.

We have recently obtained from the black shale associated with the Low-Main Seam at Newsham Colliery, in the neighbourhood of Newcastle-upon-Tyne, the remains of a small amphibian belonging to Professor Huxley's genus *Urocordylus*.* This is the second generic form that has occurred to us in this locality of the interesting series described by that learned palæontologist from the Jarrow Colliery, in the county of Kilkenny, Ireland. We propose to name this species *Urocordylus reticulatus*. We have adopted the specific denomination *reticulatus* as expressive of the reticulated structure of the surface of the cranial bones. The specimen now before us is composed of the head and twenty-three or twenty-four vertebræ in a continuous series; the dorsal aspect of the head is exposed to view, and the vertebræ lie with their left sides uppermost. The entire length of the specimen is 2¼ inches. The head, which is much crushed and injured by the fracture of the bones, is of a subtriangular form, with the posterior region truncated, and tapering in front to a short rounded snout; and there are two large curved horns projecting backwards from the occipital region, like those of *Keraterpeton*.† In Professor Huxley's species the horns were not observed; but this is not to be wondered at, for the head was in a very bad state of preservation. In our specimen, too, the bones are so much broken up that it is impossible to determine their forms; the surface, however, of several of them is in excellent condition, and exhibits, in the most distinct manner, a coarse reticulated structure of elevated ridges or lines, which, from the elongation of the meshes in some of the bones, have the appearance of strong, raised, parallel striæ. The head measures from

* "On a Collection of Fossil Vertebrata from the Jarrow Colliery, county of Kilkenny, Ireland," by Thomas H. Huxley and E. Perceval Wright (Trans. Royal Irish Academy 1867, Vol. XXIV).

† See *op. cit.*

the snout to the occipital margin $\frac{4}{10}$ths of an inch, in width at the broadest part $\frac{5}{10}$ths of an inch; the horns are $\frac{2}{10}$ths of an inch in length.

Two or three teeth are distinguishable in one of the mandibles, but are somewhat injured; they are small, have the sides nearly parallel, and are slightly curved; the apices are apparently abruptly pointed. The sternal plates are distinctly displayed, but are in a much disturbed condition; all the three, however, can be made out, two of them being much mutilated. They lie immediately behind the head, at the left side of the specimen, towards the ventral aspect; two are a little in advance of the third. They all have the surface covered with a minute reticulation of raised lines, which assume a radial disposition, as if from centres of growth. Behind the plates, on the left or ventral side of the body, there is a sort of roll, as it were, extending someway backwards, which seems to be composed of minute elliptical scales; they are, however, very indefinite; their exact form could not be determined.

The vertebræ, of which there are twenty-three or twenty-four, are very apparent, but their precise form is rather difficult to make out; they are nevertheless in regular order, but are somewhat obscured by the matrix. They each bear a long compressed or flattened plate-like dorsal spine, which is as high or a little higher than the centrum; its dorsal or free margin is truncated and serrated; below it is contracted in the antero-posterior direction, and, expanding above, somewhat resembles a fan, the resemblance being heightened by the strong radiating striæ that cover the sides. They are very similar to the vertical processes of *Urocordylus Wandesfordii*, but more particularly agree, in proportion and character, with the subvertebral bone or spine. The three or four terminal posterior vertebræ have in addition subvertebral bones similar in form and size to the dorsal spines. From this fact it would appear that these three or four vertebræ belong to the tail; and if the new species is as rich in caudal vertebræ as *U. Wandefordii*, our specimen must have lost at least seventy of the bones of its tail. *U. reticulatus* has therefore about twenty trunk or precaudal vertebræ, the number that is found in Professor Huxley's species. The vertebræ are about $\frac{1}{10}$th of an inch in length, and in height $\frac{1}{8}$th of an inch, including the dorsal spine; the height of the caudal vertebræ, measuring from the upper margin of the dorsal spine to the lower margin of the subvertebral bone, is $\frac{1}{4}$th of an inch. The zygapophyses project laterally as well as forward and backward.

There are slight indications of anterior and posterior limbs; but the appearances are too vague to be worthy of further notice, beyond that a fragment of bone seems to mark the place of the posterior limb near the termination of the trunk-vertebræ. And not far from this point there is also a small bone, which is probably one of the phalanges.

The length of the specimen, including the head and trunk-vertebræ, is only one-fourth that of the same parts of *U. Wandesfordii;* we may therefore conclude that the latter species is four times the size of *U. reticulatus.* When perfect, *U. Wandesfordii* is upwards of 18 inches long; consequently the new species would measure $4\frac{1}{2}$ inches if entire.

U. reticulatus is evidently closely related to *Keraterpeton*, as is proved by the form of the head, the two occipital cornua, and also by the character of the sternal plates: so close, indeed, does this relationship appear to be, that we have some doubt whether it should not be placed in that genus. It is true that no occipital horns were observed in *U. Wandesfordii;* but the skull of Professor Huxley's specimen was so much crushed and disturbed that much stress cannot be placed on this negative fact; and the vertebræ of our species resemble more closely those of *Urocordylus* than they do those of *Keraterpeton.* Moreover, in the latter form there is a perceptible diminution in the size of the nineteenth vertebra, and so on to the tail, while in our species the last of the three caudal vertebræ, the twenty-third or twenty-fourth, is as large as any of the trunk-vertebræ, agreeing in this respect with *Urocordylus*, and signifying that *U. reticulatus* has a long and powerful tail, which is the characteristic feature of the genus. We have therefore provisionally placed our new species in that genus.

Another question arises—Is *U. reticulatus* a distinct species?

or is it merely the young of *U. Wandesfordii?* We believe it to be distinct, because the vertical processes of the vertebræ, though strongly resembling those of that species, differ considerably from them in certain particulars. The character of the sternal plates is also different, and the surface-structure of the cranial bones is apparently peculiar; but it must be allowed that this feature may be wanting in *U. Wandesfordii* merely on account of the curious state of preservation of the specimen from which that species was described. But be this as it may, the interest of this discovery is not lessened; and, indeed, this addition to the coal-fauna of the district is the most important that has been made since our acquisition in 1867 of *Ophiderpeton*, another of Professor Huxley's genera from the Kilkenny Coal-shales. And we cannot but deem ourselves fortunate in having met with this new species of so rare a form of *Labyrinthodont Amphibian;* for much novelty is not now to be expected from the shales of Newsham and Cramlington, which have been assiduously searched for the last fifteen years.

ANTHRACOSAURUS RUSSELLI, *Huxley*.

A large fragment of the skull of this rare fossil was obtained a short time ago at Newsham; it is a portion of the anterior part of the cranium, and happily exhibits characteristic features that cannot well be mistaken. The snout is wanting, being broken off diagonally backwards from left to right; and posteriorly the specimen is broken away in a parallel diagonal line a little behind the great vomerine tusks; so that on the right side nearly the whole of the maxilla is present; on the left the fracture passes close to the base of the large vomerine tusk, consequently the maxilla of this side is almost entirely wanting. In form the specimen is rhomboidal, being diagonally broken across before and behind; the sides are perfect; it measures lengthwise 3½ inches, in breadth 6 inches.

Both the dorsal and palatal surfaces have been cleared of the matrix, a work of much care and labour; and though the parts are crushed and distorted, many of the characters are well preserved. The sculpture of the bone on the dorsal surface is distinctly displayed, and is of the usual Labyrinthodont character, resembling very closely that of *Pteroplax;* but the pits or depressions are less regular, and the surrounding ridges are rough and much broken up. The frontal bones are broken away before and behind, but the greater part of them is evidently present; they are considerably elongated, and are a little expanded in front. A triangular bone, with its apex forward, is interposed on either side between the frontals and the maxillæ; these bones are probably the postfrontals, or they may be the prefrontals and the postfrontals in combination. On the left side a fragment, probably of the nasal bone, is wedged in in front, between the anterior extremity of the frontal and the maxilla. The sutures are represented by wide, smooth, depressed lines, but, with the exception of those of the frontals, they are not very easily determined.

The other side of the specimen exhibits the roof of the mouth, but the bones are so much crushed and broken that it is impossible to make out their forms and limits. Suffice it to say that, a little in front of the great vomerine tusks, there is on each side a large deep depression (which two depressions are undoubtedly the anterior palatal foramina), and that immediately behind and towards the outer margin of the right vomerine tusk a circular depression, upwards of half an inch in diameter, indicates the position of the right posterior naris.

The teeth belonging to the fragment are nearly all present; but many of them are broken down and displaced, and only a few retain their apices. The two great vomerine tusks are not much disturbed; that on the right side stands erect, but a large portion of the crown has disappeared. It is placed somewhat nearer to the maxilla than to the central line of the skull, and is not very far from the anterior margin of the specimen; what remains of it is $\frac{5}{8}$ths of an inch in height, and it measures across the widest part of the base $\frac{3}{8}$ths of an inch. The left vomerine tusk is crushed down close to the posterior margin of the specimen, with its base near its proper position, not far from the maxilla, and the apex pointing inwards; it is broken across near to the middle; and the basal portion overlies, to some extent, the upper part. When perfect this tusk could not be less than two inches long, and is about an inch wide at the base.

Four teeth, upwards of half an inch long, lie upon the base of this large tusk, and another, about the same size, lies pressed down a little in front of it; these have their bases attached to the maxilla, and are the only maxillary teeth of this side, a very small portion of the maxilla being present. In front of these teeth a short space intervenes between them and the base of a large tooth, which stands erect, and is $\frac{3}{8}$ths of an inch in diameter; the crown lies pressed in contact with the basal portion, and with it measures nearly an inch in length. A large depression is immediately in advance of this tooth, separating it from two other teeth equally large, or, perhaps, a little larger, which are crushed down confusedly, one over the other, at the anterior extremity of the specimen. These three large teeth would seem to belong to the præmaxilla. The teeth of the maxilla of the right side are well displayed; they stand up, for the most part arranged along the alveolar ridge with their crowns (some of which are perfect) inclined backward and inward. There are thirteen of these teeth; they vary somewhat in size, and commence in front in a line with the base of the vomerine tusk. The first seven are placed close together; the first and seventh are larger than the rest, and are $\frac{1}{4}$th of an inch wide at the base; two or three of the smaller have the crown complete; when perfect, the large ones must have been upwards of half an inch long. A short space now intervenes in the series, and then there is a cluster of four more teeth, three of which are rather large and one small, the latter being placed between the first and second of the three; all their crowns are broken off; the bases of the three larger measure $\frac{1}{4}$th of an inch in diameter. Behind these is a large depression; and then the series is terminated by the two last teeth, the twelfth and thirteenth, which are placed near to each other. All that remains of the former is a very short stump, almost $\frac{1}{4}$th of an inch in diameter; the latter is apparently quite small, and is represented by a mere fragment, which is placed close to the fractured margin of the specimen.

In number and size the teeth do not exactly correspond to those of the specimen from the Lanarkshire Coal-Field described by Professor Huxley;* but the disparity in these respects does not amount to much. In the Scotch specimen there are thirteen teeth described in the left præmaxilla and maxilla, while nineteen are enumerated as attached to the same bones of the right side. In our specimen there are thirteen maxillary teeth on the right side and three præmaxillary teeth on the left, one or two apparently being wanting. So it would seem that the Newsham specimen, when perfect, had, in all probability, sixteen or seventeen teeth in the upper jaw on each side; but as the number in the two sides does not apparently agree in the Scotch specimen, our specimen may have had two or three teeth more or less on either side, thus altering the number to thirteen or nineteen, as in the specimen described by Professor Huxley.

The palatal teeth, however, are wanting in the Newsham specimen. On the left side the bone to which they are attached is broken away; but on the right side there is a ridge behind the vomerine tusk, which, perhaps, may be the alveolar plate; if so, the teeth have been removed; there are, however, some fragments in the vicinity, which possibly belong to the palatal teeth of this side.

The teeth on the whole are somewhat less than those of the Scotch specimen, and this disagreement cannot be accounted for by the difference in size of the skulls. The Scotch skull is 5·3 inches in width opposite the vomerine tusks. Our specimen measures across the same region 5·5 inches; so the latter would appear to be the larger of the two. But this is probably not the case, for our fragment seems to be a little widened by pressure. The skull, however, of our specimen, when perfect, could not be much, if at all, smaller than that described from Scotland, which is stated to be 15 inches long, and 12 inches wide at the

* Journal of the Geological Soc., Vol. XIX., p. 56, 1863.

widest part. That they were of nearly equal size is apparently confirmed by the dimensions of the vomerine tusks.

Those of the Newsham specimen seem to be quite as large as those of the Scotch specimen; in both they are about equal in diameter at the base. It is true that Professor Huxley estimates their length in the Scotch specimen to be three inches, while, judging from the fragments, we have calculated that the left tusk in our specimen could not be less than two inches long; but how much longer it may have been we cannot determine. It is certain that the two fragments into which it is broken, when taken together, measure upwards of two inches in length; and it is impossible to say how much the basal portion overlies the upper: moreover the latter is bent, and the apical extremity is wanting. We think, then, that the disparity in the number and size of the teeth and tusks is not sufficient to cause us to doubt the specific identity of the two specimens in question.

We must now turn to the character of the teeth themselves. In our specimen they have the same irregularly rounded base as those of the Scotch specimen; and like them they are, towards the apex, a little flattened, giving to the section of the crown an elliptical contour, the long axis being in the direction of the jaw; and on the frontal and dorsal aspects they are slightly carinated. So far the teeth agree; but Professor Huxley describes the surface of those in his specimen as ridged, not grooved, while in ours they may be said to be both grooved and, to some extent, ridged. The base of the teeth, when in a good state of preservation, exhibits narrow, shallow grooves, the interspaces being comparatively wide and usually a little prominent, though sometimes almost flat. This difference in the two instances is, perhaps, of not much importance, and may be accounted for by the peculiar state of preservation of the specimens: we shall shortly endeavour to show that this is the fact; in the meantime we will say a few words on the internal structure of the teeth. In this respect there is also some slight difference; our sections of the teeth and those described by Professor Huxley do not exactly agree. The only difference of any consequence, however, can be explained, we think, by supposing that the sections were made from different parts of the tooth. In *Pteroplax* the pulp-cavity, near the root of the tooth, is radiated, as it is in *Anthracosaurus;* a little nearer the base the radial spaces are wider, a little further up they are contracted, and still higher up they are contracted more, and ultimately they are lost, and the cylindrical form of the pulp-cavity established. We may therefore presume that the sections described by Professor Huxley were made near to the base of the tooth in *Anthracosaurus*, and consequently the radial form of the pulp-cavity was strongly developed. Our sections are from higher up the tooth, and the result is, that the radiation of this cavity is very imperfect and in part obliterated. In other respects the structure appears to agree with Professor Huxley's description; but this observation applies only to the general arrangement of the parts; for, as the learned Professor remarks, "the details could only be made intelligible by elaborate figures," and such were not given.

In Mr. Atthey's collection there is a portion of a right mandible which was obtained at Newsham, and which we originally thought belonged to *Pteroplax*, but which we now have no doubt belongs to *Anthracosaurus*. The surface-sculpture of the bone, the general form, character, and internal structure of the teeth demonstrate this since we have become acquainted with these features in that genus.

The fragment, which is upwards of $2\frac{1}{4}$ inches long, $1\frac{1}{2}$ inch wide behind, and $\frac{3}{4}$ths of an inch wide in front, is the anterior portion of the right mandible; it has attached to it five teeth; in front it is perfect; the posterior portion is broken away close to the fifth tooth, which, though much injured, appears to be about half an inch long. The three next in advance are not quite so long, and are separated from the fifth and from each other by considerable spaces, and from the tooth in front by a space $\frac{3}{8}$ths of an inch in length. This frontal tooth, which is perfect, is half an inch long and $\frac{3}{10}$ths of an inch wide at the base; it is placed a little way from the extremity, where there is a depression, but whether for the reception of the base of a tooth cannot be determined. The surface of the teeth is ridged, particularly towards the base, agreeing in this respect with those in the Scotch specimen: they are a little compressed above; and one, which is tolerably perfect, has the apex slightly carinated.

On making a section of one of the teeth, it is quite obvious that the ridges on the surface are owing to erosion, if not entirely, at least mainly, and that the internal structure agrees very well with that of *Anthracosaurus* when allowance is made for the variation caused by the sections not being made at the same part. Our section was made a little way up the tooth; while those of the Scotch specimens were, as we have already explained, evidently made close to the base.

There can therefore be little doubt that this fragmentary mandible really belongs to *Anthracosaurus*. We have, then, the satisfaction of recording the occurrence in the Northumberland Coal-Field, not only of a considerable portion of the cranium, but likewise of a large fragment of the jaw of this rare fossil.

The large sternal plate, nearly five inches long, described in our paper on *Pteroplax*,* is probably that of *Anthracosaurus*. It was found in the same locality, and this is the only large Labyrinthodont occurring in the Newsham shale to which it can at present be assigned, We also possess some ribs and vertebræ which perhaps belong to the same animal.

XV.—*Note on Anthracosaurus*. By ALBANY HANCOCK, F.L.S., AND THOMAS ATTHEY.

IN the following brief remarks, we wish to supply a note to our paper on *Anthracosaurus* and *Urocordylus*, published in the September number of the "Annals." In that paper we described a large portion of the skull of *Anthracosaurus*, and a portion of a mandible belonging also to the same Labyrinthodont. We spoke likewise of the occurrence of a central sternal plate, ribs, and vertebræ which we thought belonged to that Amphibian. We are now in a position to show that another considerable fragment of a skull of this interesting Labyrinthodont has occurred

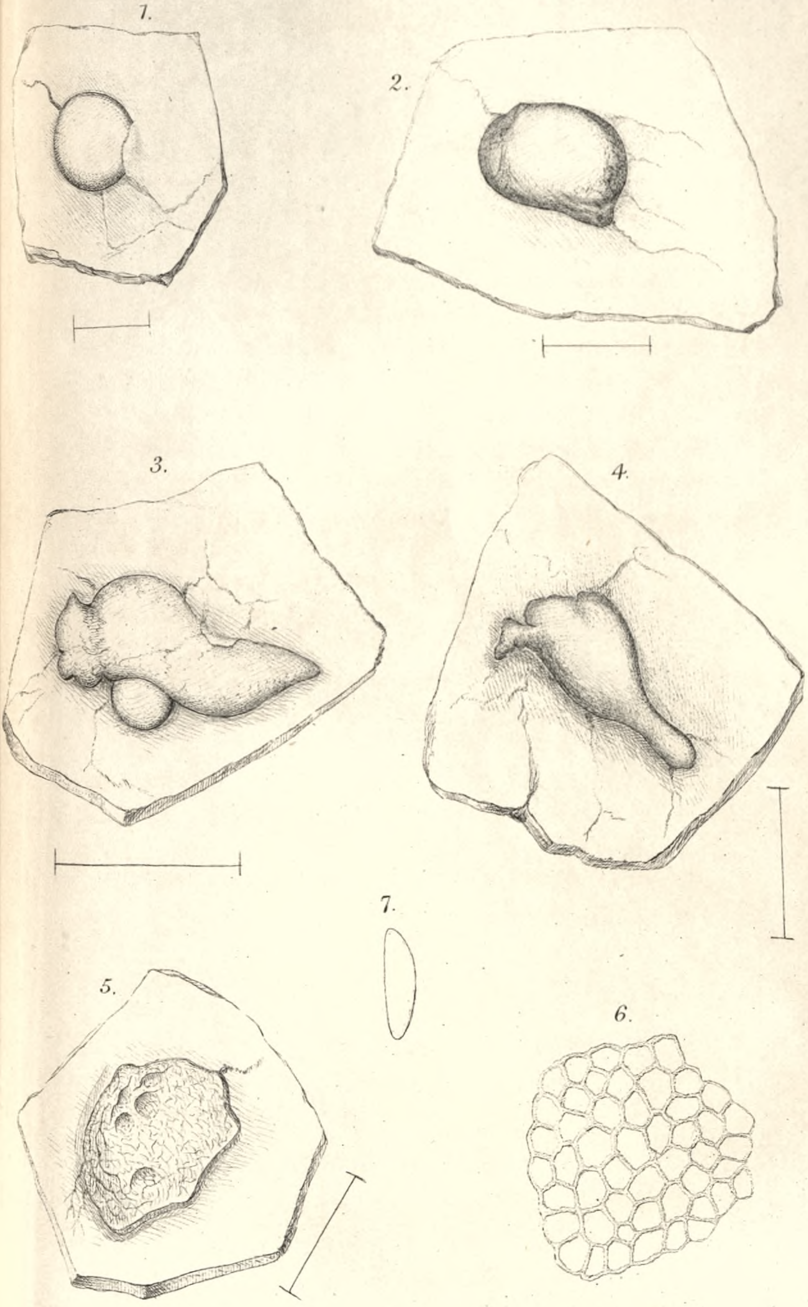
* See Annals of Nat. Hist., Ser. 4, Vol. I., p. 277.

in the same locality, the true nature of which fossil however has been misunderstood.

In the "Annals," some months ago, Mr. T. P. Barkas described what he considered to be a malar bone as large as that of a full-grown crocodile. Having obtained some authentic information respecting this enigmatical bone, we are not surprised to find that it has no resemblance whatever to a reptilian malar, and that it is, in fact, composed of several of the upper cranial bones of the Labyrinthodont alluded to.

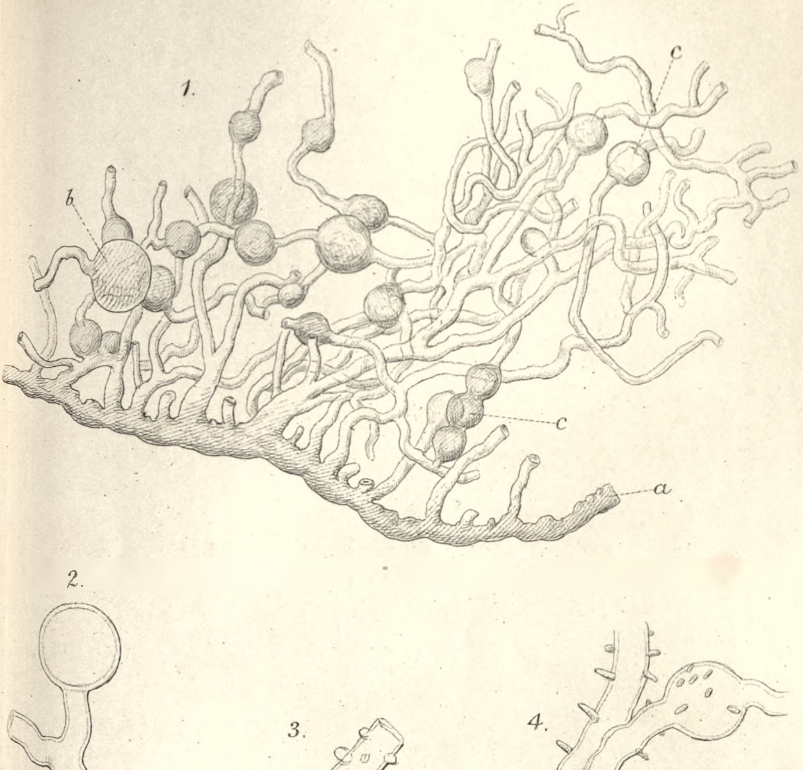
Mr. William Dinning, a clever young palæontologist, was allowed by the owner of the fossil in question to make a drawing of it; and he has kindly permitted us to refer to his figure, which represents the specimen of the natural size, and has all the appearance of great accuracy. With the aid of this drawing, and the original incomplete description in the "Annals," there is no difficulty in determining the real nature of this so-called malar. That it is the upper portion of the cranium of a Labyrinthodont there can be no doubt; neither can there be any doubt that it consists of the two frontals (which are quite distinctly displayed), the parietals, and the greater portion of the supraoccipitals.

We have recently had an opportunity of examining a perfect cranium of a large Labyrinthodont resembling *Loxomma.* In this specimen the contour of the combined frontals, parietals, and supraoccipitals resembles the general contour of the bones composing the so-called malar in the most remarkable manner; only in this fine cranium they are altogether more elongated in proportion to their width than they are in it; and, besides, in the former the outer margins of the frontals are parallel, or nearly so, while in the so-called malar the frontals considerably widen anteriorily. Now in *Anthracosaurus* this is precisely the case; and though in our specimen of this Labyrinthodont, described in the paper before referred to, the frontals are a little larger than those of the so-called malar, they agree with them exactly in form and proportion. This is sufficiently evident, notwithstanding that they are not quite perfect. Moreover, the surface-sculpture of the bone in *Anthracosaurus* is very similar



A. Hancock, del. Tuffen West, sc.

W. West, imp.



A. Hancock, del. Tuffen West, sc.

W. West, imp.

to that represented in Mr. Dinning's drawing; and indeed Mr. Dinning says that the surface-sculpture in the two is exactly the same.

We can therefore have little difficulty in concluding that this so-called reptilian malar is really a considerable portion of the upper central bones of the cranium of *Anthracosaurus*. It was found in the same locality that supplied our specimen of this Labyrinthodont, and not very long before it occurred.

XVI.—*On some curious Fossil Fungi from the Black Shale of the Northumberland Coal-Field.* By ALBANY HANCOCK, F.L.S., AND THOMAS ATTHEY. (Plates VII., VIII.)

It is now about ten years ago that a few sections of certain lenticular bodies were made and their peculiar tubular ramifications revealed. These bodies were then supposed to be of vegetable origin, and were procured in the Cramlington black shale. At the time we took these tubular ramifications to be those of a parasitic fungus related to the unicellular fungi described by Kölliker;* and as such our specimens were exhibited at one of the early microscopic soirées held by the Tyneside Naturalists' Field Club.

Since we first became acquainted with these curious and interesting bodies, we have collected a vast number of specimens (not less than one hundred and fifty) at Cramlington, Newsham, and other localities; and, having been engaged for the last few months investigating the subject, we now propose to give a succinct account of the results at which we have arrived, reserving for some future occasion more complete details of our researches.

First, then, with regard to the bodies themselves in which the peculiar structure alluded to is found. They are frequently circular, a good deal depressed and lenticular, with one side generally flatter than the other, sometimes quite flat. The largest

* See Ann. & Mag. Nat. Hist., Ser. 3, Vol. IV., p. 300, October, 1859.

are upwards of $\frac{4}{10}$ths of an inch in diameter, and nearly $\frac{2}{10}$ths of an inch in thickness. Oval, depressed forms also occur, one of which in our possession is [illegible]ths of an inch in length, though one extremity is wanting, and $\frac{7}{10}$ths of an inch wide. But by far the greater number are somewhat irregular in form, mostly partaking, however, of the circle or ellipsis: one such elongated specimen is an inch in length. Some have the margin a little sinuous; others are even pedunculate, or at least have a narrow produced process at one end; and it is not uncommon to find them very much flattened, squeezed out as it were till the margins are quite sharp. The surface is invariably dull and much like the matrix in texture, though in one or two instances we have perceived indications of a reticulated structure. They leave the matrix with great facility, frequently dropping out of it on the shale being split open.

When sections of these bodies are viewed by transmitted light, they vary in colour from carmine to warm yellow, resembling much in this respect fossil wood from the same locality, though the latter is never so bright in tint. Like fossil wood, too, the sections have a tendency to warp when placed on the slide, and consequently the outer margin or rim is frequently cracked all round on putting on the cover.

That they are non-calcareous is proved by a very simple experiment. If we place a fossil tooth or bone from the Newsham shale in dilute nitric acid, a violent effervescence immediately ensues, and the result is that in an hour or two the specimens are either entirely broken down or are so much reduced that they crumble to pieces on being touched with the finger; hence it is evident that such fossils from the above-mentioned locality retain their calcareous matter not much, if at all, changed. Now when we treat one of the lenticular bodies in question with nitric acid of the same strength no action whatever takes place, and after being immersed in it for several hours no perceptible effect is produced. Fossil wood from Newsham shale is likewise unaffected when subjected to the same influence. We have thus a proof that these lenticular bodies are non-calcareous, and strong presumptive evidence as to the probability of their being of vegetable origin.*

Indeed that they are so does not admit of a doubt. If there were no other evidence of the fact, it is demonstrated by their organic structure. Originally, as already stated, we took this organic structure (the tubular ramifications) to be a parasitic fungus, and the substance in which it was imbedded to be wood. And assuredly the tubular ramifications resemble very closely those of the unicellular fungi before alluded to, many species of which we have in our possession. The size and general character of the tubes, the mode of ramification, and particularly their bulbous enlargements, all agree very well with what we observe in these peculiar bodies. But there is one important difference: while, in the unicellular fungi, the tubes never sink deep into the substance in which they are lodged, ramifying immediately below its surface, those of the lenticular bodies, though they are connected with the periphery, permeate the entire mass. Our recent investigations, however, compel us to the conclusion that the whole, including the substance in which the tubes ramify, is but one organism, and that it is a fungus of a peculiar nature, related apparently in structure, and to some extent in form, to *Sclerotium stipitatum*, a very curious and abnormal species from India, described by Messrs. Berkeley and Currey in the "Transactions of the Linnean Society" (1862, Vol. XXIII., pp. 91 & 93). The internal structure of this living species is so similar to that of some of the coal-fungi in question, that, were it fossilized, it would assuredly be considered one of them. "The mass consists," says the Rev. M. J. Berkeley, "of very irregular, swollen, and sometimes constricted, more or less anastomosing, and more or less densely compacted threads." These words might be used to describe the tubes of *Archagaricon conglomeratum*, one of our fossil fungi described in the sequel.

We have in our possession a section of *Sclerotium stipitatum*, and, after carefully examining it, we can find no important difference distinguishing it from sections of our coal-fungi. The

* Some account of these lenticular bodies has recently been given, in "Scientific Opinion," by Mr. T. P. Barkas, who supposed them to be fish-otolites.

irregular character of the tubes, their nodular enlargements, and the large terminal vesicles, are all features that are found in both the recent and fossil species. And, moreover, many of the larger "threads" or tubes in *Sclerotium stipitatum* can be seen abutting with their ends against the dark peripheral cuticle, just as the tubes do in the fossil species, the bark or cuticle of which is similar in definition and thickness, and is also dark and opaque.*

On examining sections of these lenticular fungi from the coal-shale, we find that they occasionally appear to be almost, if not entirely, homogeneous, and that, when perfect, they always exhibit a peripheral bark or cuticle of considerable thickness, though they vary in this respect, the cuticle being sometimes comparatively thin. The colour, as before mentioned, varies from a pretty clear carmine to a warm yellow, the intensity, of course, varying with the thickness of the section, and also, to some extent, the tint. But the apparent homogeneity is not by any means constant; indeed, by far the greater number of specimens show the peculiar structure before mentioned, some to only a slight degree, others very extensively, the whole mass being filled with, nay, almost composed of, ramifying tubes. The tubes vary considerably in size in the different species (for there are many species of these fungi), and, in fact, to some extent, in the same species. In some they measure $\frac{1}{400}$th of an inch in diameter; in others they are quite minute, being only $\frac{1}{15000}$th of an inch in diameter; in some they are plain; in others, again, they terminate in large bulb-like swellings, and have here and there similar but smaller enlargements, two or three of such being occasionally placed close together. The tubes always appear to originate in the peripheral cuticle.

The mode of ramification also varies: in some species the

* Since the above was written we have obtained from Newsham a very interesting specimen of our new fungus, with the surface in excellent preservation. We have stated in the text that traces of surface-reticulation had been observed: in this new specimen the whole surface is covered with a minute angular reticulation, sharply defined by grooves, and resembling most closely the cuticular reticulation represented in the figures of *Sclerotium stipitatum* illustrating the paper of Messrs. Berkeley and Currey already referred to; so that in general form, in this peculiar surface-reticulation, in the thickness and character of the cuticle, and in internal structure our fossil fungi agree with this peculiar species from India.

tubes are long, and may be said to branch rather freely; but in others they are cramped and much contorted; they are usually inextricably involved; and in a few instances they radiate from centres, and are short, sinuous, and stout. In all cases they terminate in rounded extremities when not in bulbs.

The branches are very frequently sharply defined, and exhibit a double marginal line, indicating that they have proper walls. They are occasionally filled with the matrix; and then they are black and perfectly opaque, and have a very striking appearance. The contained black matter is continuous with the external matrix, and from this fact it may be inferred that the tubes open externally; indeed, their arrangement seems to indicate this; however, they are usually transparent, and reveal within their walls oval spore-like bodies, which pervade both the branches and the bulbous enlargements. Similar spore-like bodies are frequently scattered through the substance of the fungus amidst the ramifications; and in a few specimens in our possession these spore-like bodies are thickly scattered throughout the entire substance, no tubes or any other structure being perceptible. In others, again, nothing is observed in the homogeneous matter except circular vesicles resembling the bulbous enlargements of the tubes; in some instances such vesicles, large and small, are mingled together, and have scattered amidst them the spore-like bodies. In one remarkable specimen the vesicles seem to be formed into a connected congeries towards the margin.

Another variety of these curious fungi has the outer bark or cuticle rather thick, and it seems to be composed of two or three layers. Immediately within the innermost layer there is a thin stratum of minute granules, which in some specimens is much extended, and the granules enlarged. In the former the quarter-inch object glass is requisite to resolve them; in the latter an inch glass shows them very well. And, what is rather peculiar, at certain points of the circumference the bark or cuticle is folded inwards, the *outer* layer to a much less extent than the *inner*, thus leaving a wide space between the two. These inward foldings, of which there are three or four, bulge considerably into the substance of the fungus, and are somewhat reniform or ear-shaped. The stratum of granules follows the infoldings with the greatest regularity.

There is still another variety, which differs considerably from all the rest. This is without tubes, the whole substance being composed of large polygonal cells having the appearance of coarse cellular tissue, with here and there a dark, irregular, spherical body.

Such are the variations in the structure of these Coal-Measure fungi. They are, we have said, occasionally structureless, or nearly so; but this is rarely the case. We have sixteen specimens that appear either homogeneous, or almost so, out of one hundred and twenty-six sections, all the rest (one hundred and ten) exhibiting more or less structure. This fact militates strongly against the idea we at first entertained, that the tubular structure was a fungus parasitic in the bodies in which it is found. Were such the case these figures ought to be reversed: sixteen bodies so affected might be found in one hundred and twenty-six; but certainly we should never expect to find out of that number one hundred and ten affected and sixteen only free from the parasite.

The apparent entire homogeneity of some specimens, and the apparent partial homogeniety of others, can be accounted for as the result of fossilization. Fossil wood and other vegetable substances have frequently the structure either wholly or partially obliterated by pressure. This is not uncommonly the case with wood found in the Newsham Coal-shale; and it can scarcely be doubted that such is the case with the fungi in question. We presume that the general substance of these bodies is composed of cellular tissue (and, indeed, in one of the varieties above mentioned we have seen that it is chiefly made up of cellular tissue, and traces of such a structure have been observed in one or two other instances), and that by pressure this is almost universally obliterated. The ramifying tubes, with the spore-like bodies, being of a less delicate nature, or in some way less perishable, are sometimes preserved throughout the mass, at other times only partially preserved; occasionally the tubes are so strongly defined, that every characteristic is retained; again so delicate and attenuated are they, that their margins only can be perceived, dying out until the faintest traces of them subside into the surrounding homogeneous substance.

Those specimens that exhibit only cell-like bodies, large and small, may have had likewise ramifying tubes, and pressure may have obliterated them; or they may have had a continuous connected congeries of cells opening at the surface, as the tubes would seem to do; and in one instance, at least, extensive traces of such a structure exist. In this case the spores will have been developed in the cells; and, in fact, spore-like bodies have been observed in connexion with these cells.

We have already stated that the tubes originate in, and apparently open at, the periphery of the fungus, and that spore-like bodies are occasionally found within the tubes and the bulbous enlargements in connexion with them. Such being the case, it is only necessary to suppose (and indeed from what we have seen apparently the fact is such) that the tubes are invaginated prolongations of the outer envelope or cuticle, in order to bring the organization of these coal species into some accordance with the structure of the higher fungi, in which the spores seem to be always developed in connexion with folds, tubes, or processes of one kind or other of the enveloping membrane or cuticle, or, more correctly speaking, of the hymenium, which is itself apparently a continuation of the peripheral investment.

We shall now conclude this very imperfect account of these interesting Coal-Measure fungi with concise descriptions of a few of the more characteristic species, leaving the rest (probably as many more) for further investigation, which we hope will throw additional light on this intricate subject.

DESCRIPTIONS OF SPECIES.

1. Archagaricon bulbosum.

Tubes of equal size, about $\frac{1}{1000}$th of an inch in diameter; the main branches pretty straight, long, somewhat sinuous, with the secondary branches much contorted, involved, and crowded;

occasionally papillose, and frequently terminating in large spherical vesicles, and with smaller bulbous enlargements, sometimes two or three in close succession, their diameter being three or four times that of the branches, the terminal vesicles being much larger.

Several specimens of this species have occurred; and we have two or three of what we consider to be a variety of it with similar branches; but neither have they bulbous enlargements nor are they papillose. The peculiarities of this variety are probably owing to its state of development.

2. Archagaricon globuliferum.

Tubes various in size, the larger about $\frac{1}{2000}$th of an inch in diameter, smooth; both stems and branches straight or very little sinuous, with numerous globular enlargements five or six times the diameter of the tubes, and with a few extremely large spherical vesicles many times larger than the globular enlargements, some of them $\frac{1}{80}$th of an inch in diameter.

This species is distinguished from *A. bulbosum* by the straightness, smoothness, and minuteness of the branches, and also by the more numerous globular enlargements, and particularly by the great size of the terminal vesicles. Several specimens have been obtained.

3. Archagaricon radiatum.

Tubes large, measuring $\frac{1}{600}$th of an inch in diameter, short, smooth, a little tortuous, and appearing as if radiating from centres, but not with much regularity; their margins are not always exactly parallel, but usually somewhat irregularly sinuous.

This is a very characteristic species, and cannot be confounded with any other. We have two specimens exactly agreeing in the above characters; a third has, in addition to the radiating tubes, large, irregular, rounded vesicles. The variation is probably owing to a different state of development. The fungus is elongated and rather small.

4. Archagaricon dendriticum.

Tubes very minute, $\frac{1}{15000}$th of an inch in diameter, arranged in dendritic tufts in connexion with the periphery of the organism, and having interspersed large elliptical vesicles, which are apparently terminal. When the branches are crowded, the tuft-like arrangement is obscured.

We have only two specimens of this pretty species; they are irregularly circular, and are quite minute, being only $\frac{1}{10}$th of an inch in diameter. They do not exactly agree in internal structure, one of them having the terminal elliptical vesicles much more numerous than the other, and the organism crowded throughout with a vast number of similar vesicles.

5. Archagaricon conglomeratum.

Tubes large, uneven, cramped, and warty, irregularly enlarged and occasionally much constricted, anastomosing, and studded with cells of various sizes, sometimes so numerous that the tubes are much obscured, the whole mass appearing filled with them.

Several specimens have occurred of this well-marked species. The tubes are occasionally constricted to $\frac{1}{3000}$th of an inch in diameter, and are sometimes enlarged to considerably more than twice that size. They are of an irregular form.

EXPLANATION OF PLATES VII. & VIII.

PLATE VII.

Fig. 1. Lenticular form of *Archagaricon.*
Fig. 2. Oval form.
Fig. 3. Irregular elongated form.
Fig. 4. Pedunculate form.
Fig. 5. Irregular form, with minutely reticulated surface.
Fig. 6. A portion of the surface enlarged to show the reticulations.
Fig. 7. Transverse section of lenticular form.

PLATE VIII.

Fig. 1. General view of a few of the tubes, much enlarged, of *Archagaricon bulbosum*: *a*, peripheral envelope or cuticle of the fungus; *b*, one of the large terminal vesicles; *c*, tubular enlargement.

Fig. 2. A portion of a tube of the same species more highly magnified, with a terminal vesicle, showing the double marginal line.

Fig. 3. An enlarged portion of a tube, with bulbous swelling and papillose walls.

Fig. 4. The same, showing spore-like bodies within: *a*, spore-like bodies.

Fig. 5. Terminal extremities of three tubes without enlargements, showing double marginal line.

XVII.—*On the generic identity of Climaxodus and Janassa, two Fossil Fishes related to the Rays.* By Albany Hancock, F.L.S., and Thomas Atthey. (Plate IX.)

When the paper on the teeth of *Climaxodus linguæformis* was published,* it was not thought desirable to hazard an opinion as to their arrangement, or whether they were palatal or mandibular, or whether or not they belonged to both the upper and lower jaws. Since then we have obtained information that throws much light on the subject of these curious dental organs.

Mr. Howse having called our attention to some well preserved specimens of the teeth of *Janassa bituminosa* of Münster† from the Marl-Slate, it was at once obvious, as pointed out by that gentleman, that they were closely related to those of *Climaxodus*—so closely, indeed, that they seem to be generically the same. The differences are only those of proportion, there being not a single character of importance to distinguish one from the other.

The teeth in both forms are depressed and elongated in the antero-posterior direction, and taper a little backwards; in front there is a wide concave margin, which, standing up like a scoop

* Annals of Nat. Hist., Ser. 4, Vol. II., p. 321.

† Beiträge zur Petrefactenkunde, Heft V., p. 38, tab. 15, f. 10–14.

or dredging-bucket, is the cutting edge; behind this the surface is covered with transverse imbricated ridges, forming the grinding or crushing portion; and further down, on a lower plane, the broad depressed root projects backwards and downwards for a considerable distance. In profile they present a sigmoid curve, the frontal scoop-like portion standing up in the direction of the oral cavity, the posterior or root extremity being turned downwards in the opposite direction.

The above description will do equally well for either *Climaxodus* or *Janassa*. Our Coal-Measure species, however, *C. linguæformis*, Atthey, is considerably wider in proportion to its length, and the transverse imbricated ridges are stronger and much less numerous than they are in *Janassa bituminosa*. But *C. imbricatus*, M'Coy, from the Mountain-Limestone, seems somewhat intermediate between the two: it is proportionally narrower, and the ridges are much finer than in *C. linguæformis*.

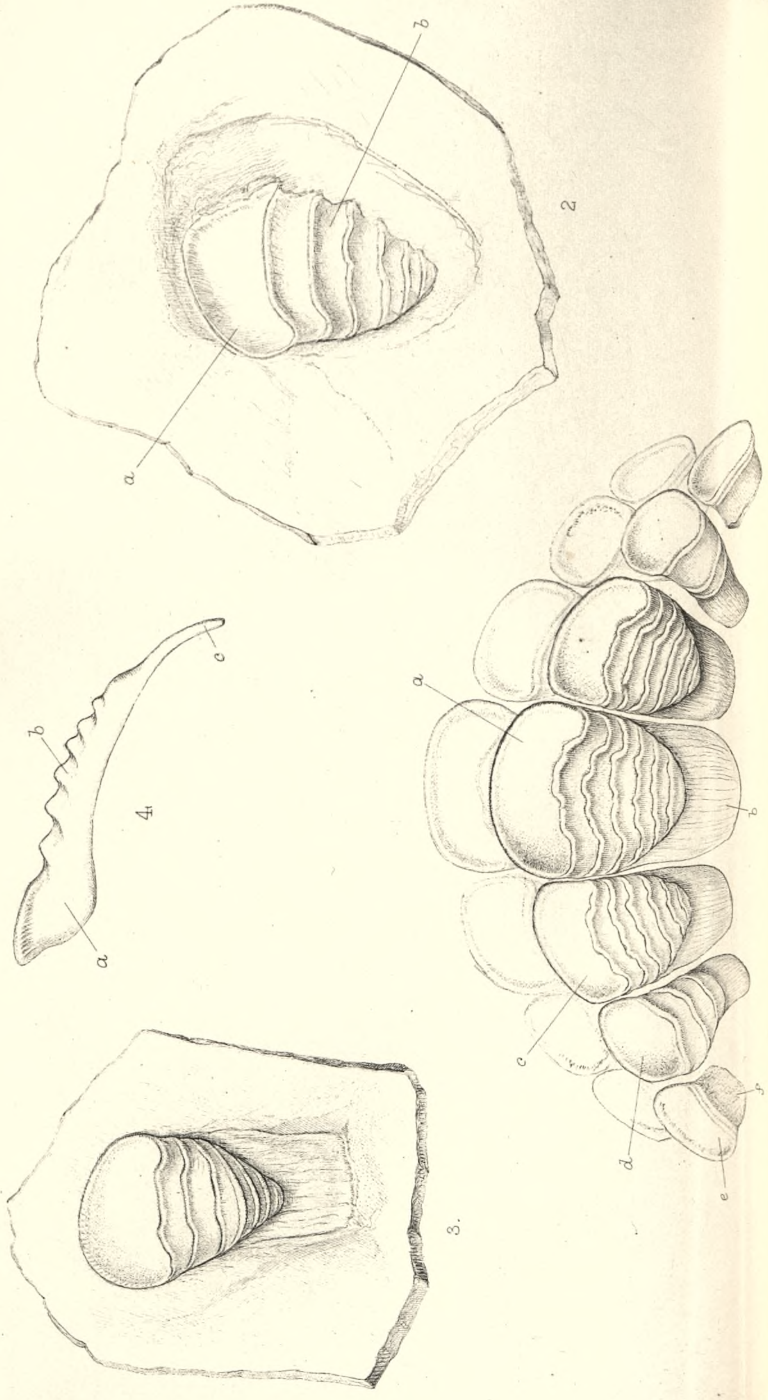
From these teeth alone the generic identity of all the three might be safely predicated; but there is further evidence in proof of the fact. *Climaxodus* and *Janassa* are both provided with two kinds of teeth. Those already indicated may be looked upon as the principal or primary dental organs; the other kind or the secondary, in the two genera, resemble each other just as closely as do the primary; and it is interesting to find that these secondary teeth agree pretty closely with some of those included in the genus *Petalodus* of authors, only they are oblique.

In *Janassa* the association of these Petalodontoid teeth with the primary ones is too obvious to be called in question. In this form the two kinds are actually found arranged in order side by side. This is proved by the specimens already referred to and by Münster's excellent figures. The Petalodontoid form has likewise been obtained associated on the same slab with the primary teeth of *Climaxodus*. We have in our possession a small slab, not so large as the palm of the hand, on which there are seven primary teeth, three or four of which lie in their natural position. On this slab there are likewise three of the Petalodontoid form, two being in contact with the primary teeth, and apparently not far removed from their original position.

Six or seven other specimens of these secondary teeth have occurred scattered in the same shale in which the primary teeth are found. The secondary teeth have a certain resemblance generically to the primary teeth, and specifically they have characters in common with their respective primary teeth. Nevertheless they are scarcely generically distinguishable from the *Petalodus* of authors, though they are, as already stated, oblique.

Having said thus much with respect to the external characters of the teeth themselves in the two genera in question, we must now make some remarks about their arrangement in the mouth. In *Janassa* it is clearly demonstrated, both by the specimens and figures before alluded to, that the teeth are similarly arranged in both the upper and under jaws. In this genus they are placed in slightly arched transverse rows, the largest symmetrical primary tooth being situated on the median antero-posterior line, and projecting a little in advance of the others. On each side of this there are two similar teeth, but somewhat less, the outside one being twisted obliquely; the row is then terminated on either side by one of the Petalodontoid form. There are therefore seven teeth in each row, including both kinds—five primary, two secondary. Munster represents five or six such rows in close succession from back to front, the teeth and rows gradually diminishing in size forward. It is evident, then, that the arrangement of the buccal armature more closely resembles that of the Rays than the Cestracionts or the Sharks; and indeed notwithstanding the difference in the teeth themselves, in their arrangement they agree in a remarkable manner with those in *Myliobatis aquila* and *Zygobatis marginata*—a relationship which was recognized by Agassiz.* In the extraordinary dental apparatus of these two interesting forms the teeth or plates are placed crosswise on the anterior portion of the jaws in rows succeeding each other from back to front. The largest primary tooth is median: on each side of it there are two other primary teeth, both of which are small in the first genus, and only one in the second; all these teeth are characterized by having six sides; and each row is flanked by a small or secondary tooth,

* Poissons Fossils, Tome III., p. 375.



A. Hancock del. Tuffen West sc.

W. West imp.

distinguished by having only five sides. Thus it appears that each transverse row is composed of seven teeth, five of which may be looked upon as primary, two as secondary, arranged exactly as the teeth are in *Janassa*, and agreeing with them exactly in number.

Now it cannot be doubted that the disposition of the teeth is the same in *Climaxodus* as it is in *Janassa;* and in fact the specimens of the former, on the slab previously mentioned, verify this assertion when aided by the light derived from the latter. Alone perhaps these specimens might have justified the inference; but taken in connexion with what is known respecting *Janassa*, there can now be no hesitation upon the subject. Indeed the large symmetrical, central teeth of two rows lie in proper order one over the other; and in contact with the upper one, and side by side with it, is the first lateral tooth in its exact true position; and a little further away, but almost touching it, is a secondary tooth, apparently belonging to this side. Overlying the first, lateral, primary tooth in front are the distorted remains of what seems to be the second lateral tooth. On the other side of the central tooth, and some little distance from it, is another primary tooth, which, from its oblique form, is undoubtedly the second lateral tooth of this side: it lies in juxtaposition to its flanking Petalodontoid tooth. All these teeth, with the exception of that last named, lie with their crowns uppermost, and belong to one row; the central tooth and the three lateral teeth of one side are all present, and lie nearly in their natural order; and the second lateral tooth and the secondary tooth of the other side are not far removed from their right position. So here we see a whole row of seven teeth complete, with the exception of one of the first lateral teeth. Two other small lateral teeth are on the same slab, and rest with their faces downwards, or in the opposite direction to those already spoken of. These belong apparently to the opposing jaw, and both lie in contact with the large central teeth; and one of them, as an opposing tooth, occupies its correct position by the side of the upper central tooth. A third Petalodontoid tooth lies a little apart, and probably belongs to this jaw.

On another small slab recently obtained there is a fine specimen of a second lateral tooth associated with a secondary tooth.

From the above it appears that there is evidence enough to show that in *Climaxodus*, as in *Janassa*, the teeth are placed in transverse rows of seven teeth each, one being symmetrical and central, and six lateral, three on each side, the extreme lateral tooth on either side being Petalodontoid in form, that there are more rows than one, and that they are placed in both upper and under jaws. In fact it is quite evident, not only that the teeth in *Climaxodus* agree in external character with those in *Janassa*, but that they also agree with them in the mode of arrangement.

The minute structure of the teeth in the two so-called genera is very similar. In both the centre of the tooth is composed of osteo-dentine, having branched anastomosing medullary canals, which are for the most part arranged lengthwise, and give off from their sides rather coarse tubules into the surrounding matter. The canals likewise send off comparatively small branches, which subdivide dichotomously as they approach the periphery of the tooth. Here many of them abut perpendicularly to the surface. The walls of these small branches assume the character of dentine, and the interstices between them are filled up with opaque white matter—probably cement; so that, by the unequal wear of these peripheral components, the surface of the tooth is always kept rough, having the granular and punctate appearance before spoken of. When quite fresh, there is a thin film of enamel covering the surface; but this seems to disappear rapidly with the use of the tooth.

The teeth of both *Climaxodus* and *Janassa* agree with the above general description; but in the latter the material appears more dense, and the cement is in greater abundance and is distributed more regularly than it is in *Climaxodus*, consequently it is found to assume a pretty regular reticulated appearance on the surface when a little worn down.

The generic identity, then, of *Climaxodus* and *Janassa* seems pretty certain; and as the latter was established many years (1832) before the former (1848), the genus *Climaxodus* must merge into that of *Janassa*. Ultimately, perhaps, *Petalodus* will be found to be more closely related than can at present be demonstrated; for it is not only in the Petalodontoid form that a resemblance is observed, but likewise in the primary teeth themselves, which show a remarkable similarity in general form to some of the *Petalodontes*.

Professor M'Coy seems to think that his *Climaxodus imbricatus* is related to *Pœcilodus*. The relationship, however, with this genus seems to us to be remote, though it may have some characters in common with *Janassa*.

The bodies of these two fishes, *Janassa* and *Climaxodus*, were covered with shagreen. In the former it is beautifully preserved, the granules being highly polished, irregularly rounded, with one side a little flattened and obtusely denticulated. On the small slab, with numerous teeth of *Climaxodus*, already noticed, is a great quantity of granular matter, but the granules are much disturbed: a few however are well displayed, and show considerable resemblance to those of *Janassa*, but the denticulations at the side are produced into sharp points, and the surface is undulated.

Although *Climaxodus linguæformis* was pretty fully described in the paper already referred to we will make, on the present occasion, some general remarks on the teeth in our possession, and also redescribe them.

The species cannot be considered common, though we have obtained eighteen primary teeth in the shale at Newsham and elsewhere, and eight of the secondary or Petalodontoid form. The largest of the former is $1\frac{3}{8}$ths of an inch in length, including the root, and upwards of $\frac{7}{8}$ths of an inch wide at the broadest part. The smaller are not more than $\frac{6}{8}$ths of an inch long, and are oblique: these are the second primary teeth. There are three about this size in the collection. We have one however which, from its obliquity, is undoubtedly a lateral tooth, that is only $\frac{3}{8}$ths of an inch in length. They are ovate, depressed, with the broad extremity anterior. The crown is upwards of two-thirds of the entire length, and is divided into two portions, anterior and posterior: the former is a wide, hollow, arched, scoop-like cutting-margin, which in some specimens is obscurely and minutely crenulated or denticulated, and is usually quite sharp. This portion occupies the anterior third of the crown; the posterior two-thirds is shield-formed, somewhat convex, with the point directed backwards and the sides evenly arched outwardly. This is the crushing or grinding-surface, and is traversed by strong transverse undulated ridges imbricated forward, and divided by wide deep grooves. In fully developed specimens there are six such ridges; but the number varies, some having four, others five; and in the small, second lateral, oblique individuals there are only three. The ridges bend upwards at the sides, and usually arch a little forward at the centre, where they are most strongly undulated, and sometimes deeply notched and angulated, roughened and granulated. But they vary considerably in these respects, some being almost smooth; and in one of our specimens all the ridges are comparatively even, though here and there slight undulations are perceptible. From this comparatively smooth state there is every degree of undulation to the most rugged. In fact, the smoothness is very much owing to wear; and in such specimens this portion of the crown is generally much reduced in thickness. The form of the grinding division of the crown also varies considerably. We have said that the sides arch outwards; they are, however, not unfrequently quite straight, and when this is the case, and the anterior ridge is free from undulations, the area assumes the form of an equilateral triangle, with one of the angles directed backwards: in two or three specimens the area is even wider than long, with the lateral angles more acute than usual. In such individuals the scoop-like cutting-margin occupies half the crown. The root is a wide plate as broad as the tooth, and tapers slightly backwards; behind, it is rounded, convex above and concave below, and projects backwards on a lower plane, the crown being elevated above its upper surface.

The second primary or lateral oblique teeth are very inequilateral, one side being concave, the other convex; they have only three ridges, with the grooves very wide; the scoop-like cutting-margin is deep, oblique, and projects laterally on the concave side.

The largest Petalodontoid or secondary teeth are nearly $\frac{4}{8}$ths of an inch wide and $\frac{3}{8}$ths of an inch long: they are inequilateral and oblique with one side concave, the other convex; they are depressed, and the crown is somewhat longer than the root; the former consists principally of a wide, sharp, hollow, scoop-like cutting-margin, which in fresh specimens is obscurely denticulated; the grinding-surface is very short, and is represented by only two transverse close-set delicate ridges immediately below the cutting-margin; the root tapers a little backwards, and is truncate.

From the character of the teeth above described, it may be inferred that the food of *Climaxodus* was composed of some soft material, notwithstanding the rather formidable appearance of the grinding or crushing-surface. The cutting-edge of the scoop-like margin is sharp and thin, and does not seem calculated to seize hard and resistant bodies; and though it is frequently worn evenly down, its sharpness is maintained, often, apparently, by the wearing of the outside, as though the teeth had been overlapped by those that opposed them. And, moreover, the edge is not broken or chipped, as might be expected if it had rough work to perform, or came into contact with bony or shelly bodies. Neither are the ridges of the crushing-surface broken, but worn regularly, retaining their sharpness, though in a few instances they are much reduced in height, as if they might even ultimately by long use entirely disappear.

At present only three species of *Janassa* are known, namely, *J. bituminosa*, Schlotheim, from the Magnesian Limetone; *Climaxodus imbricatus*, M'Coy, from the Mountain Limestone; and *C. linguæformis*, Atthey, from the Coal-Measures. Two species have been described by Mr. T. P. Barkas, under the respective names of *C. ovatus** and *C. vermiformis*.† The first is merely the variety with comparatively smooth ridges; the second is the true *C. linguæformis*, which latter was the name first used.

* Geological Magazine, Vol. V., p. 495. † Ibid, Vol. VI., p. 381.

Mr. Barkas's two names must therefore fall into the rank of synonyms.*

Climaxodus imbricatus is somewhat intermediate between the Magnesian-Limestone species and that from the Coal-Measures. The crown is narrower and more elongated than it is in *C. linguæformis*, and the ridges are more delicate, thus approximating to *Janassa bituminosa.* The anterior cutting-margin seems to have been deep; but the extreme border is wanting in M'Coy's figure: the root is also deficient. In the description in the "British Palæozoic Fossils" the posterior extremity is mistaken for the anterior.

Mr. Howse will shortly publish in the "Annals of Natural History" a full description of the oral armature of *Janassa bituminosa* in continuation of this paper. It therefore only remains for us to state that the species will stand thus:—

JANASSA, 1832, *Münster.*
Climaxodus, 1848, M'Coy.
J. bituminosa, 1820, Schloth., sp.
J. imbricata, 1848, M'Coy, sp.
J. linguæformis, 1868, Atthey, sp.

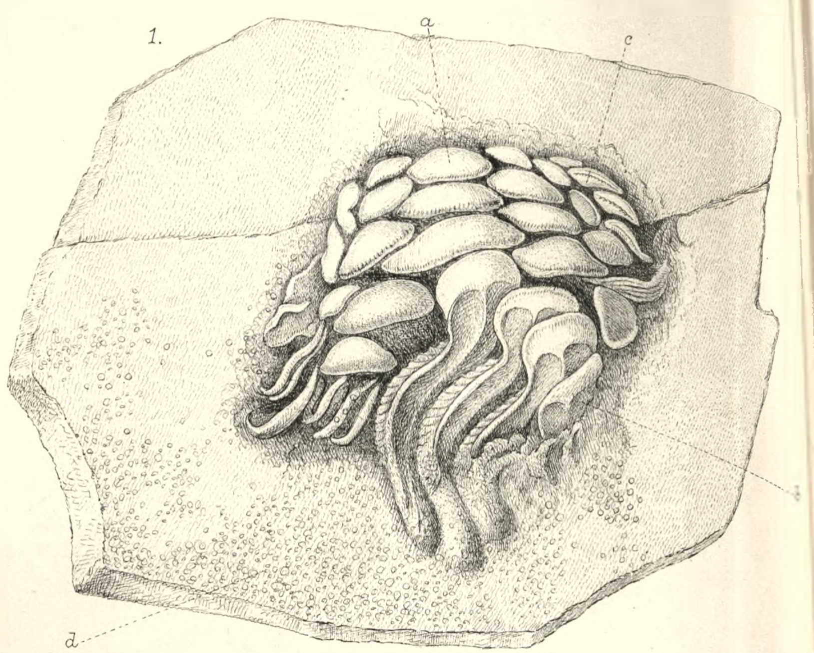
EXPLANATION OF PLATE.

PLATE IX.

Fig. 1. Two rows of teeth of *Janassa* (*C.*) *linguæformis*, a little over the natural size, arranged in order, the anterior row merely indicated: *a*, central primary tooth; *b*, root; *c*, first lateral primary

* *C. vermiformis* was not described till 1869. Mr. Atthey's description of *C. linguæformis* and that by Mr. Barkas of *C. ovatus* appeared simultaneously on the 1st of November, 1868: the first in the "Annals of Natural History," the second in the "Geological Magazine." Mr. Atthey's paper, however, was read at the meeting of the "Tyneside Naturalists' Field Club" on the previous 9th of October (see "Nat. Hist. Trans. of Northumberland and Durham," Vol. III., p. 295), so that the priority of *C. linguæformis* is clearly established. And moreover Mr. Atthey's specimens had been in his cabinet for many years, and were seen, or might have been seen, by all the palæontologists of the district. Mr. Barkas, indeed, says that he named and described *C. ovatus* in a lecture delivered by him, on the 28th of September, to the Mechanics' Institution of Newcastle-upon-Tyne. But even were this strictly correct we apprehend it would be no such publication of the species as to secure priority. Where, however, is the record either naming or describing at this time *C. ovatus?* We have searched for it in vain.

1.



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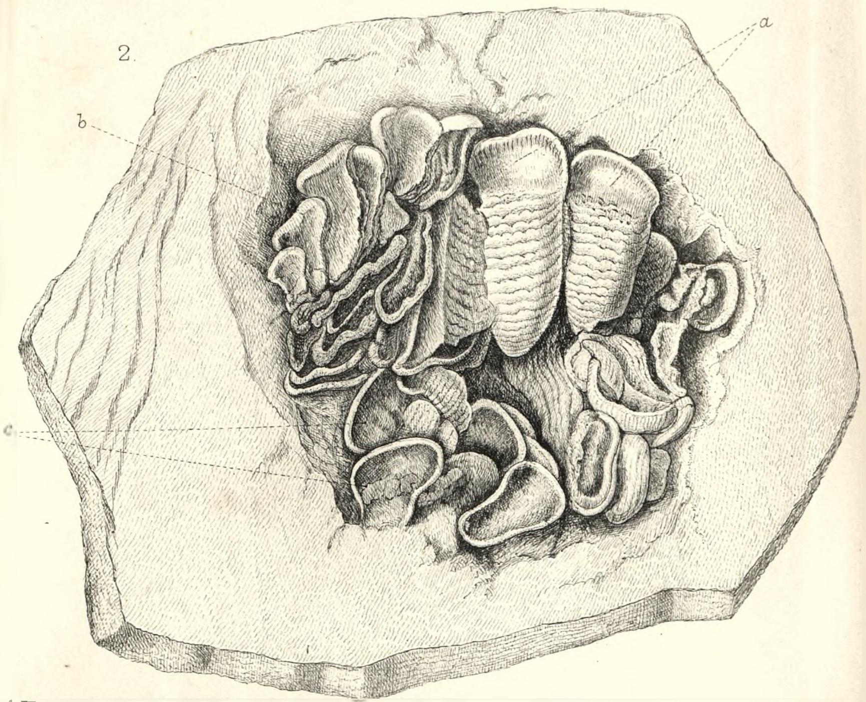

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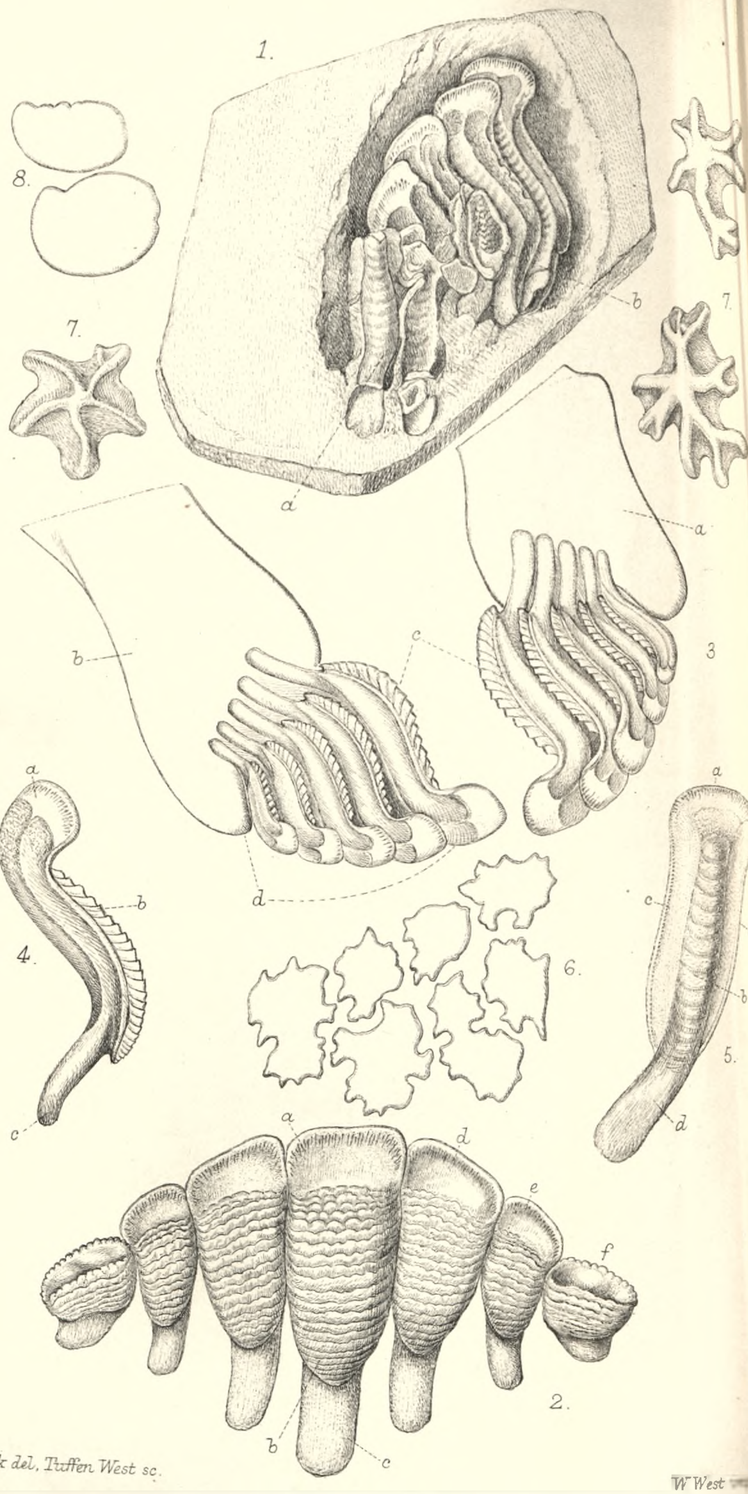


A. Hancock del. Tuffen West sc.

W West

tooth; *d*, second oblique ditto; *e*, secondary or Petalodontoid form; *f*, root of ditto.

Fig. 2. Primary tooth of *J. linguæformis*, smooth variety, slightly enlarged: *a*, scoop-like cutting-margin; *b*, grinding or crushing-surface.

Fig. 3. Primary tooth of the same a little enlarged; worn variety, intermediate between the smooth variety and those much undulated.

Fig. 4. Diagram of profile of primary tooth: *a*, scoop-like cutting-margin; *b*, crushing or grinding-surface; *c*, root.

XVIII.—*On Janassa bituminosa*, Schlotheim, *from the Marl-Slate of Midderidge, Durham.* By Albany Hancock, F.L.S., and Richard Howse. (Plates X, XI.)

Through the obliging kindness of Joseph Duff, Esq., who has been for many years actively investigating the fossil flora and fauna of the south of Durham, we have lately had an opportunity of thoroughly examining the structure of the jaw-teeth and shagreen skin of this most interesting addition to the fauna of the English Marl-Slate, which is the exact equivalent of the German Kupferschiefer.

Four groups of these remarkable jaw-teeth have been obtained by Mr. Duff at Midderidge—the first group in the year 1865, and the others during the autumn of the present year, 1869. These are, we believe, the first and only specimens that have been discovered in England.

But in Germany this species has been frequently found in the Kupferschiefer, which is very much worked, on account of the valuable copper-pyrites which it contains, in numerous localities; and consequently the general appearance of these teeth must be well known to those who are familiar with the works of Schlotheim, Münster, Geinitz, and others. According to the last-named author, the beautiful specimen still preserved in the Dresden Museum was well figured in the Dresden Magazine in the year 1762. Afterwards, in the year 1820, it was described by Schlotheim as a Trilobite, under the name *Trilobites bituminosus*

(Petrefactenkunde, p. 39); and in 1823 two figures were given by this author, in his "Nachtrag" ii., tab. 22, f. 9 *a*, 9 *b*.

Between the years 1833–1843, Count Münster figured and described numerous examples of the strongly characterized teeth and the shagreen skin of this peculiar fish under two or three generic and five or six specific names. These teeth were by him supposed to be palatal (an opinion which seems to be entertained by later German authors), and to belong to a fish of the Placoid order. After carefully examining the descriptions and figures given by Count Münster, we fully agree with those writers who consider that the following references belong all to one species, and we also are quite assured that the specimens obtained from the English Marl-Slate are perfectly identical with those described by this author in his Beiträge zur Petrefactenkunde:—Heft i. *Janassa angulata*, p. 67, Taf. 4, f. 1, 2; *J. Humboldii*, p. 122, Taf. 14, f. 4; *J. bituminosa*, Schloth., p. 122. Heft iii. *J. angulata*, p. 122, Taf. 3 & 4, f. 5 *a; Dictea striata*, p. 124, Taf. 3 & 4, f. 1, 3, 4; Taf. 8, f. 3, 4, 6, 7, 8, 9, 10. Heft v. *Janassa dictea*, pp. 37–39, Taf. 15, f. 10–16. *Byzenos latipinnatus*, Heft. vi. p. 50, Taf. 1, f. 2.

About the same time *Janassa* was briefly described by Agassiz under the name of *Acrodus larva*, Poiss. Foss. iii. pp. 147, 174, 376, tab. 22, f. 23–25; and this learned author for the first time pointed out the probable affinities of these remarkable fish-remains.

Later German authorities, and especially our friend Dr. Geinitz, had already arrived at the conclusion that the various species of *Janassa* and *Dictea* described by Count Münster must all be brought back to one form, to which, by right of priority, Schlotheim's specific name should be attached. Indeed Dr. Geinitz has so recently (Dyas, 1861) examined and carefully commented on the various species described by Count Münster, that we think it better to give a translation of his remarks than to offer detailed ones of our own, especially as Dr. Geinitz would have the advantage of seeing many of the German specimens, and as we do not, excepting in one or two points, differ in opinion from the conclusions arrived at by this excellent naturalist.

In fact, Münster himself seems to have been satisfied that his genera *Janassa* and *Dictea* were identical, and also to have had some doubts as to the value of some of the species which he has made of *Janassa bituminosa*. Dr. Geinitz observes :—

"The beautiful original of *J. Humboldti* in the Dresden Museum (Dyas, tab. 4, f. 5), of which a very good figure was given in the year 1762 in the 'Dresden Magazine,' and which happily was recovered from the ashes of the fire at the Zwinger, is again figured here, because Münster's figure is reversed. This still beautiful specimen deserves a new illustration because it furnishes a proof, that not only all Count Münster's species of *Janassa*, but also his *Dictea striata*, must be referred to the type to which the first name given by Schlotheim belongs.

"The oval, uniformly arched palate (Gaumen) is paved with from five to seven rows of chisel-formed, strongly curved at their upper enamelled end, and nail-shaped recurved teeth, which are indistinctly imbricated, and which are separated by a deep furrow into an anterior and a posterior division.

"In the teeth of the anterior division the nail-formed end is bent backwards to the throat (*ib.* tab. 5, f. 3), in those of the posterior, on the contrary, forwards (*ib.* tab. 5, fig. 4). The three middle rows of the anterior division, of which each one has six teeth, the size of which increases from before backwards, contain generally the largest teeth: only these three rows have been figured by Schlotheim, who thought he saw in them the structure of the Trilobites. On each side lie two more rows of smaller teeth, which stand obliquely to the primary rows, and of which the outer ones only appear to be lamelliform.* They are not shown in Münster's figure of *J. angulata* (Beitr. i. tab. 4, f. 1, 2). In Beitr. iii. tab. 3 & 4, f. 5, they are only partly to be seen; but on the *J. Humboldti* they are better shown, while in Münster's *J. Dictea* (Beitr. v. tab. 15, f. 10) they stand a little separated, certainly from the result of dislocation.

"The posterior shorter group of teeth, which in Münster's figure (Beitr. v. tab. 15, f. 10) is represented as correctly as possible, contains as many longitudinal rows of teeth as the

* The lamelliform teeth of Geinitz are those we have named petalodontoid.

anterior division, which in size decrease backwards, and stand in five transverse rows. Their upper enamelled end seems in all to be bent forwards, or in the opposite direction to those of the anterior group of teeth. Münster ascribes such a curvature to two teeth only, which in his specimen are situated immediately between the two divisions of the palate and out of place (Beitr. v. p. 39, tab. 15, f. 13, *g*, *h*); but he announces expressly that this palate is a little drawn out and dislocated, for which reason the teeth are not in their usual regular position.

"In our *Janassa*, the original of *J. Humboldti*, Münster, all the remaining teeth of the first cross row of the posterior division, from the line *a b*, have an equal curvature forwards of their upper part. The teeth of the cross rows standing behind them are only marked by broken roots. This specimen shows yet another character of the genus *Janassa*, which has not yet been described in any other specimen. At the posterior part of the head, or rather at the entrance of the throat, there are two large, similarly formed, bent teeth (*d d*), like all the others of the posterior division, which Count Münster took for ear-bones (Beitr. i. 1843, p. 122).

"On the specimens which are broken through parallel to the palate-plate, as in 'Dyas,' tab. 5, f. 1, the six-sided form of the teeth shows itself clearly; but the boundary between the anterior and posterior divisions of the teeth shows itself also on these very distinctly, as the front teeth of the former have the anterior side concave and the hinder convex; but on the latter this appears reversed (*ib.* tab. 5, f. 1). In Münster's figures this relation is only taken into consideration in *J. Dictea*.

"In our *J. Humboldti* (*ib.* tab. 4, f. 5) the first cross row of teeth of the posterior division is by pressure driven close to the last cross row of the anterior division, and partly under it, for which reason one cannot see the separating furrow; and Count Münster has felt himself justified in placing *J. Humboldti* with *Dictea* (Beitr. v. p. 38).

"From the similar form of the teeth of Münster's *Janassa* and *Dictea*, of which the structure is always tubular, while the outer surface of the root shows more or less distinct transverse roots (Dyas, tab. 4, f. 5, *c*, and tab. 5, f. 1), and from the perfectly similar arrangement of the teeth in *J. angulata*, *J. Dictea*, and *J. Humboldti*, Münster, with that in our figures, which cannot be recognized in Münster's ideal and quite incorrect figure (Beitr. iii. tab. 3 & 4, f. 2), there can exist no doubt whatever as to the identity of both genera and the five different species in them.

"In *Dictea striata*, Münster (Beitr. iii. tab. 3 & 4, f. 1), the whole contour of the fish appears before us, though the swimming-appendages which surround the body permit a different explanation, because this specimen lies more on the belly. The length of the fish, without the caudal fin, is 0·390 metre; the height of the head 0·080 metre, the body at the pectorals, not including these, 0·071 metre; the greatest width between the ventrals and the pectorals 0·110 metre, at the anal fin 0·055 metre, and at the base of the tail 0·035 metre broad. The whole body and all the fins or swimming-enlargements are covered with a fine shagreen skin.

"The specimen shown (Dyas, tab. 5, f. 1) widens out at the back of the head on each side in an arched, triangular, wing-shaped, blunt process (*c c*), which may represent the cross-bone (*os transversale*).

"*Byzenos latipinnatus*, Münster, 1843 (Beitr. vi. tab. 1, f. 2, p. 50), from the Kupferschiefer of Richelsdorf, is a fragment covered with fine shagreen, but which does not admit of a perfect description, and which might just as well be referred to *J. bituminosa* as to any other genus of fish."

With the above remarks we entirely concur, excepting the statement that the teeth of *Janassa* are palatal, as it is proved, by their relationship to *Myliobates*, that they are true jaw-teeth. The other remark that does not appear to us satisfactory is, that the two bodies designated by Count Münster ear-bones are considered by Dr. Geinitz to be teeth placed near the entrance of the throat. The specimens from our locality do not show a trace of these peculiar bodies; but we are disposed to consider them casts of a pair of cranial cavities rather than teeth. That they are not teeth seems to be clearly indicated by the entire absence of enamel covering, as pointed out by Count Münster.

Dr. Geinitz has also incorrectly classified this fish with the Cestracionts; but, by the observations made in a former paper, it will be seen that we agree with Professor Agassiz in placing *Janassa* among the Rays.

We now, after these introductory remarks, proceed to give a general description of the oral armature of this curious fish, and in conclusion a special description of the several specimens obtained by Mr. Duff.

The dental apparatus of *Janassa bituminosa* is very peculiar; it cannot, however, be distinguished generically from that of the so-called *Climaxodus linguæformis*, Atthey, the Coal-Measure representative of Münster's genus; and for a comparison of the two we would refer to the previous paper on the subject, published in the November number of the "Annals."*

The teeth of the fish now before us, like those of the Coal-Measure species, are of two kinds, primary and secondary, the latter being petalodontoid in form. The largest of the primary, including the root, are 1¼ inch long, and half an inch wide; they are elongated, somewhat depressed, ovate, tapering a little posteriorly, and have the surface divided into two well-marked portions—an anterior scoop-like cutting-margin, and a posterior ridged crushing-surface or disk, with a long depressed root extending backwards (Pl. X., figs. 2, 4, 5). The scoop-like cutting-margin is considerably more than one-fourth the entire length of the crown: it projects upwards and forwards, and is smooth and concave, with the edge usually obtuse and arched or a little sinuous from wear, but when comparatively fresh is pretty regularly arched, and when quite perfect is probably denticulated, if we may judge from the small lateral teeth. The crushing surface or disk is elongated, the sides being nearly parallel, though tapering to a blunt point behind, the general form resembling that of a lengthened shield. The surface is convex, and is covered with about twenty close-set transverse

* Hancock and Atthey, "On the Generic Identity of *Climaxodus* and *Janassa*." In the figure of the restored row of teeth of the so-called *Climaxodus linguæformis* illustrating the former paper, the under row is represented as in advance of the upper, purposely to indicate its relation to the latter. But the specimen clearly demonstrates the fact that the upper row projects a little in advance of the under, as is the case in *Janassa bituminosa*.

ridges, imbricated forwards, and irregularly undulated, notched, and tuberculated, and arched forwards at the sides.

The scoop-like cutting-margin and the crushing-disk we shall call the upper surface, these being, in fact, the only exposed portions, though in reality they represent the surface that is usually considered the back of the tooth. The other or opposed surface, which in ordinary cases would be called the front, we shall name the under surface, because it is undermost as the tooth rests on the jaw. The under surface, then, presents a very peculiar appearance: it is divided into three sharply defined, longitudinal, flattened areas or facets, so that in transverse section this side would show as half a hexagon. The central area, which is divided from the two lateral areas by a ridge or angle, is usually a little channelled. The back of the scoop-like cutting-margin is also a little flattened at the sides and centre.

The root is a depressed process, longitudinally striated, somewhat narrower than the crown, and about half its length: it originates in the under surface near to the posterior extremity, and arches backwards and downwards. It is consequently an extension, as it were, of the crown in a plane below the crushing-disk.

When seen in profile the primary teeth are observed to assume a decided sigmoid curve, the anterior scoop-like cutting-margin being turned rather abruptly in one direction, and the posterior extremity of the crushing-disk and root in the other or opposite direction (fig. 4).

The large primary teeth, which hold a central position, are symmetrical; the smaller lateral ones, though they agree in every other respect with the above, are more or less oblique; the sides being unequal, particularly the scoop-like portion, one side of which is more developed than the other. And the root likewise is turned a little to one side, especially in the second lateral.

The secondary or petalodontoid teeth are not more than $\frac{3}{8}$ths of an inch long, and about the same wide; they are depressed, and partake otherwise of the general characters of the primary teeth. They are more inequilateral and oblique than the smaller primaries, one side being much more arched than the other. The cutting-margin is slightly arched and denticulated, but is narrow and only a little concave; the crushing-disk, too, is wider than long, the transverse imbricated ridges being reduced to about half a dozen.

The upper surface of all the teeth, whether primary or secondary, is covered with a thick layer of opaque white enamel-like matter. This has a very striking appearance, contrasting as it does with the dark hue of the rest of the tooth, and being strongly defined around the margin by a thickened rim, which is best seen when the tooth is turned with its face downwards. And, moreover, when the enamelled surface is a little worn, it becomes pitted and freckled all over with dark irregular points, which are sometimes elongated, particularly on the anterior or cutting-margin.

There is little difficulty in determining the manner in which these curious teeth are placed in, or rather on, the jaws; for apparently the whole of the teeth of both jaws have been found lying in their original position, though the jaws themselves have entirely disappeared, they having undoubtedly been composed of cartilage. Having carefully examined Mr. Duff's specimens, which will shortly be described, and after a full consideration of Count Münster's figures and descriptions, we can have little hesitation in giving the following account of the arrangement of these rather extraordinary dental organs—and this notwithstanding that we are acquainted with nothing exactly like it, either in fossil or recent fishes, except in the so-called *Climaxodus*.

First, then, the teeth are arranged in both upper and lower jaws (Pl. X., figs. 2, 3) in precisely the same order. In both they are placed in transverse horizontal rows, across the anterior portion of the jaws, and in such a manner that never more than a single row in each jaw is in operation at the same time. Each such horizontal row is composed of seven teeth (five primary, two secondary), placed lengthwise, with the cutting-margin in front. A large symmetrical primary tooth is situated on the longitudinal median line, or exactly over the symphysis; on each side of this central tooth are a first and a second asymmetrical primary tooth, making up the five primaries. These are flanked on either hand with a single secondary or petalodontoid tooth, completing the full complement of seven. They diminish in size from the centre, the flanking petalodontoid teeth being quite small in comparison with the large central primary tooth.

The rows are placed one above the other in horizontal ranges, the lower rows acting merely as mechanical supports to the upper row, or that which was alone employed in cutting and crushing the food. There are from four to seven such horizontal rows, the teeth diminishing in size downwards, the lower ones having been first developed, and in succession having had their period of active operation. As they wear out (that is, as the cutting-margins become blunt, and as the imbricated ridges of the cutting-disks are obliterated or reduced), a new row is developed behind, and, rising up, falls forward, and rests upon the row last in use; while at the same time the dentigerous membrane is pushed forward, and the oldest row, the lowest in the series, or that which was first developed, falls away. Thus, by this double action of growth and decay perpetually going on, there is always an efficient row at the surface, able to initiate the process of alimentation, sustained at a proper elevation on a firm basis.

This constant renewal of the oral armature is nothing extraordinary, as it is common to all the Sharks and Rays, the close allies of *Janassa*. But that the new set of teeth should overlie and be supported by the old ones is indeed without a parallel, so far as we are acquainted with the subject of ichthyic dentition, with the exception of the so-called *Climaxodus linguæformis;* and that interesting Coal-Measure species has been shown to be a true *Janassa*, in the paper previously quoted from the November number of the "Annals." The only instance that occurs to us in which something similar is found is seen in the Greenland Shark, *Squalus borealis*, in which the older teeth of the lower jaw lie in front of, and give support to, the last developed or those in use. Teeth of *Petalodus*, we believe, have also been found lying in regular order, as if forming a portion of a vertical row.

This curious pile of teeth forms a close, dense mass, increasing in size upwards, or as the last-developed teeth are approached—the smaller rows of teeth, as already stated, being below; and the teeth themselves are, as it were, interlocked. The central teeth of each horizontal row are the only ones that are placed exactly above each other; the lateral teeth of the successive rows are arranged in quincunx, so that they may be looked upon as forming slightly diverging diagonal lines, having the central teeth as their starting-point. Now, the first primary lateral teeth, or those next the centre, underlie to some extent the under surface of the central teeth; and the second primary lateral underlie in a similar manner the margins of the first primary, and so with the third or petalodontoid teeth. Thus the whole mass becomes interlocked like a piece of masonry; or, if we take all the central teeth to form a vertical row, and consider in like manner the various lateral teeth, then it might be said that the teeth composing such vertical rows had their lateral margins insinuated between those of the adjacent rows.

In consequence of this interlocking and close approximation, the back or under surface of each tooth becomes worn, and the three longitudinal areas or facets, already described, become more strongly defined. The central area and the two lateral areas are in this way affected by the three teeth that conduce to the support of each superincumbent tooth. That this is the fact is apparently demonstrated by the central area being occasionally grooved transversely, corresponding as the grooves do to the imbricated ridges of the crushing-disk of the supporting teeth (Pl. X., figs. 1 & 5).

As a further proof that such is the fact, it may be observed that when the crushing-disk has by previous use being worn smooth, which frequently occurs, the central facet of the corresponding superincumbent tooth is likewise smooth. It is only when the ridges are retained that these impressions are observed in the upper teeth; and indeed were no other evidence at hand, it is patent enough that these peculiar facets are in part the result of wear, for they exhibit on their surfaces the internal structure of the matter composing the tooth. And that the opposing crushing-disk is not equally and mutually worn arises from the fact that it is covered with a layer of hard enamel-like matter.

The existence of the transverse grooves would seem also to prove that while they were produced by the rubbing-motion of the teeth upon each other, the motion itself must have been very limited, or neither the grooves nor the sharp definition of the facets could have existed. And in this way we have a corroboration that the retention of the old effete teeth is merely for the mechanical support that they supply to the upper row of teeth, upon which teeth alone devolves the function of cutting and crushing the food.

The four groups of teeth obtained by Mr. Duff at Midderidge are very instructive, and though in a more or less disturbed state, are quite sufficient to show the original disposition in the mouth. One of the specimens was quite perfect when found; but unfortunately an idle lad got hold of it, after the quarryman had carefully laid it aside, and in the mere lack of thought broke away a great number of the teeth. Happily however the anterior portions of nearly the whole of them are still left sticking in the matrix, so that not only their number can be ascertained, but likewise the exact limit of those belonging to the upper and lower jaws respectively, and their precise arrangement thereon.

This specimen of the buccal armature was not only complete when deposited, but is lying on the slab in its natural position; and probably when buried the whole fish was present, and lay with its back uppermost. Consequently, the mouth being situated beneath, as in the Sharks and Rays, the teeth of the overhanging upper jaw would lie in advance of those of the lower. Such is the case in the specimen now before us, as is determined by the presence of a quantity of shagreen, indicating as it does the direction in which the body of the fish was deposited. There are about three inches of this shagreen, extending from the posterior margin of the mass of teeth, or those which belong to the under jaw. And, in fact, there can be little doubt, that had the slab been continued backwards sufficiently far, we should have had an impression of the whole fish, marked out by the shagreen, similar to the figure given by Munster of his *Dictea striata*.

The cutting or anterior margins of the teeth are downwards, for the most part buried in the matrix. Many of the roots and, to a great extent, the crushing-disks, having been removed, as before stated, the specimen is as it were hollowed out, and presents an oval disk-like aspect, an inch and three-quarters long, and an inch and a quarter wide. The broken anterior portions of the teeth line this cavity in almost perfect order as if observed from the interior of the mouth, their external or anterior extremities being turned from the observer. The group thus seen is divided into two portions, an anterior and posterior. The teeth of the former or upper jaw have their faces or anterior scoop-like cutting-margins and crushing-disks, or as much of them as is left, turned downwards, and are closely packed together in five horizontal rows of seven teeth each. The central teeth of the five rows rest one upon the other in the median antero-posterior line diminishing in size forwards and upwards as the specimen is seen. These five central teeth are flanked on either side by three others, which likewise diminish in size in front. These teeth, of which there are in all thirty-five, as already stated, belong to the upper jaw. A similar cluster of teeth belongs to the under jaw, and composes the posterior half of the general batch. These are arranged in the same fashion as those of the upper jaw; but instead of having the anterior scoop-like cutting-margins turned downwards, they are placed in the opposite direction, looking upwards. The anterior margins of the two sets of teeth meet in the transverse middle line, and are pressed close together, so that the entire batch is continuous, there being no hiatus anywhere, the mouth in fact being closed, and the teeth of the two jaws pressed together. In the under jaw there are likewise five horizontal rows of seven teeth each, though, on account of the injury the specimen has sustained, the exact number is not so easily determined as it is in the other jaw.

This specimen has apparently been as complete as that figured by Münster (Beitr. Heft. v. Taf. 15, figs. 10, 11) under the name of *J. Dictea*, and is indeed a very good counterpart of the specimen there represented; only in ours the front or scoop-like cutting-margins of the teeth are buried in the matrix, the view of the specimen being obtained as it were from the oral cavity, while Count Münster's figure has the front of the teeth exposed as they would be seen had the fish been laid upon its back.

Another of Mr. Duff's specimens (Pl. XI., fig. 1), however, presents the same aspect as that of the figure just referred to, and is almost perfect, rising as that does in bold relief from the matrix in the form of an irregularly rounded cluster, having the peculiar vesicular appearance seen in most of Münster's figures. This appearance is very remarkable, and at first sight has, as was suggested to us on showing the specimen to a friend, no little resemblance to a cluster of ova-capsules of *Fusus antiquus*, particularly when the teeth are a little disturbed.

In connexion with this cluster of teeth a large patch of shagreen is beautifully displayed, and enables us to determine, in like manner as in the former instance, which is the anterior margin of the specimen, the spreading of the shagreen indicating the direction of the body of the fish.

In this specimen, as in the first-mentioned, the teeth are divisible into two sets, which have their cutting-margins opposed to each other across the transverse median line. Those of the anterior set belong to the upper jaw, and are closely packed together and interlocked in the manner previously described, in four transverse or horizontal rows: the remains of a fifth row are distinctly visible. The arrangement is the same as in the first-described specimen: that is, in each row there is a central tooth with three lateral ones on each side, the extreme flanking tooth on either hand being petalodontoid in form; and the teeth composing the row next the transverse median line are the largest, while those in front, or those in the lower supporting rows, become gradually smaller.

The teeth of the lower jaw, or those at the posterior margin of the cluster, are in a comparatively disturbed state; but the anterior cutting-margins are turned forward, so as to oppose those of the upper jaw, whose cutting-margins are turned backwards. In the lower jaw four horizontal rows are distinctly determinable, while indications of a fifth can be traced. On account of the disturbance of these teeth the central large teeth of four rows are well displayed in profile, being turned over towards the right of the observer, and lying in regular order one behind the other, so that the whole length of the teeth is exposed, the roots being traceable in the matrix. Several of the lateral teeth are scattered on either side, and three or four are removed to some distance to the left.

This specimen is fortunately broken through transversely near the centre in such a manner that the greater portion of the upper or crushing-disks, with the anterior cutting-margins of one row of teeth, and the backs or under surfaces of another, are finely displayed. And thus we obtain a clear demonstration of the arrangement of the teeth in this fine specimen, and at the same time a complete exposition of the characters of the teeth themselves.

A third slab exhibits a dense mass of teeth of an irregularly rounded form, comprising numerous teeth of both jaws (Pl. XI., fig. 2). Here, again, the shagreen shows the position in which the body of the fish was deposited; but as all the teeth have the anterior scoop-like cutting-margins in one direction, there can be no question as to which is front. The specimen rests on the slab with the face uppermost, much as in the last case, only the whole are turned forward, and, unlike it, the teeth are in a much disturbed state, particularly those of the under jaw, which lie uppermost. These, or at least all that remain of them, have been pushed so far forward that they overlie those of the upper jaw towards the left side, leaving exposed the upper surface of the large central tooth and the first lateral of the working row of the upper jaw, which are well exhibited in their true position; and the remains of a second lateral tooth and one or two of the petalodontoid form are seen at the extreme right. These exposed teeth of the upper jaw have their crushing-disks and cutting-margins turned upwards; and their roots are well displayed, sinking backwards into the matrix. The few teeth of the under jaw already spoken of on the left have their under surfaces or backs exposed, the crushing-disks being turned down to oppose those of the upper jaw. At the posterior part of the general mass several of the second primary and petalodontoid teeth lie scattered about, chiefly with the under surfaces uppermost.

The remaining specimen (Pl. X., fig. 1) to be noticed, though consisting only of a few teeth, is very interesting, inasmuch as it displays in profile an entire vertical row lying in almost exact order, one resting upon the other. The whole length of the teeth is seen, from the cutting-margin to and including the root, bent in a deep sigmoidal curve. The series appears to be of the central teeth: four lie in close contact, the back or under surface of one individual resting upon and fitting exactly to the face or upper surface of that immediately below it. A very imperfect fragment of a fifth tooth is seen pressed to the under surface of the fourth of the series; and in front considerable portions of two lateral primaries lie with their under surfaces uppermost, one of which exhibits in a remarkable manner the transverse grooves caused by the rubbing of the crushing-disk of the tooth on that supporting it. Similar transverse grooves can be seen on one or two other teeth of the series. A considerable fragment of a second primary lies near the centre of the row.

The minute structure of the teeth is rather peculiar; and though we have not examined it in the entire tooth, and though our account of it must necessarily be imperfect, as it is from mere fragments, yet we cannot refrain from saying something on the subject.

We have stated that the upper surface (namely, the anterior scoop-like margin and the crushing-disk) is covered with a layer of opaque-white enamel-like matter. This coating is thickest over the crushing-disk, where it is of a considerable depth. When the tooth is quite fresh, there appears to overlie this a thin film of transparent enamel. The interior is composed of a rich brown-coloured substance, which may be looked upon as a form of dentine, made up of large, branched and anastomosing tubes with thick walls, which, for the most part, run lengthwise: their cavities are undoubtedly medullary channels; they are narrow in proportion to the thickness of the entire tube. These give off, almost at right angles, small, irregular, branched and anastomosing tubes, which, penetrating the overlying white enamel-like matter, abut near to the surface. The white matter also penetrates occasionally into the interior of the tooth, insinuating itself between the tubes; but the central portion is usually so exceedingly dense that few traces of it are to be observed. On the upper or concave face of the cutting-margin, however, the dentinal tubes, which are here small and arranged lengthwise in parallel order, lie buried in the white matter that in many instances permeates the entire scoop portion.

The tubular matter, whether at the surface or in the interior, is composed of concentric layers; and coarse, branched tubules, originating in the medullary channels, penetrate their walls. The whole of the brown tubular matter composing the mass of the tooth is probably dentine, as we have just stated; or it may be, as stated in the paper already quoted on *Climaxodus* and *Janassa*, osteodentine, the small marginal tubes only being dentine; but the structure of the whole appears to be the same. We feel equally at a loss how to denominate the white matter.* It is minutely granular, but otherwise quite structureless. If we are correct in designating it enamel, then there must be two kinds of enamel; or what is the transparent film seen on the surface in perfect specimens?

When the white coating is worn a little, the extremities of the small dentinal tubes that penetrate it are seen at the surface, and as they wear more readily than the white matter, the whole surface becomes minutely punctured. On the cutting-margin, however, the white matter is usually to some extent minutely grooved longitudinally, in consequence of these superficial tubes of the dentine-like matter running parallel to the surface.

The minute structure of the tooth as above described is seen to be essentially the same as that of the so-called *Climaxodus*; but in the latter the brown dentinal tubular matter of the interior is not so dense, consequently the white matter penetrates more

* In the paper on *Climaxodus* and *Janassa* this white coating is called "cement." On further examination, however, we find that it has not the character of cement, but is merely granular, and in every respect is similar to the white external layer in *Janassa*.

extensively through the tissue. The small dentinal tubes abutting at the surface, too, are more branched and are less regular. The external white layer appears to be not so thick; but it is almost always so much stained with black carbonaceous matter that it is not easily distinguished. Indeed we have only in one instance detected it without the aid of transmitted light; but in section when so viewed its presence is usually observed.

The shagreen (Pl. X., fig. 6) with which the body of this fish is covered is exhibited in three of the four specimens obtained by Mr. Duff. In one of them a considerable patch of it is very beautifully displayed, no disturbance whatever having taken place in the tubercles. They are minute, and, though pretty close together, they are seldom in contact, there generally being a space between them less than half their diameter. They are in the form of irregularly rounded bosses, with the surface smooth and glossy, and the margins sinuous and produced into points. Sometimes, however, they are much elongated, and are frequently very irregular in shape, with the marginal prolongations much produced, variously formed, sharp or obtuse. Others have one margin comparatively smooth, the points being confined to the opposite side. Some are quite devoid of all such irregularities, the margins being smooth or only a little sinuous at one side: these are rounder and larger than the others (fig. 8). Another form (fig. 7), not by any means uncommon, is irregularly stellate, with the rays ridged and sometimes a little bifurcated.

From the fineness of the cutting-margin in the so-called *Climaxodus* it was inferred in the former paper, so frequently referred to, that the food must have been composed of some soft material. We are disposed to draw the same conclusion from the structure of the teeth of *Janassa bituminosa*. The scoop-like cutting-margin is certainly much used, for it is almost always greatly worn in a regular manner: only in one instance have we seen it a little broken. In would be an efficient instrument in cutting vegetable substances, and these might afterwards require the aid of the crushing-disk.

In corroboration of this view of the food we may quote a passage from Munster, who says of his *Byzenos latipinnatus*, that "the intestine seems to have been very full when the fish died. It is more elevated than the other parts of the body. On some places one sees in the interior a black earthy mass in which small pointed bodies appear, which are like small pieces of shiny coal." May not this "black earthy mass," and "pieces of shiny coal," be carbonized vegetable matter, the food of the fish?

It is unnecessary here to dilate on the affinities of *Janassa*, as the subject is discussed in the former paper, already quoted. We may remark, however, that the full investigation of the Permian species has only the more confirmed our opinion of its close alliance with the Coal-Measure form (the so-called *Climaxodus linguæformis*), and of a certain relationship of both to *Myliobates* and *Zygobates*.

We may also state that *Janassa* is more closely related to *Petalodus* than was at first thought; for we now find that the latter genus is provided with both symmetrical and oblique teeth; so that it is quite probable that they may be found to be arranged in much the same manner as those of *Janassa*, especially as the former have been found in vertical series, as previously stated.

EXPLANATION OF PLATES X. & XI.

PLATE X.

Fig. 1. Somewhat enlarged view of a central vertical row of teeth of *Janassa bituminosa*, seen in profile, and exhibiting transverse grooves and ridges on the underside: *a*, under surface, with transverse grooves, of apparently two lateral teeth; *b*, a portion of a second lateral tooth.

Fig. 2. Horizontal row of teeth of the same, a little enlarged: *a*, anterior scoop-like cutting-margin; *b*, crushing-disk; *c*, root; *d*, first lateral tooth; *e*, second ditto; *f*, flanking petalodontoid tooth.

Fig. 3. Diagram showing the central vertical row of teeth in profile, and to explain their relationship to the jaws: *a*, supposed upper jaw, *b*, supposed under jaw; *c*, the teeth in use; *d*, effete supporting teeth.

Fig. 4. Profile view of a central tooth, somewhat enlarged: *a*, anterior scoop-like cutting-margin; *b*, crushing-disk; *c*, root.

Fig. 5. View of underside of central tooth: *a*, cutting-margin; *b*, central area or facet, exhibiting transverse grooves; *c c*, lateral facets; *d*, root.

Fig. 6. Shagreen, tubercles much enlarged, in their natural order.

Fig. 7. Three stellate tubercles of the same.

Fig. 8. Two smooth tubercles.

PLATE XI.

Fig. 1. A group of teeth, a little over the natural size, of *Janassa bituminosa*, seen in front, the anterior cutting-margins being exposed: *a*, central row of teeth of upper jaw; *b*, of under jaw, with their sides exposed; *c*, petalodontoid teeth; *d*, shagreen.

Fig. 2. Another group: *a*, the upper surface of two teeth of the upper jaw; *b*, the remains of teeth of the under jaw, with their under surfaces exposed; *c*, scattered petalodontoid teeth, with their undersides uppermost.

XIX.—*Note on the "Geology" of Messrs. Baker and Tate's New Flora of Northumberland and Durham.* By Jas. W. Kirkby.

In the first chapter (geology) of the "New Flora of Northumberland and Durham," there are certain statements which I wish to notice. These statements relate to the Permian formation, as described at pp. 18–21.

In commencing the description of the formation the author—Mr. George Tate—says that only one member of it appears in the two counties named, though "it *was* usual to group with it an irregular, loose, sandy deposit, and some red sandstones lying beneath it." From the way this is put it might be supposed that the classification of these rocks in the Permian series was a thing of the past, and that geologists generally agreed in placing them with the Carboniferous system. But this ought scarcely to be said when perhaps the author and Mr. Howse are the only two who adopt that view of the question; while by Sir Roderick I. Murchison,* Sir Charles Lyell,† Professor Ramsay,‡ Professor

* Siluria, 4th edit., pp. 327, 8, 9. † Elements of Geology, 4th edit., pp. 301 & 305.

‡ Geological Map of England and Wales, 3rd edit.

Phillips,* Mr. H. H. Howell,† Dr. Geinitz,‡ Professor King,‖ and other geologists of note, they are grouped with the Permian series.

The question of the systematic position of these sandstones—usually known as the Lower Red Sandstone—can of course only be determined on its scientific merits; and I have no wish to try to swamp the opinion of the author by any quotation of big authorities. But it seems to me as if both he, and the gentleman whose views he adopts, placed too great stress upon the Tynemouth section, which is not a typical one so far as concerns the Lower Red Sandstone. It may be, in fact, that the red sandstone and shale, from which Mr. Howse got his Coal-Measure plants in 1857, are true Coal-Measure rocks; but it does not follow that the soft yellow sandstone overlying it, and which is seen lying beneath the Magnesian Limestone in its range southward in various places for nearly 120 miles, also belongs to the Coal-Measures.

The soft yellow sandstone never contains fossils, so that palæontological evidence as to its position is out of the question. But when it is seen following the course of the Magnesian Limestone, from where the Coal-Measures lie comparatively flat in North Durham, across their outcropping edges in the southern portion of the coal field (Wingate, Cornforth, Thrislington), and afterwards passing into Yorkshire with the Magnesian Limestone, and there seen with it resting sometimes on Coal-Measures (Pontefract, Pebbley Dam, &c.), and sometimes on Millstone Grit (Knaresborough, Bramham Park), and in some cases actually passing up gradually into the overlying Magnesian Limestone so as to render their exact separation impossible (Knaresborough), it is my opinion that the physical evidence quite suffices to show that the most appropriate classification for this sandstone is with the Permian, and not with the Carboniferous rocks.

* Map of the Geology of Yorkshire.

† Geo. Surv. Map of the Tynemouth and Seaton Sluice districts.

‡ Dyas: introduction of. See translation in Trans. Manchester Geo. Soc., Vol. IV., p. 121.

‖ Monograph of Perm. Fossils. &c.

Another point to which I would refer is the statement that the western escarpment of the Magnesian Limestone, in passing across the Coal-Measures, forms a broken line of eminences of nearly equal height throughout. The height of the escarpment certainly is never very great, but it is subject to considerable variation of level. From South Shields to West Boldon it ranges from under 100 to 300 feet; thence to Thrislington, from 300 to 550 feet; then on to Westerton, where it attains the height of 644 feet; afterwards by Eldon (540 feet) to East Thickley, where it is about 400 feet; from this point it rises again to 650 feet to the W. of Redworth where it is highest, and where the Coal-Measures appear to run out, though to the south of these the elevation of the escarpment or western termination of the limestone descends to 220 feet at Pierce Bridge.

The Marl Slate ought scarcely to be described as slightly magnesian when it has been shown by Mr. E. J. J. Browell to contain from 12 to 39 per cent. of Carbonate of Magnesia. Eighteen species have been described as found in this deposit.

In the *compact limestone* of Mr. Tate over sixty species have occurred instead of eighteen as mentioned. A list of thirty-three species is given in the Quarterly Journal of Geo. Soc., Vol. XVI. (1861), p. 318; and the discovery of additional species is noticed in Nat. Hist. Trans. Northum. and Durham, Vol. I.

The *concretionary* and *pseudo-brecciated* limestones are described as containing molluscs, corals, fish of the genera *Palæoniscus* and *Acrolepis*, a Calamite, and other obscure plants. It is difficult to say what beds Mr. Tate intends to include in this his fourth group, as he refers to no localities where they may be seen. Professor King, in his arrangement of the same series of rocks, has a brecciated and pseudo-brecciated limestone for his second subdivision. Perhaps it is to this limestone that the author refers; but it, strictly speaking, contains neither corals nor shells, nor yet fish or plants. It is essentially an unfossiliferous deposit if taken alone, as by Professor King. The only examples of *Palæoniscus*, *Acrolepis*, and *Calamites*, that occur above the Marl Slate have been found in the higher beds of the Magnesian Limestone, or in the fifth group of Mr. Tate.

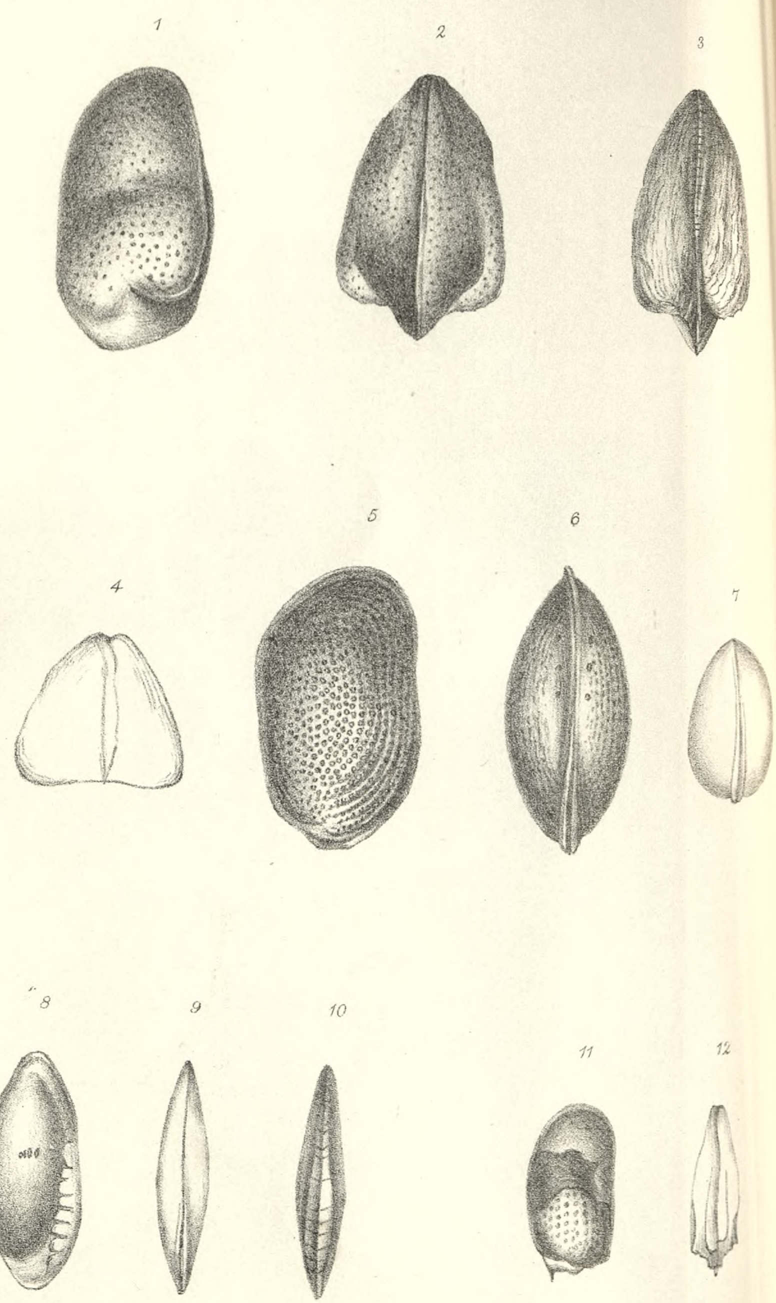
In subdividing the Magnesian Limestone into five groups the author has followed Professor King, and with him appears to have erred in making one too many; for the third and fourth groups of Mr. Tate, and the second and third of Professor King, are undoubtedly but the same limestone under different aspects, being termed fossiliferous or shell limestone when charged with organic remains, and cellular or pseudo-brecciated when without fossils. Sometimes the limestone under its fossiliferous form is seen resting on the lower beds or *compact* limestone of Mr. Tate, as at Humbleton Hill and Claxheugh; and sometimes the limestone under its cellular or pseudo-brecciated form is seen in exactly the same position, as at the Trow Rocks, Down Hill, Ryhope Pit, and Fulwell Water Works. Indeed there are more localities showing the latter arrangement than the former. But there is no section showing the one resting on the other; though there are sections showing the one passing from a shell limestone into one that is pseudo-brecciated on the same geological horizon, as at Claxheugh and Tunstall Hill.

So far as my experience has gone the most natural method of grouping the Magnesian Limestone strata of Durham is that which arranges them in three subdivisions, without including the Marl Slate. This method was first proposed by Mr. R. Howse, in 1857. It is perhaps more strictly applicable to the Magnesian Limestone of the north of the county than to that of the south, where the middle portion of the series appears to undergo considerable change, and the upper beds are not seen: I here speak of the limestone in its range from Thrislington to the Tees.

In giving 100 feet as the thickness of the fifth group Mr. Tate considerably understates it: 250 feet is nearer the average thickness; but it greatly exceeds this estimate on the coast between Sunderland and Marsden.

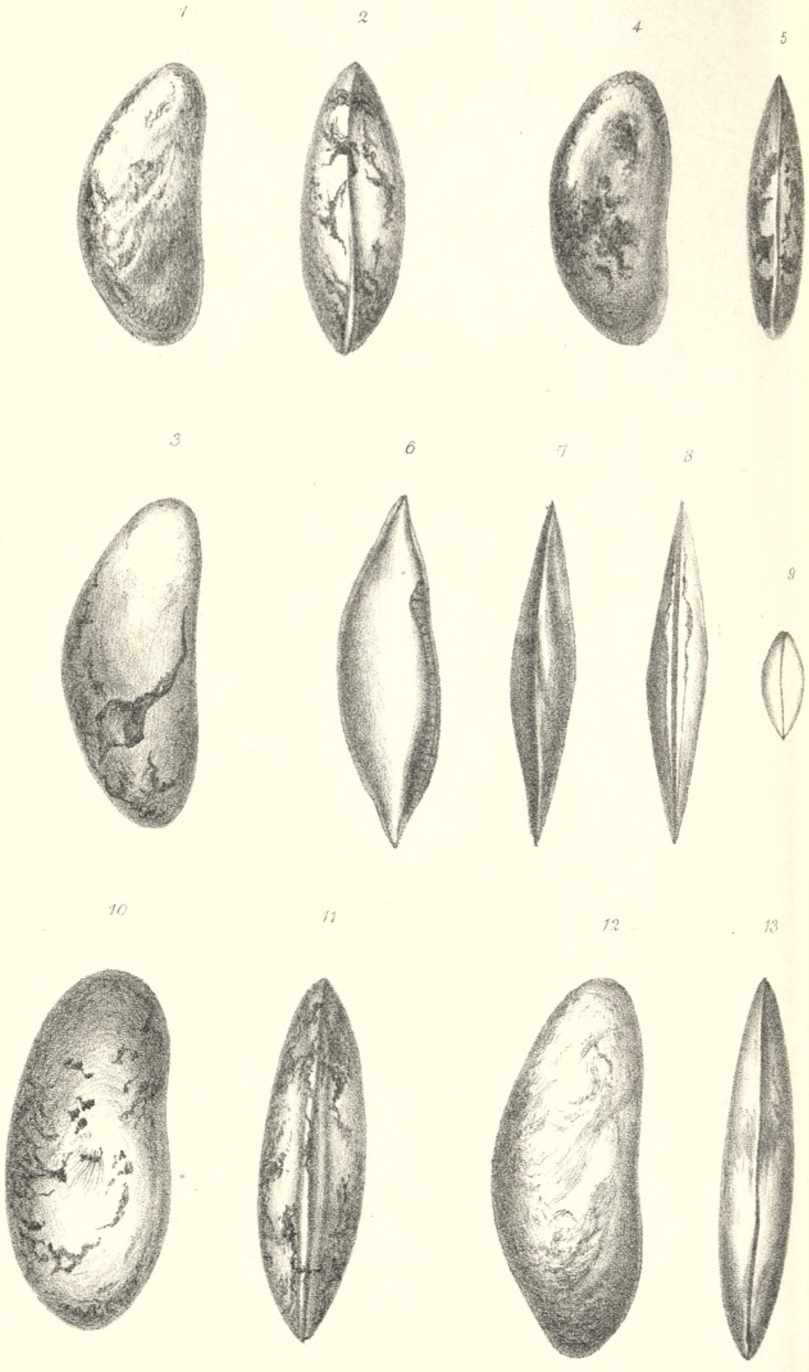
But as 300 feet as given for the third and fourth groups is 150 feet too much, the estimate of 600 feet as the total thickness of the Magnesian Limestone is probably nearly correct.

G. S. Brady del et lith.



S. S. Brady del et lith.

W. West imp.



G. S. Brady del. et lith.

W. West imp.

XX.—*Notes on Entomostraca taken chiefly in the Northumberland and Durham District* (1869). By GEORGE STEWARDSON BRADY, C.M.Z.S., &c. (Plates XII.–XIV.)

DURING the past year my attention—so far as Natural History is concerned—has been chiefly directed to the Entomostraca of tidal rivers; but having had some not altogether unproductive opportunities of collecting in localities of a different character, I propose now to lay the results of these "horæ subsecivæ" before the Club.

The gatherings which I have to notice are—

1. From between tide-marks: at Sunderland, and at Boulmer, near Alnwick.

2. From fresh water at Fulwell Cemetery, Sunderland.

3. Marine; from a depth of 15–30 fathoms off the Durham coast.

BOULMER AND SUNDERLAND.

These gatherings consisted of the muddy sand which is found not unfrequently coating flat shelving rocks, and matted together in many cases by dwarf filamentous Algæ of such genera as Sphacelaria, Polysiphonia, Callithamnion, &c. As a general rule, the tidal rocks of our district are too much storm-beaten to allow of their harbouring any great quantity of movable deposit of this kind, and it is only in somewhat sheltered nooks that the requisite conditions can be found. Several interesting species, new to the district, occurred in these localities, and it is not less interesting to note the occurrence abundantly in a living state of several which we had previously known only from the shell: in this category we may notice *Cytherura cellulosa* and several other species of that perplexing genus. The most noteworthy of the newly found species are *Cythere Robertsoni*, *Cytherura similis*, *flavescens*, *angulata*, *undata*, and *gibba*, *Paradoxostoma pulchellum*, *hibernicum*, and *Fischeri*.

The following is a complete list of the species obtained, the asterisks indicating their comparative abundance, * * * being intended to denote the prevailing species, and * those which appear to be very scarce :—

	BOULMER.	SUNDERLAND
Cythere lutea, *Müller*	***	***
viridis, *Müller*	***	**
albomaculata, *Baird*	***	***
pellucida, *Baird*	***	......
castanea, *G. O. Sars*	***	*
tenera, *Brady*	*	**
porcellanea, *Brady*	***	......
gibbosa, *B. & R.*	*	......
Robertsoni, *Brady*	......	*
villosa, (*G. O. Sars*)	**	*
Loxoconcha tamarindus, (*Jones*)	**	**
Xestoleberis aurantia, (*Baird*)	**	......
Cytherura nigrescens, (*Baird*)	***	** (?)
similis, *G. O. Sars*	*	......
flavescens, *Brady*	***	......
cuneata, *Brady*	***	......
striata, *G. O. Sars*	**	*
angulata, *Brady*	*	......
undata, *G. O. Sars*	*	......
gibba, (*Müller*)	*	......
cellulosa, (*Norman*)	*	***
Cytherideis subulata, *Brady*	***	......
Paradoxostoma variabile, *Baird*)	**	***
abbreviatum, *G. O. Sars*	**	***
hibernicum, *Brady*	**	......
Fischeri, *G. O. Sars*	**	......
ensiforme, *Brady*	......	*
pulchellum, *G. O. Sars*	**	......
Sclerochilus contortus, (*Norman*)	*	*

Paradoxostoma hibernicum, *Brady*. Plate XII., figs. 10, 11.

The type specimens of *P. hibernicum* were found in rock-pools in the Great Isle of Aran, Galway Bay, but, having been preserved in spirit, had lost the beautiful coloured markings which they doubtless possessed when living. I have therefore given here, from one of the Boulmer specimens, enlarged representations, which convey a better idea of this very distinct and handsome species.

Paradoxostoma Fischeri, *G. O. Sars*. Plate XII., figs. 1–3.

Paradoxostoma Fischeri, G. O. Sars. Oversigt af norges marine Ostracoder, p. 96.

Sclerochilus gracilis, Brady and Robertson. Ann. and Mag. Nat. Hist., Ser. 4, Vol. III. (1869). Plate XX., figs. 11, 12.

The species described by Mr. Robertson and myself under the name *Sclerochilus gracilis*, was not recognized by us as being identical with the *P. Fischeri* of Sars. Indeed we had supposed it to belong, as our name indicates, to a different genus, arriving at this conclusion from a consideration of the form of the shell. The animal itself we had no opportunity of examining; but none of our specimens exhibited the beautiful dark coloured arborescent or dendritic markings so characteristic of the genus *Paradoxostoma*. The figures now given represent both male and female shells.

Paradoxostoma pulchellum, *G. O. Sars*. Plate XII., figs. 4, 5.

The male of this species has not previously been observed, but I presume, from the rather elongated form of the carapace, that the specimen here figured belongs to that sex.

FULWELL.

This gathering was taken from the almost dried-up bed of some ornamental water through which a small stream usually runs. The water had been let off previous to my visit, and all my captures were made in a small pool about two or three inches deep, which had been accidentally left behind. My impression is that even this spot had not long before been quite dry, as the mud brought up was (much of it) a good deal caked. My object in going to this spot was to obtain specimens of *Potamocypris fulva*, which I thought I remembered having seen in gatherings previously obtained there, but which I did not at the time thoroughly recognize as distinct from *Cypridopsis villosa*. These earlier specimens were indeed recorded in my "Monograph" under the latter name, but as I now believe erroneously. I well remember the difficulty I felt in forming a judgment as to their specific character, and I was probably deterred from describing them as a new species by the fear of unnecessarily multiplying names. My object this year was imperfectly attained by the capture of five or six specimens of this species, but I was fortunate in obtaining a much greater prize in an ostracod—*Cypris ornata*, Müller, new to the British fauna, and scarcely inferior to any in size and beauty. The gathering was interesting in another respect—several individuals of species usually white or whitish in colour, were distinctly tinted with green, not as a mere superficial stain, but in clouded patches evidently entering into the substance of the shell: these were *Candona candida*, *Cypris gibba*, and *Limnicythere inopinata*. The fact is useful as showing that colour must not be accepted as at all a constant or invariable character, even in species which seem to be most stedfast in that respect. The following list embraces all the Ostracoda found at Fulwell.

Cypris compressa, *Baird.*
gibba, *Ramdohr.*
virens, (*Jurine.*)
ornata, *Müller.*
reptans, (*Baird.*)
Cypridopsis obesa, *Brady & Robertson.*
Potamocypris fulva, *Brady.*
Candona albicans, *Brady.*
Limnicythere inopinata, (*Baird.*)

Cypris ornata, *Müller*. Plate XIV., figs. 1–3.

Cypris ornata, Müller. Zool. Dan. prodrom. 2391. Entomostraca, p. 51, Tab. III., figs. 4–6. Lilljeborg. De Crustaceis, Tab. X., figs. 19–22—(not of Fischer—"Über das genus Cypris.")

Monoculus ornatus, Jurine. Histoire des Monocles, p. 170. Pl. XVII., figs. 1–4.

Carapace of the female, seen from the side, oblong, subreniform, higher in front than behind, greatest height situated a little in front of the middle and equal to half the length: extremities rounded, the posterior much narrowed, superior margin much elevated (almost gibbous) about the anterior third, thence sloping with a gentle curve backwards, inferior sinuated in the middle; seen from above oblong-ovate, widest in the middle, thence tapering evenly to the extremities which are pointed, greatest width considerably less than half the length. The shell exhibits under the microscope, when placed in a favourable light, a delicately reticulated or tesselated structure (shown in figs. 1, 2, towards the posterior extremity); the surface is smooth and shining, pale green, beautifully but irregularly banded with dark green and orange. In my specimens the normal coloration seems to consist of an encircling fillet of orange with a transverse broad pellucid band behind the middle, and a sharply defined black patch over the eyes, beneath which are several dark green cloudy patches; but the appearances vary so largely, according to the method of illumination, that it is difficult to describe correctly even a single specimen, of which no two are exactly alike. Length, $\frac{1}{18}$th of an inch. Setæ of lower antennæ very short, as in *C. reptans*.

I at first supposed that this might be the male of *C. virens*, which species occurred abundantly in the same gathering, but further examination showed the supposition to be incorrect, all my specimens being females. Some doubt may perhaps be entertained as to its identity with Müller and Jurine's species, but though their written descriptions are often very characteristic, their figures can scarcely be depended upon for perfect accuracy, and I am the more disposed to consider the reference correct, from Müller's description of the shell structure, "aucta valde magnitudine testa tessellata sive reticulata apparet, haud tamen pellucida." His description of the coloration agrees also closely with that of my specimens. Professor Lilljeborg's figures agree well with my examples and evidently refer to the same species; but Fischer has unaccountably identified Müller's *C. ornata* with the *C. virens* of Jurine (*tristriata*, Baird), the figures given by the two authors being widely different, much more so indeed than the species themselves actually are. Fischer's figures refer undoubtedly to *C. virens*, and not to the present species.

Genus. POTAMOCYPRIS, nov. gen.

Carapace compressed, reniform; shell calcareous and rather thick, valves unequal, the right much the larger and overlapping on the dorsal and in the middle of the ventral margin: dorsal margin of the left valve somewhat flattened, that of the right boldly arched, hingement simple. Limbs short and stout, superior antennæ six-jointed, shortly setose, inferior altogether destitute of swimming setæ; first and second feet as in *Cypris*; abdomen rudimentary.

I have as yet met with only one perfect animal of this genus, though not a few empty shells have been found in various widely separated localities. These have always occurred in running water, not far from the sea, except in one or two cases where dead shells have been brought up by the dredge. Further opportunities will probably reveal more points of difference between this and the closely allied genus *Cypridopsis* than I am now able to point out. The marked inequality of the valves, together with the absence of swimming setæ from the lower antennæ, are however of sufficient importance to call for recognition as generic characters.

POTAMOCYPRIS FULVA, (*Brady.*) Plate XIV., fig. 4.

> *Bairdia fulva*, Brady. Monog. recent Brit. Ostrac., p. 474. Pl. XVIII., fig. 21. Brady and Robertson. Ann. and Mag. Nat. Hist., Ser. 4, Vol. III. (1869). Plate XVIII., figs. 1–4.

The yellowish colour of the carapace from which this species was first described suggested to me the specific name, which proves however inappropriate, the one or two living specimens since found having been green. The one living example recently got at Fulwell is dull green, with a large patch of a darker shade about the centre of the dorsal margin, on which are one or two small orange blotches. The shell is usually (though not always) rather coarsely punctate and sparingly hispid. Its general appearance is somewhat like that of *Cypris villosa*, but larger and coarser: other more important distinctions are pointed out in the generic definition.

P. fulva has occurred in the following localities:—Roundstone Bay and River Liffey, Ireland; Scarpa Floe and Montrose Basin, Scotland; near the mouths of the Warn Burn, and rivers Coquet, Wansbeck, and Blyth, Northumberland; and Fulwell Cemetery near Sunderland. In all places the number of specimens was very small, usually only one or two.

DURHAM COAST.

I am indebted to the kindness of the members of the Seaham Natural History Club for the opportunity of joining in an afternoon's dredging off that place. Of the larger marine animals nothing important was noticed, the ground dredged over not having been so favourable as on some previous occasions; but amongst Microzoa, especially Ostracoda, a large number of interesting captures were made, comprising many species new to our district. Before proceeding to enumerate these I may notice also the occurrence of a rotifer (*Brachionus Mülleri*) (?), and of the larval form of one of the Echinoidea, probably *Echinocyamus pusillus*.

The following Copepoda were also taken on this occasion—*Alteutha bopyroides*, *Dias longiremis*, *Pontellina brevicornis*, and an undescribed species allied to *Euterpe gracilis*, Claus.

LIST OF OSTRACODA.

Pontocypris mytiloides, (*Norman*)	* *
Cythere pellucida, *Baird*	* *
castanea, *G. O. Sars*	*
tenera, *Brady*	* *
porcellanea, *Brady*	* *
Robertsoni, *Brady*	*
quadridentata, *Baird*	* *
emaciata, *Brady*	*
tuberculata, (*G. O. Sars*)	* * *
semipunctata, *Brady*	*
limicola, (*Norman*)	* *
Jonesii, (*Baird*)	* *
Eucythere Argus, (*G. O. Sars*)	* *
declivis, (*Norman*)	* *
anglica, *Brady*	* *
Cytheridea papillosa, *Bosquet*	* * *
Ilyobates bartonensis, (*Jones*)	*

Loxoconcha tamarindus, (*Jones*)	**
elliptica, *Brady*	*
guttata, (*Norman*)	***
multifora, (*Norman*)	*
granulata, *G. O. Sars*	*
Xestoleberis depressa, *G. O. Sars*	**
Cytherura nigrescens, (*Baird*)	*
similis, *G. O. Sars*	*
producta, *Brady*	***
striata, *G. O. Sars*	**
angulata, *Brady*	**
cuneata, *Brady*	*
acuticostata, *G. O. Sars*	**
cellulosa, (*Norman*)	**
clathrata, *G. O. Sars*	*
Cytheropteron nodosum, *Brady*	**
latissimum, (*Norman*)	***
Bythocythere simplex, (*Norman*)	**
constricta, *G. O. Sars*	**
Cytherideis subulata, *Brady*	*
Sclerochilus contortus, (*Norman*)	**
Xiphichilus tenuissima, (*Norman*)	**
Paradoxostoma variabile, (*Baird*)	*
ensiforme, *Brady*	*
flexuosum, *Brady*	*
(?) hibernicum, *Brady*	*
Hodgii, *Brady*, nov. sp.	*

In all forty-four species, one of which (*Paradoxostoma Hodgii*) is new to science, and fifteen others are additions to our local Fauna.

LOXOCONCHA GRANULATA, *G. O. Sars*,

Was figured in my "Monograph of the recent British Ostracoda" from a single specimen taken at Stranraer. Some doubt however still existed as to the identity of the specimens, and the figure given was not large enough to represent it satisfactorily. I have therefore here drawn, on a larger scale, the specimen recently dredged off the Durham coast. This species, though probably widely distributed, seems to be scarce in point of numbers, except in a dredging recently made by Mr. Robertson in Loch Long, where it occurs abundantly.

Genus. XIPHICHILUS,* nov. gen.

Shell thin and fragile, smooth; valves compressed, elongated, pointed at both ends, nearly equal, ventral margins much compressed, forming a flattened knife-like plate which is widest behind the middle, and marked by several transverse, hair-like lines: outline, as seen from above, compressed, bi-fusiform; hinge simple. Limbs excessively long and slender: superior antenna six-jointed, and quite destitute of setæ, inferior sparingly setose; mandibles very long and slender, styliform, palp (?) bi-articulate, slender, and terminating in two long setæ. Abdomen produced into two long tapering processes.

Only two members of this genus are yet known, both of which are here for the first time figured. Though very nearly allied, in internal anatomical structure, to *Paradoxostoma*, the characters of the shell are such as to suggest the propriety of placing them in a distinct genus, and some slight anatomical differences appear to confirm this view. The very remarkable external appearance of the shell will be at once recognized on reference to the plates.

Xiphichilus tenuissima, (*Norman.*) Plate XII., figs. 6–9; and Plate XIV., figs. 5–10.

Bythocythere tenuissima, Norman. Brit. Assoc. Report (1868), p. 294.

The shell of this species has been well described by Mr. Norman, and was by him referred (owing to some general likeness to that of *B. simplex*) to the genus Bythocythere. But an examination of the contained animal, which I have been fortunate enough to obtain recently in good condition, compels me to remove it from the position provisionally assigned to it by Mr. Norman.

* ξίφος a sword; χεῖλος a margin.

The superior antennæ are excessively slender, having the first four joints of near equal length and about nine times as long as broad, the last two about one-third the length of the preceding: the lower antennæ have a single seta at the apex of each joint and one in the middle of the penultimate; urticating seta long and slender, triarticulate. Last leg having the second joint excessively long, the third about one-fourth and the last one half of its length; ungues long, slender, and slightly curved. Length, $\frac{1}{20}$th of an inch.

Dredged in 15–30 fathoms, about eight miles from shore, between Sunderland and Seaham Harbour. Apparently not very scarce, as a good series of specimens was obtained on this occasion. It is remarkable, however, that so large a species should have been overlooked, if it were present, in dredgings made on previous occasions in the same district. Two explanations suggest themselves—first, that the habitat of the species may be restricted to an area north of Seaham which was dredged on this occasion, other dredgings having been uniformly made further south; or secondly, that it may have been previously passed over as the larva of a cirriped, to which it bears a very striking resemblance when seen through a simple hand lens. Mr. Robertson has recently taken this species in Kilchattan Bay, Ayrshire.

XIPHICHILUS AMYGDALOIDES, nov. sp. Plate XIII., figs. 8–10.

Carapace as seen from the side oblong-oval or almond-shaped, tapering gently to the extremities which are much narrowed, rounded, and nearly equal in breadth, superior margin gently and evenly arched, inferior also arched, but slightly sinuated in front of the middle, greatest height in the middle and equal to rather more than one-third of the length. Seen from above much compressed, rhomboidal or doubly fusiform, tapering equally from the middle, where it is widest, to the subacutely pointed extremities; greatest width equal to about half the height or one-fifth of the length. Surface perfectly smooth; the transverse lines of the knife-like ventral margin very conspicuous when seen from below (fig. 10). Animal unknown. Length, $\frac{1}{30}$th of an inch.

One specimen only dredged by Mr. Jeffreys, in St. Magnus Bay, Shetland.

PARADOXOSTOMA HODGII, nov. sp. Plate XII., figs. 12, 13.

Carapace as seen from the side elongate subarcuate; greatest height situate in the middle and not much exceeding one-third of the length, extremities narrowed, rounded; superior margin boldly arched, inferior sinuated in the middle, curving gently upwards behind: seen from above much compressed, linear ovate, widest in the middle, tapering gradually and evenly to the extremities which are subacutely pointed; width scarcely exceeding one-fifth of the length. Shell smooth and polished, transparent, yellowish, the limbs of the animal showing plainly through. Length, $\frac{1}{40}$th of an inch.

I have much pleasure in dedicating this species to Mr. George Hodge, of Seaham Harbour, in recognition of the kind assistance which he has often afforded me, as well as of his numerous contributions to the zoological literature of this district.

CYTHERURA INSOLITA, nov. sp. Plate XIII., figs. 11, 12.

Carapace as seen from the side oblong, subquadrangular, highest in the middle; greatest height equal to about half the length; anterior extremity rounded, posterior almost rectangularly truncate and produced at its upper extremity into a slender acutely pointed process; superior margin evenly arched, inferior almost straight: seen from above the outline is compressed, subcuneiform, obtusely pointed in front, centrally mucronate behind; greatest width behind the middle, equal to not much more than one-third of the length. Shell-surface smooth, distinctly and rather largely punctate behind the middle; colour yellowish, central areola almost black. Length, $\frac{1}{80}$th of an inch.

Dredged by Mr. D. Robertson, off Orkney.

Bythocythere turgida, *G. O. Sars.* Plate XIII., figs. 1-4.

Also gained admission into my "Monograph" on the strength of a single female carapace, dredged probably off Holy Island. The shell now under notice belongs to the male, and was dredged off Eddystone Lighthouse. For the opportunity of figuring it I am indebted to my friend Mr. D. Robertson, of Glasgow, who has more recently taken it abundantly in Kilchattan Bay, Ayrshire.

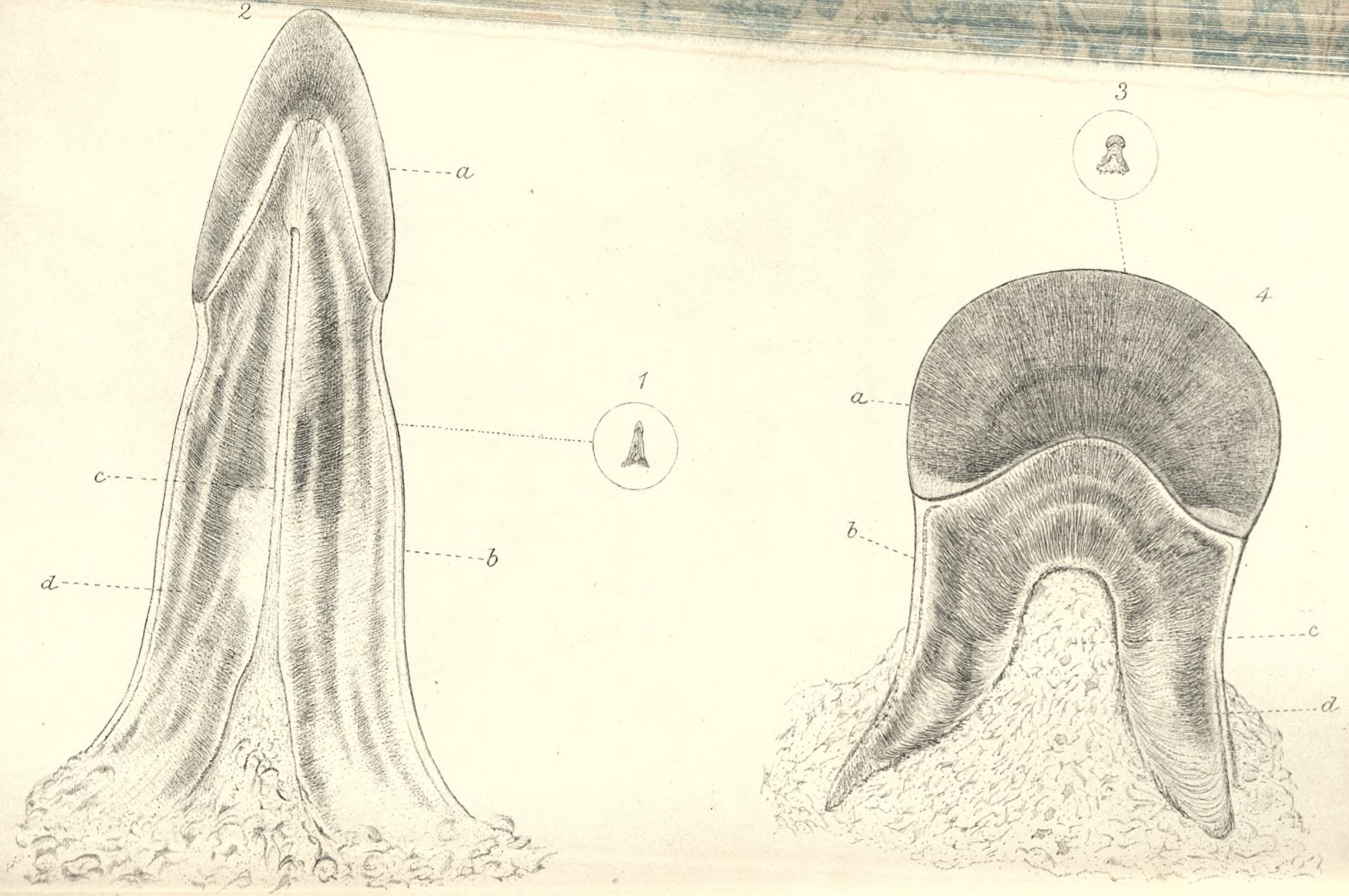
EXPLANATION OF PLATES.

PLATE XII.

Fig. 1. Paradoxostoma Fischeri, female, seen from left side, × 84.
Fig. 2. ,, ,, ,, from above, × 84.
Fig. 3. ,, ,, male, from left side, × 84.
Fig. 4. ,, pulchellum, male, from left side, × 84.
Fig. 5. ,, ,, ,, from above, × 84.
Fig. 6. Xiphichilus tenuissima, female, from left side. × 40.
Fig. 7. ,, ,, from above, × 40.
Fig. 8. ,, ,, from below, × 40.
Fig. 9. ,, ,, from front, × 40.
Fig. 10. Paradoxostoma hibernicum, (? male), from left side, × 84.
Fig. 11. ,, ,, from below, × 84.
Fig. 12. ,, Hodgii, from left side, × 84.
Fig. 13. ,, ,, from below, × 84.

PLATE XIII.

Fig. 1. Bythocythere turgida, (? male), from left side, × 40.
Fig. 2. ,, ,, from above, × 40.
Fig. 3. ,, ,, from below, × 40.
Fig. 4. ,, ,, from front, × 40.
Fig. 5. Loxoconcha granulata, (? female), from left side, × 84
Fig. 6. ,, ,, from above, × 84.
Fig. 7. ,, ,, from front, × 84.
Fig. 8. Xiphichilus amygdaloides, from left side, × 40.
Fig. 9. ,, ,, from above, × 40.
Fig. 10. ,, ,, from below, × 40.
Fig. 11. Cytherura insolita, from left side, × 60.
Fig. 12. ,, ,, from below, × 60.



W. Dinning del. Tuffen West sc.

PLATE XIV.

Fig. 1. Cypris ornata, female, seen from left side, × 40.
Fig. 2. ,, ,, ,, from above, × 40.
Fig. 3. ,, ,, post-abdominal ramus, × 84.
Fig. 4. Potamocypris fulva, lower antenna, × 210.
Fig. 5. Xiphichilus tenuissima, female, upper antenna, × 210.
Fig. 6. ,, ,, lower antenna, × 210.
Fig. 7. ,, ,, mandible, × 210.
Fig. 8. ,, ,, first maxilla, (?) × 210.
Fig. 9. ,, ,, last foot, × 210.
Fig. 10. ,, ,, abdomen, × 210.

XXI.—*On the Teeth of the Ballan Wrasse* (*Labrus maculatus*). By Joseph Wright. (Plate XV.)

Having lately had an opportunity of examining the teeth of the Ballan Wrasse (*Labrus maculatus*), and finding them to be interesting examples of tipped teeth, similar to those of some of the fossil fish of our Coal-Measures, I venture to lay before the Club the result of my observations.

About two years ago, in a paper read before one of the scientific societies of the metropolis, on the teeth of some fossil fishes, this peculiar structure was pointed out as new, and was considered of such importance that a new genus was based on it. Yet, notwithstanding this statement, the same structure had been described nearly thirty years before by Agassiz, in his great work on the fossil fishes, and was shown by him to exist in Pygopterus and Saurichthys, and also in the recent genera Polypterus and Lepidosteus. In the last part of the Transactions of this Club, the same structure is described as being found in the teeth of Gyrolepis, Amblypterus, Pygopteris, and Cycloptychius: Mr. Atthey also informs me that he has found the same structure in Acrolepis, which he has obtained from the Marl Slate. But we need not be astonished that the author of the paper referred to had not seen this structure in the fossil fishes mentioned when he has overlooked it in the species before us, which is common on most parts of the British coasts.

The teeth of the Ballan Wrasse are of a bluntly conical form, slightly incurved, and are firmly fixed in the jaws; they diminish in size from front to back, the posterior being much less than the anterior; there are also a few smaller teeth in the front of each jaw, slightly within the row of larger ones. The enamel-cap is distinctly seen on each tooth, and in some instances the points are much worn.

The pharyngeal bones, of which there are three, one under and two upper, are covered with teeth, which are also firmly fixed in the bone, and all have the enamel-cap distinctly shown. These teeth vary in form and also in size; in the under pharyngeal bone, the teeth in the front are short and stout, of a hemispherical form, but passing backward they are smaller and more conical. On the upper pharyngeal bones some of the larger teeth are of conical form, and have a projecting shoulder at the base of the cap.

The food of these fishes, consisting chiefly of the mollusca and crustacea found in their rocky habitats, seems to wear away their teeth very rapidly, and consequently we find that provision is made for their renewal. In the substance of the pharyngeal bones are cavities, in which the teeth are to be seen in process of formation, and as the old ones are worn off, the floor of the cavity, with the tooth firmly fixed in it, seems to be lifted to the surface, to occupy their place.

The teeth in the jaws are also rapidly renewed, and before the old tooth drops off a new one is ready to fill its place.

On making a section of one of the teeth from the jaws, we find it to be composed of dentine and enamel; the pulp-cavity occupies nearly the entire length of the tooth, and from it at nearly right angles the dental tubes pass off, a small bundle of them passing into the enamel-cap. A thin film of enamel coats the side of the tooth up to the base of the cap; the enamel of which the cap is composed is very dense, and in the section is of a brown colour. So thoroughly distinct does this enamel-cap appear to be from the dentine which it covers, that in one of the teeth I examined it easily came off, and in section is like the barbed head of an arrow.

In the pharyngeal teeth there is the same structure, the same thin film of enamel on the sides, and the same dense enamel-cap; but the pulp-cavity is entirely filled by the substance of the pharyngeal bone.

In a short treatise on the teeth, by Professor Owen, published in 1854, he states that the pharyngeal teeth of the Wrasse are examples of teeth in which only one of the dental tissues is to be found. He also, in his "Odontography," gives a figure of what he terms a large species of Labrus; but in neither case does he mention the species he examined, and it is evident, from what I have laid before you, that his description and figure will not apply to the teeth of the Ballan Wrasse, in which we find both dentine and enamel; and the manner in which the teeth are fixed to the pharyngeal bone is very different to that figured by the Professor.

Whether the structure I have endeavoured to describe is characteristic of the Labroids, I have not had the means of determining; but should opportunities offer of examining other species of the family, I shall be glad to lay the results before the Club.

The accompanying plate is from a drawing by Mr. William Dinning, to whom my best thanks are due.

EXPLANATION OF PLATE XV.

Fig. 1. Tooth of Ballan Wrasse, natural size.

Fig. 2. Magnified section of the same: *a*, enamel-cap; *b*, thin film of enamel coating the sides of the tooth; *c*, pulp cavity; *d*, dentine.

Fig. 3. Pharyngeal tooth of Ballan Wrasse, natural size.

Fig. 4. Magnified section of the same: *a*, enamel-cap; *b*, thin film of enamel coating the sides of the tooth; *c*, pulp cavity filled with the substance of the pharyngeal bone; *d*, dentine.

XXII.—*Entomological Notes for the Year* 1869. By THOS. JOHN BOLD.

Mosquitoes.—Not a little misapprehension and alarm exist in the minds of many people on the subject of mosquitoes, who, seeing their appearance noticed in the newspapers, begin to dread a visit from these the greatest pests of the insect world. This is totally groundless; for, although we have in this country more than a dozen distinct species of mosquito, yet they never are numerous enough in individuals to cause more than a very trifling annoyance: indeed in most seasons are totally unnoticed, but in case of an unusually hot summer they, like all insects, become more than usually active, and force themselves upon our notice by the persistency of their attacks. Mosquitoes very often enter our sitting-rooms towards the end of summer, but we more frequently hear their shrill piping note than see the insects; nor do we find them alight on the place selected for attack as they (like all blood-sucking flies) do so very gently. The swelling and irritation caused by their bite is no doubt the effect of an irritating fluid injected into the wound for the purpose of causing the blood to flow freely; and very curiously, in their case, as in that of "clegs," "horse-flies," and other blood-sucking Diptera, it is only the females that have such sanguinary tastes: what the other sex feed on, in many of the species, remains a mystery.

A mosquito is a small simple-looking two-winged fly, or gnat, with very long delicate legs, not much over one-third of an inch in length, and having a proboscis nearly half as long as itself, which is porrect, or stretched out in front of the insect's head.

Our British species form the genus *Culex*, and they are most abundant in low-lying swampy situations, as they pass the first stages of their existence in water.

I have mounted and sent to the Museum of the Natural History Society an individual, which I caught at dinner on my own nose, and which I have no doubt Mr. Wright will gladly show to any one curious enough to favour him with a visit.

The woody Gall of the Oak, and its Insect.—The subject of galls is a very curious and interesting one. All plants are more or less subject to them, and none more so than the oak, which has them in great variety. The one sent is so regular in shape, and so hard in texture, that few would think it the work of an insect. It is always found at the end of the twigs, and in clusters, never exceeding six in number. Without doubt these galls are formed by the parent insect depositing its eggs, and probably an irritating fluid in the bark. The larva feeds in the centre of the spongy mass of the gall, and changes to pupa and imago within, afterwards issuing by a small hole which it gnaws in the side of its prison. I opened some of these galls on the 23rd of October, finding full fed larva, pupa, and perfect insect fully developed: indeed, some of the latter came out of their own accord a few days later when the galls were lying on my table.

The insect is, I think, *Cynips quercus-terminalis*, Fab., female; and connected therewith is one of the most startling problems of Entomology: *there are apparently no males:* over and over again have the galls been collected, and carefully kept, until all the inmates have come out, but invariably with one result—the whole (sometimes many hundreds) being females.

I have mounted, on a slab for the Museum collection, a bundle of six galls, and one split to show the cavity made by the larva, with two of the perfect insects.

Blatta Maderæ.—This cosmopolitan insect is so frequently imported by foreign-going ships, that an instance, which was recently brought to my notice, is only worth noting, as showing how easily such pests are spread over the world. A lady, on reaching home from the East Indies, sent her cabin sofa to a tradesman in South Shields for repairs, and he was considerably astonished, on ripping up the lining, to find it swarming with fine large lively cockroaches, which immediately fled in all directions over his premises. Some of them were caught and brought to me alive, and these I have mounted for the Museum collection.

Pulex talpæ.—Amongst some insects sent me from Cheviot, by Mr. J. Hardy, were four specimens of a fine large flea, which he took from the neck of a short-tailed field mouse. These are I think identical with the species figured by Curtis, British Entomology, pl. CXIV., as *Ceratopsyllus talpæ* = *Pulex talpæ*, Insecta Britannica, III., 4? One of the specimens is a male, the others females: the first has the antenna erect and distinctly visible; whilst all the females have these organs procumbent, and nearly out of sight. In fleas the antennæ are placed in cavities on the sides of the head immediately behind the eyes, and are said to be concealed from view by movable valves. In some species these organs (the antennæ) are carried erect, and were formed by Curtis into the genus *Ceratopsyllus*, which has not been adopted by modern writers: justly so in my opinion, for otherwise my male would belong to one genus, and the females to the other. I fail to see any traces of the said movable valves, the erect antennæ of the males allowing the cavities in which they lie to be distinctly seen; whilst the antennæ of the females, although level with the surface of the head, can be plainly observed to be uncovered. I am doubtful of my reference to "Insecta Britannica," where the length given for this insect is only three-quarters of a line, whilst my specimens are fully 1½ line in length; nor does Mr. Walker mention the eight strong spinous hairs which are placed transversely on the dorsal penultimate segment, although they are clearly figured in Curtis's plate to which he refers.

Local Corixæ.—In the Natural History Transactions of Northumberland and Durham, Vol. I., p. 317, I recorded the occurrence in our district of ten species of aquatic Hemiptera of the genus *Corixa*. Last year's (1869) endeavours have increased the number of our local species to eighteen, of which two are new to science: I therefore give a corrected list of the whole.

1. *C. Geoffroyi*, Leach. In ponds and streams; exceedingly abundant everywhere.

2. *C. Panzeri*, Fieb. Very rare at Gosforth in August.

3. *C. hieroglyphica*, L. Duf. In ponds, but not abundant. September and October.

4. *C. Sahlbergi*, Fieb. In ponds, &c. Common nearly everywhere at the end of summer.

5. *C. Linnei*, Fieb. Very rare. Long Benton. September.

6. *C. semistriata*, Fieb. Rare. Gosforth. September.

7. *C. præusta*, Fieb. In running water; abundant. Long Benton, Gosforth, &c. September and October. A female of this species flew into my room after dark, attracted by the light at which I was reading, and was so very active that I had great difficulty in securing her.

8. *C. Boldi*, Douglas and Scott. Entomologist's Monthly Magazine, Vol. VI., p. 245. A new species, of which only a female has occurred at Gosforth, in August.

9. *C. sodalis*, Douglas and Scott, l. c. Also new to science. Rare. Gosforth. September.

10. *C. nigrolineata*, Fieb. Always in ponds, and very abundant in September and October.

11. *C. striata*, Fieb. In running water. Long Benton, Gosforth, Heaton, &c. Abundant. September and October.

12. *C. Falleni*, Fieb. With the preceding but much less common.

13. *C. distincta*, Fieb. Rare. Long Benton and Gosforth. September and October.

14. *C. fossarum*, Leach. In ponds, &c. Long Benton and Gosforth. August to October. Common.

15. *C. dubia*, (Fieb.) Douglas and Scott. Gosforth. Very rare.

16. *C. venusta*, Douglas and Scott. Ouseburn. Very rare. September.

17. *C. Douglasi*, (Fieb.) Douglas and Scott. Gosforth. Not rare. August and September.

18. *C.* [*Cymatia*] *Bonsdorfii*, Sahlb. Gosforth. Somewhat rarely, in August.

Hemiptera.—Dr. Power, who visited our district in August last, met with the following Hemiptera at Wallington. Few of them are rare, but all are interesting from the locality:—

Trapezonotus agrestis, *Panz.*
Stygnocoris sabulosus, *Schill.*
Bryocoris pteridis, *Fall.*
Sphyracephalus ambulans, *Fall.*
Idolocoris errans, *Wolff.*
Apocremnus obscurus, *Kirs.*
variabilis, *Fall.*
Psallus varians, *H. Schf.*
Ætorhinus angulatus, *Fall.*
Lygus pabulinus, *Lin.*
campestris, *Lin.*
Salda stellata, *Curt.*
riparia, *Fall.*
saltatoria, *Lin.*
new sp.
Nabis limbatus, *Dahlb.*
Sigaria minutissima, *Lin.*

XXIII.—*Miscellaneous Notices and Observations.*

Panopæa Norvegica.—Last autumn a fisherman brought to me a full-grown living specimen of this mollusc, which he said he had taken near Ryhope a little below low-water mark. He had been collecting bait, and while so engaged noticed the animal in the water, and waded in for it. I never heard of its occurrence in any other instance except in deep water, but have no reason to doubt the truth of the account given me by the fisherman.—*George S. Brady, Sunderland, April 12th*, 1870.

Fresh-water Rhizopods.—In some gatherings made by the hand dredge in Fardings-lake, near Marsden, I noticed numerous specimens of *Difflugium*, an organism which I do not remember seeing elsewhere in this district, but which may probably only need looking for to be found frequently.—*Ibid.*

Bonito.—A specimen of this fish was hung up, some few months ago, in the shop of a Sunderland fishmonger, who informed me that it had been taken in the herring nets in this neighbourhood. This fish appears to be of rare occurrence in the British seas, and specimens found so far north must be looked upon merely as wanderers. Mr. Couch, in his "History of British Fishes," notes its occurrence in the Forth, Clyde, and at Whitehaven. I found it so good eating that I could wish its wanderings were more frequent!—*Ibid.*

Notes of Local Lepidoptera.

Sesia bembeciformis.—Plentiful. Larva numerous in old poplars near the town.

C. porcellus and *M. stellatarum.*—Larvæ on yellow bed straw, on the coast.

S. populi.—Larvæ numerous on poplars and willows.

Hepialus sylvinus and *velleda.*—The latter in Jesmond Dene: the former numerous at Newbiggen-by-the-Sea.

M. tristata (local).—Plentiful near Hexham. End of June.

C. munitata (very local.)—Four specimens at Newbiggen: took sixteen the year previous on the same spot.

L. littoralis.—Four or five at Newbiggen.

X. polyodon.—Several of the dark variety with markings almost imperceptible; indeed, every degree of colour from light bone to nearly black.

C. graminis.—Plentiful on flowers of ragwort at Newbiggen.

Agrotis valligera, tritici, and *cursoria.*—Very numerous. Marsden.

A. obelisca, about twenty, and *A. aquilina,* three or four at Marsden (both local).

Triphena subsequa (very local).—One specimen at Newbiggen.

Cirrædia Xerempelina (very local).—Found one larvæ at Witton-le-Wear on lichen on the trunk of a large ash tree on the 10th of May. It spun up in about ten days, and the imago made its appearance on the 26th of July.

Crambus Warringtonellus (local).—Three or four at Newbiggen.

The *Tortrices* and *Tineæ* were not plentiful last season, the larvæ having probably perished by the long drought of the previous summer.

The best of my captures were—*A. cnicana* and *P. prælongana*.

At Sweethope in September I took *Cidaria psittacata* (local), *miata*, and *testata;* also larvæ of *Notodonta camelina* and *dromedarius* on birch and alder; a few *Dictæa* on poplar, and one *Dictæoides* on birch. The larvæ of *Bombyx rubi* were numerous on the heather.

Many species of butterflies (*Diurni*) were scarce with us last season, although the common whites, *Pieris, Brassicæ,* and *Napi,* were as numerous as usual, but not so in the South of England.

The Common Blue, Meadow Brown, Nettle Tortoise Shell, and Red Admiral, showed themselves in average numbers.

Of *Vanessa Cardui* (Painted Lady) I only saw one specimen on the wing. The larvæ were very numerous on the thistles at Marsden the year previous.

V. Io (Peacock) seems to have left the neighbourhood altogether. I have not seen a single specimen on the wing here for four or five years.—*W. Maling, St. Mary's Terrace, Newcastle, April* 1*st*, 1870.

XXIV.—*Note on the Occurrence of the Trunk of an Oak in the Boulder Clay.* By Sir Walter C. Trevelyan, Bart.

On the 24th of June, 1869, when walking along the line of the Northumberland Central Railway, I observed in a cutting through the "Boulder Clay," between the Lindenshaw and Cocker Burns (at an elevation of about 450 feet above the sea), part of the stem of an ancient oak tree, standing in a vertical position, and looking very like the stump of a tree which might have been growing on the spot, but it appeared to be at too great a depth in the clay (the top of it being 3·50 feet below the surface) for that to have been the case.

It struck me then that it must have been buried in the Boulder Clay at the time of the deposition of that formation.

I was not able to examine it carefully at the time, and being anxious to have the opinion of a more experienced geologist than myself, and of one who had been much occupied in a district where such superficial beds predominate, I asked Mr. Topley (of the Geological Survey) to come and examine it with me, which he did on the 10th of July, and again on the 12th, when, with the assistance of Mr. Holmer (the engineer of the line), it was carefully dug out, and we then found it to be part of the trunk of an old oak tree, about four feet long, and 3·50 feet in girth. The lower end appears fractured, as if broken off in a storm; but it bore scarcely any, or very slight, marks of attrition, and on the part which was still protected by the clay the bark was well preserved. The other parts which had been exposed in the cutting for more than two years were stripped of the bark, but the wood, looking like "bog-oak," is hard and sound, evidently owing to the impervious nature of the stiff clay in which it was imbedded. This clay contains many boulders, principally of neighbouring sandstones, but they are not much rolled, though occasionally there occur also some of limestone bearing marks of glacial action.

From the appearance of the log I do not think it can have been washed from any great distance, but that it was probably broken from a tree growing in the neighbourhood and dropped on the mud, and this probably before the modification of the drift into its present slopes and valleys.

The presence in the "Boulder Clay" of this portion of a tree in so perfect a state (if it is of the glacial period) is an indication, I think, that the *whole* of the country had not been covered with ice, as has been supposed by some geologists, but that there were parts free from it, on one of which this tree was growing; and the contents of the bed, principally derived from the neighbouring rocks, and not much waterworn, show that the present appearance of the valleys and hill-sides is greatly due to the action of the water supplied by the gradual melting of the snow and ice in the warmer temperature of the period when they began to disappear, is also indicated by the insertion of ice-worn and angular blocks of stone, the former with their scratched and polished surfaces in all positions, such as they could scarcely have been in when under a glacier.

Though no doubt great part of the bed, and especially the clay, was originally due to the attrition and crushing of subjacent rock-surfaces by ice, yet their present arrangement, I believe, as I have suggested above, to be principally owing to the subsequent action of the water from the melting ice and snow.

XXV.—*Meteorological Report for* 1869. Edited by the Rev. R. F. Wheeler, M.A.

It is with great pleasure that the editor of the Meteorological Report proceeds to lay before the members of the Tyneside Naturalists' Field Club, the results of observations made during 1869 by the various members who so ably interest themselves in this part of the work of the Club. An increase has again to be recorded in the staff of our observers; but it would be of great additional service if even more would made a practice of recording occurrences at all out of the usual course which come under their notice from time to time. The "Notes on the Month," which now for so many years have formed part of the published Transactions of this Club, will indicate readily to any one the kind of information desired. The habit of so noticing things around us is one which is capable of affording the highest gratification. Easy as practice makes the habit, it is one which requires cultivation at first; but in the end it is capable of affording no less profit than pleasure. Our northern counties, in many respects, offer as fine a field for work of that kind as any part of the British Islands. It matters not whether it be the arrival, stay, or departure of migratory birds; the ever varying seasons; the geology; or the botany, for which last the Flora of Northumberland, lately published by the Club, offers a help perhaps not to be matched in any other part of England: every one may easily find for himself a hobby which he can ride to his heart's content, and feel at the same time that his labours need not perish with himself. In the Transactions of the Club they can find a resting place, and be made as useful to others as they have been pleasant to the observer. The editor cannot but congratulate the Meteorologists of the North on the completion, during the last autumn, of the self-registering anemometer at Alnwick Castle, by His Grace the Duke of Northumberland.

The Duke has most kindly promised to place the records of this instrument at the disposal of the Club, as well as all the other meteorological observations now regularly made at the Castle. The first instalment will be found in its proper place in the following report.

NOTES ON THE MONTHS.

January.—

"January blossoms fill no man's cellar."

—*Portuguese Proverb.*

Greenwich.—With the exception of the seven days from January 19th to 25th, the month of January was exceptionally warm. The mean temperature of January was 41·1°, being 4·9° higher than the average of 98 years, higher than the corresponding temperature in 1867 by 6·9°, and in 1868 by 3·9°, but lower than 1866, when 42·6° was recorded.

The daily range of temperature was 0·2° less than the average.

The readings of the barometer, at the height of 160 feet above the mean level of the sea, oscillated above and below the average during the first few days of January, but on the 6th a steady increase set in, and with the exception of the 14th and 15th, remained constantly above the average till the 25th, the readings during the whole of this time being generally above 30 inches. A period of depression then ensued, which lasted till February 3rd, and on two occasions during this time the defect from the average was as much as 0·8 inch, being 28·9 inches. On the 30th there was a very severe gale in Ireland, which did much damage to the embankments of the Suir and Barrow; also at Queenstown. The Railway Stations at Dunkettle and Youghal were destroyed. On the 31st there were extraordinarily high tides around the Irish coasts, in the English Channel, the Thames, the Welsh coast, the coast of Cumberland, &c., and great damage was done.

North Sunderland.—A very dull misty foggy month, with a rare continuance of southerly winds.

Wallington—The year began with a sharp frost. On the 1st the thermometer fell to 15°, and on the 25th and 26th to 18°. On fourteen nights there was a slight frost. On the 25th snow fell, the only time it did so during the month. The month throughout was very spring like. The 30th and 31st were marked by strong winds.

Wylam.—A wonderfully fine mild month.

Barometer—Mean height at 8 A.M., 29·807; highest, 30·394 on the 18th; lowest, 28·725 on the 29th.

Thermometer—Mean $\left(\frac{\text{max.} + \text{min}}{2}\right)$ 40·59°: mean of fourteen years (including 1869) 37·29°, excess of 1869, 3·30°; highest, 55° on the 10th; lowest 21° on the 1st. Mean of wet bulb, 37·58°, of dry bulb, 39·71°.

Fall (rain and melted snow)—1·97 inches; days of fall, twelve; greatest in twenty-four hours, 0·39 inch on the 4th.

Height of river at Wylam Bridge, 3·6 feet; highest, 8 feet on the 5th.

Wind (from clouds overhead)—Resultant of month, W., 7° N.

North Shields.—Cloudy or rainy all the month. The maximum temperature on the 31st was 55·5°, and the minimum was 26·6°. On six days the temperature was below 32° on the grass.

Hartlepool.—The winds were almost entirely southerly: on the 3rd, 17th, and 26th they were polar or northerly for a few hours. At midnight, between the 28th and 29th, a gale sprung up from the south, veering to the westward: it decreased about 6 A.M., having reached to a force of nine, Beaufort's scale. The tidal harbour being directly open to this wind, the waves washed down screens at the ferry landing. The mean force of wind during the month was four, Beaufort's scale.

The greatest fall of rain was during the gale on the 29th, when 0·45 inch fell. Rain fell on seventeen days.

The sea was remarkably calm, owing to the heavy winds being off the land. The greatest height of crest of waves above the general level was two feet. During seventeen days it was less than one foot.

At 4 P.M. on the 1st the temperature rose above freezing point. During the 24th and morning of the 25th there was a slight frost.

LUNAR HALOS were seen at Rothbury on the 26th; at North Shields on the 26th; at Sunderland on the 23rd, 25th, 28th, and 29th; at Darlington on the 26th.

SOLAR HALOS were seen at Sunderland on the 7th and 26th.

AURORÆ BOREALES were seen at Sunderland on the 5th; at Greta Bridge on the 17th.

METEORS were seen at Rothbury on the 3rd.

SNOW fell at Byrness on the 23rd and 25th; at Rothbury on the 25th; at Greta Bridge on the 1st.

THUNDERSTORM at Otterburn on the 3rd.

THUNDER was heard, but LIGHTNING was not seen, at Byrness on the 29th; at Rothbury on the 29th; at Bywell on the 29th; at Horsley near Wylam on the 29th; at Stamfordham on the 29th; at Darlington on the 29th.

LIGHTNING was seen, but THUNDER was not heard, at Allen heads on the 3rd and 11th; at North Shields on the 29th; at Greta Bridge on the 23rd.

Rainbows were seen at Byrness on the 8th; at Otterburn on the 5th; at Rothbury on the 5th; at Seaham Hall on the 15th.

February.—

"When gnats dance in February the husbandman becomes a beggar."
—*Old Proverb.*

"Small showers last long, but sudden storms are short."—*Shakspeare.*

Greenwich.—The month of February was, like January, exceptionally warm. The mean temperature of February was 45·3°, being 6·9° higher than the average of 98 years, and with the sole exception of 1779, when the same temperature was recorded, higher than the corresponding value in any year in the period 1771–1868.

From February 4th till March 7th small fluctuations in the movements of the barometer occurred, the readings being alternately above and below the average in short periods; the amount of excess or defect on one occasion only, being greater than 0·4 inch.

The daily range of temperature was 0·7° greater than the average.

North Sunderland.—A mild month on the whole. S.W. and westerly winds were remarkably prevalent.

Wallington.—A fine spring-like month. The lowest reading of the thermometer was 23° on the 29th. On twelve nights there was a slight amount of frost. Farmers had abundant supplies of cattle food as the grass was good.

On the 25th a violent gale of wind began to blow at 12 noon, and the thermometer rose 10° between 1 p.m. and 3 p.m.

Bywell.—The mild weather during the greater part of the month advanced vegetation too rapidly; the fall of temperature towards the end of the month did much good.

Wylam.—A fine mild month, with much wind. Everything very forward: a thrush's nest with eggs in it on the 4th.

Barometer—Mean height at 8 A.M., 29·730; highest, 30·255 on the 15th and 22nd; lowest, 28·687 on the 1st.

Thermometer—Mean, 44·66°; mean of fourteen years, 39·36°, excess of 1869, 5·30°; highest, 62° on the 6th; lowest, 29° on the 13th. Mean of wet bulb, 39·86°; of dry bulb, 42·93°.

Rainfall—1·56 inches; greatest in twenty-four hours, 0·29 inch on the 1st; days of fall, thirteen.

Height of river, 4·9 feet; highest, 17·5 feet on the 8th.

Wind—Resultant, W., 11° S.

North Shields.—The maximum temperature recorded was 59° on the 5th, and the minimum 30° on the 28th. On only one day was the temperature on the grass below 32°.

Hartlepool.—On the 14th we had a strong gale of wind, which reached a maximum of 10, Beaufort's scale, between 6 and 9 A.M., from W. by N. The barometer was reported to be falling all over the United Kingdom, with a gale from the westward, and clouds or rain, except in Cornwall, where the sky was clear. It was however rising in France, and at Paris it was one inch higher than at Nairn. The wind was generally strongest on the east coast, but nowhere so high as at Hartlepool, except at Ardrossan, on the west coast of Scotland, which at the time was nearly to windward of this place. Mean force of wind during the month was 4·3.

The greatest fall of rain was 0·93 inch on the 1st. Rain fell on fifteen days.

The greatest height of crest of wave over the general level of the sea was three feet on the 2nd. For twenty days it was less than one foot. On the 26th there was a high tide which reached 22·4 feet above the cill of the dock gates at Hartlepool, and consequently was 19 feet above low water of ordinary spring tides. Besides being an equinoctial spring tide, it appears to have been further raised by the winds, which are reported to have been south-westerly, or in the direction of the tide wave in the Atlantic on the 25th, and to have changed to the north-west when it rounded the north of Scotland.

The barometer, after a steady rise of an inch in fifteen hours on the 2nd, was steady for the remainder of the month.

During the 5th, 6th, 7th, 8th, and 9th the temperature was never lower than 46°, and the only time when it approached the freezing point was on the 28th.

Solar Halos were seen at Byrness on the 11th; at Rothbury on the 11th, 12th, and 13th; at Sunderland on the 6th; at Darlington on the 9th and 12th.

Lunar Halos were seen at Rothbury on the 17th, 18th, and 23rd; at North Shields on the 24th; at Sunderland on the 17th, 20th, and 23rd; at Darlington on the 23rd.

Aurora Borealis was seen at North Shields on the 27th.

Rainbows were seen at Byrness on the 9th and 17th; at Sunderland on the 14th, 16th, and 25th; at Seaham Hall on the 17th and 18th.

Thunder was heard, but Lightning was not seen, at Byrness on the 7th.

Lightning was seen, but Thunder was not heard, at Rothbury on the 19th; at Seaham on the 19th.

Snow fell at Byrness on the 22nd and 28th; at Elsdon on the 27th and 28th; at Rothbury on the 2nd, 22nd, 27th, and 28th; at Otterburn on the 22nd and 27th; at Stamfordham on the 28th; at Horsley near Wylam on the 2nd, 23rd, 27th, and 28th; at Sunderland on the 27th; at Seaham on the 28th; at Darlington on the 27th and 28th.

March.—

"A March without water
Dowers the hind's daughter."

—*French Proverb.*

Greenwich.—On the 2nd of March weather of a wintry character set in and continued until the end of the month, the average deficiency of daily temperature for this period exceeding 4°.

Upon the whole of the first quarter of the year the mean daily temperature was in excess to the amount of more than 2°.

The mean temperature of March was 37·5°, being 3·5° lower than the average of the preceding 98 years, and 6·5° colder than in 1868.

The daily range of temperature was 2·1° less than the average in March.

From the 8th to the 21st the readings of the barometer were constantly below the average; an increase then occurred which reached its maximum on the 23rd; but on the 26th a rapid decrease set in, and the readings remained in defect during the remainder of the month.

North Sunderland.—Very cold and stormy month. On the 28th there was a very high tide with a gale from N.E.

Wallington.—A wintry month after the two preceding spring-like ones. The change took place just in time to check the over forward vegetation, or the fruit crops would have been entirely destroyed. The lowest readings of the thermometer were on the 3rd, 7th, and 17th, when 18° of frost were recorded. There was more or less of frost on every night throughout the month.

Wylam.—A cold ungenial month, with a good deal of wind; much of it from N. and E. Vegetation was at a standstill nearly all the month; a very even temperature prevailed.

Barometer—Mean height at 8 A.M., 29·889; highest, 30·429 on the 25th; lowest, 28·908 on the 2nd.

Thermometer—Mean, 38·29°; mean of fourteen years, 40·49°; deficiency of 1869, 2·20°; highest, 52° on the 19th; lowest, 25° on the 11th. Mean of wet bulb, 35·10°; of dry bulb, 37·26°.

Rainfall—1·89 inches; greatest in twenty-four hours, 0·42 inch on the 28th; days of fall, eighteen.

Height of river, 2·8 feet; highest, 4 feet on the 20th.

North Shields.—First week rather fine, afterwards cloudy, with rain and snow. The maximum temperature recorded was

54° on the 28th, and the lowest 26·8° on the 3rd. On eight days the temperature was below 32° on the grass.

Seaham.—On the 18th there was a strong gale of wind about 3 P.M. The barometer was very unsteady for hours.

Hartlepool.—The barometer began to fall on the 1st, at noon, and at 9 A.M. on the 2nd was $\frac{7}{10}$ths of an inch lower. This depression was followed by a gale from the N.N.E., which lasted from noon till midnight. In the twenty-four hours preceding 9 A.M. on the 3rd there was a rise of $1\frac{1}{10}$th inches.

On Good Friday, the 26th, at 5 P.M., a gale sprang up, which continued without intermission till 6 P.M. on the 29th; its direction varied from N.N.W. to E.S.E., and its force from 9 to 6 Beaufort's scale. There was no remarkable indication of the approach of this gale at Hartlepool, but a general atmospheric disturbance was reported, extending over Western Europe.

Rain fell on twenty-two days, but on no day in large quantities.

The sea was at a height of from three to four feet during the gale at the end of the month.

SOLAR HALOS were seen at Byrness on the 2nd and 7th; at Rothbury on the 12th and 14th; at North Shields on the 22nd and 23rd; at Sunderland on the 1st, 3rd, 7th, 10th, 12th, and 14th; at Darlington on the 9th, 14th, and 21st.

LUNAR HALOS were seen at Rothbury on the 19th and 23rd; at Sunderland on the 20th; at Darlington on the 23rd.

AURORÆ BOREALES were seen at Elsdon on the 2nd; at Rothbury on the 2nd; at Sunderland on the 2nd, 9th, and 18th; at Darlington on the 18th; at Greta Bridge on the 2nd.

THUNDERSTORMS occurred at North Shields on the 10th; at Sunderland on the 27th; at Seaham on the 27th; at Middlesbro' on the 27th.

THUNDER was heard, but LIGHTNING was not seen, at Sunderland on the 27th and 28th.

SNOW fell at Byrness on the 3rd, 10th, 11th, 12th, 13th, and 14th; at Otterburn on the 1st, 10th, 12th, 14th, and 17th; at

Elsdon on the 1st, 9th, 10th, 11th, 12th, 13th, 14th, 21st, 22nd, 23rd, and 26th; at Stamfordham on the 1st, 2nd, and 10th; at Horsley near Wylam on the 1st, 2nd, 8th, 10th, 17th, 26th, 27th, 28th, 29th, and 31st; at Sunderland on the 9th, 10th, 11th, and 12th; at Seaham on the 2nd, 10th, 11th, 12th, 13th, 14th, 26th, and 27th; at Darlington on the 10th, 11th, 13th, 27th, and 28th; at Greta Bridge on the 10th, 11th, 12th, 13th, 14th, 15th, 16th, and 27th; at Middlesbro' on the 2nd, 10th, and 11th.

Hail fell at Byrness on the 20th; at Horsley near Wylam on the 4th, 11th, 26th, and 29th; at Seaham on the 2nd, 18th, and 27th; at Middlesbro' on the 2nd, 10th, and 27th; at Greta Bridge on the 28th and 29th.

The Registrar General reports that the winter of 1869, although the mean temperature was in excess of the average, was not favourable to the public health, for in addition to an epidemic of scarlet fever, trying and exceptional climatic conditions prevailed. "The winter just gone affords another example of the effect of the vicissitude of temperature on the health of the people, and warns those who are very susceptible to such variations to endeavour, in their manner of life, to counteract in some measure the severity of the climatic changes experienced in an English winter. The period of life when the greatest susceptibility to a fatal attack of bronchitis exists is after sixty-five; but at forty-five and under fifty-five the increase is remarkable, as also the high rate of mortality in infancy."

The estimated population of the largest towns in Northumberland and Durham, and the respective death-rates for the first quarter of 1869 was as follows:—

	Estimated Population.	Deaths.	Annual Rate to 1000 living for first three months, 1869.
Newcastle (Borough boundaries)......	130,503	989	30·42
Sunderland (Municipal boundaries)...	111,520	698	25·38
South Shields ditto ...	65,363	467	28·98
Gateshead ditto ...	42,928	325	30·70
Tynemouth ditto ...	40,003	227	23·01

April.—

"A cold and moist April fills the cellar and fattens the cow."

—*Portuguese Proverb.*

"A sunshiny shower never lasts half an hour."

—*Bedfordshire Proverb.*

Greenwich.—On the 6th of April a period of warm weather set in and extended to April 29th. The mean daily excess of temperature for those twenty-four days was 5¼°. On the 30th of April a period of warm and cold days alternated, till well into May, but the colder predominated, as the temperature was nearly 0·6° below the average daily.

The mean temperature of April was 50·3°, being 4·3° higher than the average of 98 years, higher than the corresponding temperatures in 1866, 1867, and 1868, when 47·9°, 49°, and 48·1° respectively were recorded, but lower than in 1865 by 2°.

There have been only four instances of warmer Aprils, viz., 1779, 1821, 1844, and 1865.

The daily range of temperature was 1·4° greater than the average.

The readings of the barometer, at the height of 160 feet above the mean level of the sea, were generally above the average during April, the only departure worth notice being from the 15th to the 17th, when a depression took place to 29·06 inches. From the 21st to the end of the month high readings were prevalent, the mean amount of excess above the average for this period being as much as 0·24 inch.

The thunderstorm of April 14th extended over Lancashire, Staffordshire, Yorkshire, Cumberland, and as far north as Aberdeenshire; indeed, all over the country north of 52°. A storm was also noted at Worthing, in Sussex.

North Sunderland.—Remarkably warm and still month.

Wallington.—A wintry month for the most part. The frosts at night were very destructive to the fruit blossoms, especially pears, apricots, plums, and cherries on walls. On April 1st and 8th, 11° of frost were registered; on the 9th, 12°; on the 3rd and 27th, 6°; on the 4th and 27th, 7°; and on the 19th, 10°. The closing week of the month was remarkably hot and dry.

On the afternoon of the 14th, in the midst of a severe storm of thunder and lightning, with the wind varying constantly in different directions, a whirlwind swept over the farm of Sweethope, on the estate of Sir W. C. Trevelyan, Bart. It commenced its work of destruction on the S.W. of a small plantation and passed on to the north-east side. Every tree was uprooted and scattered in various directions. A strong stone wall, seven yards in length, next succumbed to its violence, then passing over a field it levelled seventy yards more of wall. It then came in contact with a flock of sheep whirling them up into the air, killing five, and breaking the legs and tearing off the horns of several others. Sweethope Lough was next visited. Here one side of the room over the boat-house was carried away, the walls and beams below being also lifted out of their places. Close by a stable had been built which was entirely thrown down, and a large beam of wood carried between seventy and eighty yards away. The spars and slates were found scattered about in all directions hundreds of yards away from the spot. Pieces of slate were driven fast into the fir trees. Meeting another wood in its course it made a passage ten yards in width, uprooting hundreds of trees, snapping many in half, and breaking others at various heights from the ground. It overthrew a stack of hay about 400 yards away from this last plantation, and then ceased.

The appearance of the wind was that of dense white mist, and the shape triangular, with the apex downwards.

On the same day there was a heavy fall of hail about 3 P.M., which broke several squares of glass in the vineries and plant houses, and cracked others.

Bywell.—The grass grew much during the month, and vegetation was healthy and promising. The promise of fruit very good. Farmers well forward with their work.

Wylam.—A fine breezy month. On the 14th there was a thunderstorm, which was very general over Northumberland and

Durham, and which was marked by a very violent and sudden gust of wind from S.W. at 2.30 P.M.

Barometer—Mean height at 8 A.M., 29·969; highest, 30·576 on the 29th; lowest, 29·074 on the 16th.

Thermometer—Mean, 47·98°; mean of fourteen years, 46·02°; excess of 1869, 1·96°; highest, 76° on the 12th and 14th; lowest, 29° on the 1st. Mean of wet bulb, 40·60°; of dry bulb, 43·13°.

Rainfall—2·07 inches; greatest on the 15th, 0·84 inch; days of fall, ten.

Height of river, 2·4 feet; highest, 4 feet on the 4th and 18th.

Wind—Resultant, W. 4° N.

Whitley.—On the 14th a very peculiar and grand thunderstorm occurred. It began suddenly about 2.45 P.M. The first intimation was a peculiar darkness occasioned by what seemed at the distance to be a wall of dense brown cloud approaching from the South, but which proved to be only an immense column of dust. The wind veered quite round the compass. The storm lasted about three hours. The flashes of lightning were of the most vivid kind, and were remarkable as occurring two and even three at a time, the course of each flash being parallel to the others.

During the course of the storm the wind veered from S. to W., then N. to E., and back again to S. The sea was high the night before, but during the course of the storm was nearly calm. The thermometer rose to 68° during the day. It was placed on a north wall well shaded.

North Shields.—A very bright meteor was seen on the 12th; its direction was from W. to S.W. The pear was in blossom on the 10th.

The maximum temperature, 72·5°, was registered on the 11th, and the minimum, 32·2°, on the 4th. On no occasion did the temperature fall below 32° on the grass.

Sunderland.—Mr. Backhouse describes a "very magnificent thunderstorm, on April 14th: many of the flashes of lightning were among the grandest I ever saw, and consisted of several nearly simultaneous ones. In two cases I saw a phenomenon I never noticed before, viz.: the flash remained a considerable time (a second or two) being very bright at first, and gradually growing fainter, first at the point it started from and then at the end, till it became quite faint, though exactly the same in shape and place as at the first. A friend who saw it independently (in one flash) well described it as 'the lightning appearing to leave its mark in the clouds.'"

Seaham.—On the 14th there was a very severe thunderstorm at 5 P.M., with hail and rain. The hail was remarkable for its size and shape. It was not rounded but angular, and many of the hailstones were quite an inch across.

Hartlepool.—On the 15th the barometer was at 29·69 inches at 9 A.M., and fell 0·58 inch in twenty-four hours. It remained low till 9 P.M. on the 16th, from which time the pressure increased till it reached 30·02 inches at 9 P.M. on the 18th. This recovery was reported to be uniform over the whole kingdom. With a trifling exception, there was a gradual rise of pressure, till on the 29th the highest point during the half year ending June 30th was reached, viz., 30·40 inches.

On the 14th the maximum temperature was at the unusual height of 71°. The thermometer fell at the same time as the barometer, noted above, till on the 18th the minimum reading was as low as 34° during a gale from the N.E.

On the 18th a gale of wind, from the N.N.E., reached its greatest height of 8, Beaufort's scale. A considerable fall of both barometer and thermometer preceded this gale. The mean force of wind was 3·6, Beaufort's scale.

The greatest fall of rain was on the 15th, when 0·38 inch fell. Rain fell on ten days.

The sea reached a height of three feet on the 18th and 29th, and was less than one foot during twenty days.

Solar Halos were seen at Rothbury on the 8th, 19th, 22nd, and 23rd; at Sunderland on the 1st, 2nd, 4th, 10th, 12th, 15th, 19th, 22nd, and 24th.

Lunar Halos were seen at North Shields on the 22nd and 25th; at Sunderland on the 22nd; at Darlington on the 1st.

Auroræ Boreales were seen at Sunderland on the 15th and 26th; at Greta Bridge on the 3rd.

Rainbow was seen at Rothbury on the 7th.

Thunderstorms occurred at Otterburn on the 11th; at Rothbury on the 11th and 14th; at Horsley near Wylam on the 14th and 15th; at Sunderland on the 14th; at Seaham on the 14th; at Middlesbro' on the 14th; at Darlington on the 14th; at Greta Bridge on the 14th.

Thunder was heard, but Lightning was not seen, at Byrness on the 11th; at Otterburn on the 13th; at Horsley near Wylam on the 11th.

Lightning was seen, but Thunder was not heard, at Allenheads on the 11th; at North Shields on the 11th; at Sunderland on the 11th; at Greta Bridge on the 11th.

Snow fell at Rothbury on the 2nd, at Horsley near Wylam on the 2nd and 3rd; at Sunderland on the 3rd.

Hail fell at Rothbury on the 14th; at Seaham on the 1st and 14th; at Middlesbro' on the 14th.

May.

"Water in May is bread all the year."

—*Spanish Proverb.*

"Who doffs his coat on a winter's day
Will gladly put it on in May."—*Old Proverb.*

Greenwich.—A decided cold set in on the 13th of May, and continued with trifling exceptions till the 1st of June. It was the most intense towards the end of the month, when deficiencies of daily temperature, amounting to 11° and 12°, were experienced. The mean temperature of the period from May 13th to June 1st was 3·9° in defect daily, and the loss of temperature was almost wholly during the hours of the day, which were usually from 6° to 7° too low. The night temperatures were usually about their average value.

The mean temperature of the month was 50·5°, being 2·1° lower than the average of 98 years, and lower than the corresponding period in 1868 by 6·8°, but higher than in 1866, when 50·1° was recorded.

The daily range of temperature was 3·4° less than the average. It is very seldom that the daily range in May is so small as it was in 1869.

The fall of rain was 1·2 inches in excess.

On the 1st of May a steady fall of the barometer commenced and lasted till the 6th, the minimum recorded being 29·02 inches, but on the same day an equally steady rise took place and attained its maximum (30·06 inches) on the 13th. Decreasing readings were again recorded between the 14th and 19th, and from this time to the end of the month the readings were above and below the average several times.

North Sunderland.—Very cold ungenial month. Potatoes in some gardens to north of village damaged by frost on the 29th.

Wallington.—Owing to the prevalence of N. and N.E. winds, and severe frosts on five nights, the fruit which was set upon the wall trees was much injured. More than half fell off. The earlier blossoms of the apple trees were entirely destroyed. On other trees the fruit set amounted to about one-third of an average crop. The coldest days were the 1st, 5th, 9th, 14th, and 29th. The mean night temperature was 32·7°. The vegetation was fully three weeks later than in 1868.

Whitfield.—The thermometer was at and below freezing point on twelve days in May. The lowest temperature recorded was 24° on the 6th. On May 1st the thermometer stood at 56°.

Bywell.—Owing to the prevalence of easterly winds vegetation made but little progress this month. Farmers were well forward with turnip sowing. The frost on the night of the 29th hurt the fruit trees, and damaged the early potatoes.

Wylam.—A cold dull month.

Barometer—Mean height at 8 A.M., 29·900; highest, 30·389 on the 14th; lowest, 29·123 on the 7th.

Thermometer—Mean, 45·55°; mean of fourteen years, 50·93°; deficiency of 1869, 5·38°; highest, 62° on the 2nd; lowest, 31° on the 9th. Mean of wet bulb, 43·64°; of dry bulb, 46·29°.

Rainfall—3·86 inches; greatest, 1·12 inches on the 7th; days of fall, sixteen.

Height of river, 2·1 feet; highest not observed.

Wind—Resultant, E., 29° N.

Holly flowers in immense profusion.

Whitley.—The month of May was cold throughout, and was remarkable for the prevalence of northerly and easterly winds. Vegetation was much checked.

A very remarkable display of the aurora occurred on the 13th, and seems to have been seen at very different points. The following account of an aurora, which was seen on April 2nd, is from the pen of Mr. Plummer, of the Durham Observatory, and was communicated by him to the Royal Astronomical Society of London.

"A short time ago the idea occurred to me that something might be added to our knowledge of the nature of the Aurora Borealis by means of the analysis of its light by the spectroscope, and I resolved to examine its spectrum upon the first opportunity. A very fine aurora was visible at Durham soon after midnight on April 2nd. It is the result of the observations made upon that occasion that I have now the honour to communicate to the society.

"The light of the aurora appeared to the eye as white, perhaps slightly bluish, and not of the more common ruddy hue. There were few or no rays, but broad sheets or waves of light succeeded each other rapidly, proceeding from the arch to the height of about 30° from the horizon. Upon being examined by the spectroscope, one *bright* line was immediately seen. At the brightest parts of the arch this line was perhaps equal in intensity to that of the most conspicuous of the lines in the Nebula of Orion: it presented ordinarily a somewhat hazy appearance, but at times would flash out sharply and well defined. It was difficult to make any accurate measurement of its position, but two approximate measures were taken by illuminating the field suddenly by means of a hand lamp, and placing the cross wires as nearly as possible on the position in which the line had been seen. These two estimations are respectively 19·40 and 19·25 revolutions of my scale, and place the line between the solar lines D and E; or very nearly half-way between D and *b*.

"The two conspicuous pairs of lines near D in the air spectrum would be represented on my scale by the numbers 17·89 and 18·61 revolutions; but I cannot believe that the two aforesaid estimations are so much in error as to render it possible that the latter of these lines is the one seen in the spectrum of the aurora. I am therefore led to the conclusion that the spectrum of the aurora is *not* identical with that of air, but as some doubt may exist on this point, I shall anxiously await the next appearance of an aurora to verify this result. The advanced season, however, renders it unlikely that an opportunity will occur for some months; I have therefore thought it right to communicate my present results, however imperfect they may be.

"It may be worthy of remark, that the line in the aurora spectrum agrees closely with that of the more conspicuous of the lines in the spectrum of *a* Orionis, between the solar line D and E. I have measured this line upon two occasions, February 12th and 13th, and the resulting measures were 19·35 and 19·38 revolutions respectively. There is also a tolerably conspicuous line in Aldebaran, near the same place. It is also necessary to state that all these measurements have been referred directly to the Sodium line D, by the observation of the spectrum of the metal from the salt with an alcohol flame, both before and after the observations. They are thus strictly comparable."

In the course of the discussion which followed on the reading of this paper Mr. Huggins stated that the same single line had been seen by Struve in Russia, about April last year, who found it not only in auroras of which the light was white, but where they were pink also. The Astronomer Royal remarked that different results might be obtained in different countries. The aurora was only properly seen in the North: as visible here we do not see the bottom of the aurora, but only the faint uttermost parts of that visible in the North of Europe.

North Shields.—The maximum temperature registered was 59° on the 30th, and the minimum 35·7° on the 13th. The greatest fall of rain was 0·62 inch on the 6th.

Hartlepool.—The mean force of winds, which were principally from the N.E., was high, viz., 4 on Beaufort's scale, but there was no case of a severe gale.

The greatest fall of rain was 0·58 inch, and occurred on the 19th. Rain fell on seventeen days.

The greatest height of the sea above the general level was three feet. There were only six days below one foot.

The mean temperature was 2·3° lower than in April.

Solar Halos were seen at Sunderland on the 4th, 5th, 14th, 19th, and 30th.

Auroræ Boreales were seen at Rothbury on 5th, 11th, 12th, 13th, 27th; at Sunderland on the 13th; at Greta Bridge on the 13th; at Middlesbro' on the 13th.

Rainbows were seen at Sunderland on the 27th; at Seaham on the 20th.

Snow fell at Byrness on the 3rd and 7th.

Hail fell at Horsley near Wylam on the 11th; at Middlesbro' on the 20th.

Thunder was heard, but Lightning was not seen, at Horsley near Wylam on the 22nd; at Middlesbro' on the 20th.

June.—

"Mist in May and heat in June,
Make a harvest come right soon."
—*Old Proverb.*

Greenwich.—From June 2nd to June 8th (except on the 4th, which was cold,) the whole period was warm, and exceedingly so on the 7th, on which day, throughout the whole of the twenty-four hours, there was an excess of temperature of no less than $14\frac{3}{4}°$, and the mean temperature of the six days ending June 8th was $3\frac{1}{2}°$ in excess over the average daily temperature for the period. A remarkably severe period of cold weather set in on June 10th and continued unchecked till the end of the month, some days being marked by exceedingly low temperatures; the nights as well as the days were equally cold; and the average temperatures for these days for the whole twenty-four hours was as large as $6\frac{3}{4}°$ in defect of daily temperature.

The mean temperature of June was 55·3°, being 2·9° lower than the average of 98 years, and lower than any corresponding period since 1824 with the sole exception of 1830 and 1860, in the first of which years the same value was registered, and in the second 54·8°. The mean temperature of June in 1868 was 62°, being 6·7° higher than this year.

As far back as 1770 there have only been ten instances of lower temperature than in 1869 for May and June, viz., in 1773, 1792, 1795, 1799, 1805, 1812, 1814, 1816, 1821, and 1824. In 1855 the mean temperature was the same as in 1869.

The daily range of temperature was 0·4° greater than the average during June.

The barometric variations during June were very small, the greatest departures from the average only amounting to — . 4 and + . 3 respectively. The readings were, with the sole exceptions of the 4th, 12th, 13th, 14th, and 15th, constantly in excess of the average, and usually above or very close to 30 inches.

North Sunderland.—Fine weather from the 2nd to the 8th. Very cold and ungenial from the 8th to the 22nd. The last week was fine and warm, though the wind was from the north. The Cheviots were covered with snow on the 16th.

Wallington.—The first and third weeks were scarcely like summer. Swallows arrived earlier than usual in 1869, but they perished afterwards by scores from cold and starvation. Flies were very scarce. The weather continued cold up to the 20th. On the 21st a great change took place, comparable only to passing from winter to summer, and the weather continued warm until the end of the month.

On the 15th there was a heavy thunder shower, with a strong gale of wind at night. Trees were uprooted, branches broken off, and the ground strewed with green leaves.

Wylam.—A fine month..

Barometer—Mean height at 8 A.M., 30·063; highest, 30·413 on the 28th; lowest, 29·406 on the 16th.

Thermometer—Mean, 54·22°; mean of fourteen years, 56·84°; deficiency of 1869, 2·62°; highest, 55° on the 26th; lowest, 33° on the 1st. Mean of wet bulb, 50·23°; of dry bulb, 54·93°.

Rainfall—1·45 inches; greatest, 1·00 inch on the 16th; days of fall, seven.

Height of river, 1·3 feet; highest not observed.

Wind—Resultant, N., 14° W.

Whitley.—There were a few warm days at the beginning of the month. On the 9th and 10th strong cold northerly winds prevailed, and much damage was done to the crab pots of the Cullercoats fishermen. On the 15th a very strong gale sprung up suddenly from the N. at 7.30 and continued all night. Two fishing boats with their crews were lost off Cullercoats. There was no wind of any consequence sixteen miles out at sea until 10 o'clock P.M. The storm did not reach Whitby until midnight. It is remarkable that the coming storm escaped the vigilance of the Meteorological Office, although their returns for the 15th show a rapidly increasing difference of barometrical pressure between stations W. and E. There was a thunderstorm in London on the same day between 1 and 2 P.M., when the lightning struck the sailing barge S X lying in the Thames off Charlton, and ignited the straw with which it was laden.

On the 16th and 18th there was much snow on the Westmorland, Cumberland, and Yorkshire hills. Ten days later there was snow on Skiddaw.

North Shields.—On the 6th a maximum temperature of 73°, and a minimum of 38° on the 1st was recorded. The rainfall was 1·47 inches below the average for the years 1860–65.

Sunderland.—A singular mirage was seen on the 16th by Mr. Backhouse.

Seaham.—On the 15th there was a strong gale of wind about 7.40 P.M., which increased in violence during the night.

Hartlepool. — The barometer was very steady during this month. On the night between the 15th and 16th, a gale from the north-east reached a height of 8, (Beaufort's scale,) and caused the loss of several fishing boats, and the lives of fourteen Hartlepool fishermen. The local instruments did not give any remarkable indication of this gale, but there was considerable difference of pressure between the western coast of Ireland and the east coast of England. The gale was accompanied by a heavy fall of rain along the east coast of England.

The highest temperature for the half-year ending June 30th was reached on the 7th, viz., 76°.

Mean force of wind, 3·2, Beaufort's scale. The prevailing direction has been north-easterly, but vessels from the Baltic reported that westerly winds had been general at sea.

The greatest fall of rain on the 16th, during the gale, was 0·58 inch. Rain fell on nine days.

The sea has been generally calm during the month; but during the gale on the 16th it reached a height of three feet, and exerted a pressure of 27 cwt. per square foot against the end of the new pier.

A remarkable mirage was apparent to the south-east for several hours during the 26th.

Solar Halos were seen at Sunderland on the 2nd, 8th, 10th, 11th, 18th, and 27th.

Hail fell at Byrness on the 4th.

Rainbow was seen at Sunderland on the 14th.

Thunderstorms occurred at Rothbury on the 6th, 10th, and 14th.

Lightning was seen, but Thunder was not heard, at Rothbury, on the 16th.

Thunder was heard, but Lightning was not seen, at Byrness on the 20th; at Rothbury on the 15th and 26th; at Allenheads on the 15th; at Bywell on the 15th; at Horsley near Wylam on the 7th and 14th; at Seaham on the 15th; at Middlesbro' on the 15th.

During the quarter ending the 30th of June the Registrar General reports that the health of the country was good: a mild April, followed by a cold May and June, did not act very unfavourably on the public health. The deaths were below the average of the season, and the improvement would no doubt have been greater if the preceding March had been more genial, for many bronchial affections which commenced then, terminated fatally in the present quarter.

The rate of mortality in the northern counties was twenty-three per thousand. Scarlet fever was epidemic in some districts of Durham.

The death rates for the quarter in the chief towns in Durham and Northumberland is shown in the following table.

	Estimated Population.	Deaths.	Average Rate to 1000 living for 2nd three months, 1869.
Newcastle (Borough boundaries) ...	130·503	779	23·96
Sunderland (Municipal boundaries)	111·520	524	18·85
South Shields ditto ...	65·363	391	23·99
Gateshead ditto ...	42·928	250	23·36
Tynemouth ditto ...	40·003	220	22·06

July.—

"July God send thee calm and fayre,
That happy harvest we may see,
With quyet tyme and healthsome ayre,
And man to God may thankful bee."
—*Old Poem.*

Greenwich.—The cold period which began in June continued until July 3rd. On the 4th a warm period began and continued until the end of the month, with very little rain, the temperature for these twenty-eight days averaging a daily excess of 3·4°.

The mean temperature of July was 64·5°, being 3·1° higher than the average of 98 years, lower than the corresponding temperature in 1868 by 3°, but higher than in any previous year as far back as 1859.

The daily range of temperature was 1·5° greater than the average.

The mean readings of the barometer, at the height of 160 feet above the level of the sea, were with few exceptions above the average. The maximum recorded was 30·24 inches, the minimum 29·64 inches, and the range of readings 0·60 inch. The only movement worthy of notice commenced on the morning of the 23rd, the reading then being 29·92 inches. It attained its minimum (29·64 inches) on the 26th, and a steady rise then occurred which lasted till the 30th.

Otterburn.—A beautiful circling waterspout was seen on the 28th.

North Sunderland.—A very hot dry month. The 15th and 16th were two remarkable days. The 15th was a very hot day. There was a strong gale from W.N.W. to W. from 10 A.M. to 6 P.M., rising again as the night went on. The barometer was very steady. On the 15th the wind was remarkably soft, varying from W. to N.W.

Wallington.—July was very fine and warm from the 1st to the 24th. During that period only three slight showers of rain fell. In the last week rain fell on five days to the amount of $\frac{8}{10}$ths of an inch, which saved all the growing crops. The first dish of peas was gathered on July 4th; eighteen days later than in 1868.

Wylam.—A fine warm breezy month.

Barometer—Mean height at 8 A.M., 30·013; highest, 30·420 on the 11th; lowest, 28·850 on the 7th.

Thermometer—Mean, 62·03°; mean of fourteen years, 59·07°; excess of 1869, 2·96°; highest, 84° on the 22nd; lowest, 40° on the 1st. Mean of wet bulb, 56·93°; of dry bulb, 62·48°,

Rainfall—0·29 inch; greatest fall, 0·10 inch on the 6th; days of fall, seven.

Height of river, 1·2 feet; highest, 1·4 feet.

Wind—Resultant, W., 4° S.

North Shields.—The maximum temperature recorded was 78·8° on the 16th, and the minimum 45·2° on the 1st. The rainfall was 1·64 inches below the average of the years 1860–65. The heaviest fall was 0·86 of an inch on the 27th.

Seaham.—On the 28th there was a very heavy thunder shower at Seaham Harbour, but scarcely any fall at Seaham only one mile distant.

Hartlepool.—The mean force of the wind for the month was 3·49 (Beaufort's scale, 1–12). The maximum force was six. The highest temperature recorded was 80°, and the lowest 50°. The heaviest rainfall was 0·24 inch. The mean height of the sea in feet above the general level was 0·03. The maximum height 1.

Solar Halos were seen at Middlesbro' on the 23rd; at Darlington on the 26th.

Hail fell at Otterburn on the 28th.

Rainbow was seen at Rothbury on the 22nd.

Thunderstorms occurred at Byrness on the 26th and 28th; at Rothbury on the 25th, 26th, and 28th; at North Shields on the 26th and 28th; at Middlesbro' on the 18th, 26th, and 28th; at Seaham Hall on the 26th.

Thunder was heard, but Lightning was not seen, at Byrness on the 18th; at Otterburn on the 28th; at Rothbury on the 10th; at Bywell on the 18th, 22nd, and 25th; at Sunderland on the 24th and 29th; at Seaham on the 28th; at Darlington on the 26th; at Middlesbro' on the 7th.

Lightning was seen, but Thunder was not heard, at North Sunderland on the 28th; at Allenheads on the 28th; at Rothbury on the 28th.

August.—

"Dry August and warm,
Doth harvest no harm."—*Old Proverb.*

Greenwich.—A sudden change set in on August 1st; the temperature declined below its seasonable average and continued so till the 21st, with frequent rain in light showers: the average daily deficiency of temperature for the period was 2·8°. From the 22nd there was a warm period of a week's duration with brilliant sunshine, and the excess of temperature daily was as large as 8°: on the 28th the excess reached 12°. On the 29th the weather changed to cold bleak and cloudy, and the daily deficiency of temperature averaged 3·8° till September 3rd.

From the 1st to the 14th of August the readings of the barometer oscillated above and below the average several times. The absolute minimum, 29·39 inches, (being also the absolute minimum for the month,) occurred on the 9th. From the 14th to the end of the month the readings were, almost without exception, above the average, and above 30 inches.

The mean temperature of August was 60·8°, being 0·1° higher than the average of 98 years, lower than in 1868 and 1867 by 2·8° and 1·2 respectively, but higher than in 1866, 1865, and 1864, when 59·4°, 59·9°, and 59·6° respectively were recorded.

On the 24th severe earthquakes were felt at Arica and other parts of South America, St. Thomas in the West Indies, &c.

North Sunderland.—A generally fine month up to the 28th.

From the 13th to the 28th hot and dry. The 24th, the 25th and 26th were especially warm days. On the night of the 28th there was a sudden fall in temperature. Barometer steady.

Wallington.—Showers of rain were frequent from July 26th to the 3rd of August. On only three days afterwards throughout the month was there any rainfall of consequence. Crops of all kinds suffered much from drought, and the pastures were in many places quite burnt up. Up to the 28th, which was the warmest day of the year, the weather was all that could be desired for harvest work. After that date a great change took place, and the temperature fell very greatly. The wind veered to N.E. about 8 P.M. on the 28th. The maximum thermometer, read at 9 P.M. on the 28th, recorded a temperature of 80°: on the three following days it was 49°, 56°, and 60·5° respectively.

Whitfield.—On the night of the 11th the thermometer fell to 35°, on the 29th to 33°, on the 30th to 31·5°. There was ice on the ponds on the 31st, and yet the 28th was the hottest day in the year when the temperature reached 76°.

Wylam.—A very fine warm breezy month.

Barometer—Mean height at 8 A.M., 30·125; highest, 30·445 on the 17th; lowest, 29·518 on the 9th.

Thermometer—Mean, 57·75°; mean of fourteen years, 58·87°; deficiency of 1869, 1·12°; highest, 91° on the 29th; lowest, 40° on the 3rd. Mean of wet bulb, 53·03°; of dry bulb, 56·42°.

Rainfall—1·25 inches; greatest, 0·32 inch on the 4th; days of fall, ten.

Height of river, 1·56 feet; highest, 1·7 feet.

Wind—Resultant, W., 18° N.

North Shields.—The maximum temperature on the 28th was 81°, and the minimum 40·3° on the 31st. The rainfall was 1·56 inches below the average of the years 1860–5.

Sunderland.—At West Hendon House on the 28th the thermometer reached 85°. At 2 P.M. a slight E. wind came on and cooled the air considerably; but it continued very hot until 7 P.M.

when a brisk N.W. breeze sprung up, and, about 8 P.M., changed to N. and grew stronger. The maximum temperature on the 29th was only 55°.

Hartlepool.—The mean force of the wind for the month was 3·26 (Beaufort's scale, 1–12). The maximum force was seven. The highest temperature was 78°, the lowest 42°. The heaviest rainfall was 0·38 inch. The mean height of the sea above the general level in feet was 0·35. The maximum height 2. The maximum force in cwt. per square foot was 20.

SOLAR HALOS were seen at Sunderland on the 3rd, 10th, 16th, and 31st.

RAINBOW was seen at Sunderland on the 1st and 29th.

AURORA BOREALIS was seen at Sunderland on the 11th; at Darlington on the 26th.

HAIL fell at Middlesbro' on the 26th.

THUNDERSTORMS occurred at Allenheads on the 10th; at Rothbury on the 4th; at Sunderland on the 1st and 2nd; at Middlesbro' on the 10th and 29th.

THUNDER was heard, but LIGHTNING was not seen, at Byrness on the 1st; at Rothbury on the 1st, 2nd, 10th, 12th, and 13th; at Allenheads on the 5th; at Horsley near Wylam on the 5th and 10th; at North Shields on the 1st and 2nd; at Middlesbro' on the 1st and 19th; at Sunderland on the 1st; at Darlington on the 29th.

LIGHTNING was seen, but THUNDER was not heard, at North Sunderland on the 14th, at Allenheads on the 1st.

September.—

> "The winds of the day wrestle and fight
> Longer and stronger than those of the night."—*Old Proverb.*
> "A pear year a dear year."—*Old Proverb.*

On the 12th and 13th very violent gales of wind prevailed, especially in the Channel and along the western coasts of the island, and great damage was done to shipping.

On the 17th the Island of St. Thomas, in the West Indies, was shaken by a very violent earthquake. Somewhere about the same time the rock off the coast of Newfoundland, on which the "Germania" and "Cleopatra" were wrecked, was raised considerably by volcanic agency.

On the 26th there was a great eruption of Mount Etna, and violent earthquakes in many parts of the world about that time.

Greenwich.—On September 4th the temperature passed above the average, and the weather was generally warm until the end of the month, with frequent heavy gales and storms. The average daily excess of temperature in the last twenty-seven days of the month was 3·2°. Upon the whole of the three months ending September 30th the temperature was in excess to the amount of 1·9° daily.

The mean temperature of September was 59°, being 2·5° higher than the average of 98 years. In 1868 the value recorded was 60·5°; in 1867 and 1866, 57·6° and 56·4° respectively.

On the 1st of September a fall of the barometer set in and reached its minimum (29·50 inches) on the 6th; a rise then occurred to 29·76 inches on the 7th. Decreasing readings were again recorded to 29·20 inches on the 10th, succeeded by a small increase to 29·40 inches on the 11th. A rapid fall then took place, and reached its lowest point at 5 A.M. of the 12th, 28·58 inches being recorded; and this again was followed by a steady rise to 30·08 inches on the 23rd. From this time to the end of the month the mercury was very fluctuating.

During the periods of great depression in September, viz., from the 9th to the 20th, violent gales raged from the S.W., causing great destruction of life and property. The mean pressure of the wind during this month was as much as one pound the square foot. On numerous occasions pressures were registered above thirty pounds to the square foot. The mean daily horizontal movement of the air in September was 349 miles, against 213 and 224 miles in July and August respectively.

North Sunderland.—A dull unsettled month. Very wet from the 8th to the 19th. Windy from the 17th, with some very heavy gales. From the 19th the weather was on the whole favourable to the harvest.

Wallington.—Rain fell on twenty-four days and much difficulty was experienced in getting in the oat crop. Much of the crop had to be left out in the fields until October and was greatly damaged by the wet.

Whitfield.—A remarkably wet month.

Wylam.—A fine month, with a great deal of wind.
Barometer—Mean height at 8 A.M., 29·676; highest, 30·453 on the 1st; lowest, 29·029 on the 12th.
Thermometer—Mean, 56·40°; mean of fourteen years, 54·84°; excess of 1869, 1·56°; highest, 71° on the 9th and 10th; lowest, 41° on the 22nd. Mean of wet bulb, 52·30°; of dry bulb, 56·10°.
Rainfall—2·94 inches; greatest, 0·63 inch on the 13th; days of fall, seventeen.
Height of river, 2·59 feet; highest, 8 feet on the 18th.
Wind—Resultant, W., 23° S.

North Shields.—The maximum temperature was 69·5° on the 25th; the minimum 43° on the 22nd. Rain fell on twenty-one days, and the quantity was 1·12 inches in excess of the average.

Hartlepool.—The mean force of the wind for the month was 4·29 (Beaufort's scale, 1–12). The maximum force was eight. The highest temperature recorded was 69°, the lowest 45°. The greatest rainfall in any one day was 0·97 inch. The mean height of the sea in feet above the general level was 0·43. The maximum height 3. The maximum force in cwts. per square foot was eight.

SOLAR HALOS were seen at Sunderland on the 3rd, 8th, 9th, 11th, 17th, 18th, 19th, and 23rd; at Darlington on the 16th and 19th.

LUNAR HALOS were seen at Rothbury on the 16th, at North Shields on the 16th; at Sunderland on the 14th, 16th, and 20th.

Auroræ Boreales were seen at Rothbury on the 27th; at Sunderland on the 10th and 27th.

The Rainbow was seen at Rothbury on the 26th; at Sunderland on 14th, 15th, 18th, 19th, 20th, and 27th; at Seaham on the 13th.

Thunderstorms occurred at Rothbury on the 4th; at Horsley near Wylam on the 4th; at North Shields on the 5th; at Greta Bridge on the 5th; at Middlesbro' on the 5th and 7th.

Thunder was heard, but Lightning was not seen, at Byrness on the 8th and 15th; at Otterburn on the 5th; at Rothbury on the 11th; at Horsley near Wylam on the 14th; at Sunderland on the 5th; at Seaham on the 5th; at Middlesbro' on the 13th; at Darlington on the 5th.

Lightning was seen, but Thunder was not heard, at North Sunderland on the 17th; at Middlesbro' on the 30th.

The Registrar General reports that the death rate in the northern counties for the quarter ending September 30th, was 21·34 per thousand. Scarlet fever was most fatal in Stockton, some parts of Durham, Chester-le-Street, Gateshead, and Tynemouth. The usual table for the largest towns in Northumberland and Durham is subjoined.

	Estimated Population.	Deaths.	Average Rate to 1000 living for 3rd three months, 1869.
Newcastle (Borough boundaries) ...	130·503	770	23·68
Sunderland (Municipal boundaries)	111·520	612	21·77
South Shields ditto ...	65·363	436	26·46
Gateshead ditto ...	42·928	525	30·31
Tynemouth ditto ...	40·003	514	26·18

October.—

"The dews of the evening industriously shun,
They're the tears of the sky for the loss of the sun.."—*Old Rhyme.*

On the 1st and 2nd of this month a very great storm visited parts of the United States of America, and proved to be hardly less destructive than the great earthquakes of South America. One effect was to bury under sand some of the most important oyster beds in that part of the world.

From the 1st to the 11th violent shocks of earthquake were felt at Manilla.

Greenwich.—The warm period which set in on September 4th continued until the 16th of October; the average excess of mean daily temperature for the whole period of forty-three days was 3·4°, and of the first sixteen days of October 3·7°. On the 17th of October the weather suddenly changed and became cold and wintry in its character, with sleet, hail, frost, and snow, and strong winds. This severe cold weather continued with but slight variation to the end of the month. The pressure of the wind on October the 16th and 19th reached thirty pounds to the square foot.

The mean temperature of October was 48·9°, being 0·8° lower than the average of 98 years, higher than the corresponding period in 1868 and 1867 by 1° and 0·2° respectively, but lower than in any year in the period 1853–66. The rainfall was 1·1 inches below the average.

The readings of the barometer were generally high. From the 4th to the 14th they were remarkably steady, scarcely varying $\frac{1}{4}$th of an inch throughout the period, and constantly above the average. On the 14th a decrease set in and lasted till the 16th. The minimum at that time, at the height of 160 feet above the mean level of the sea, was 29·13 inches. From the 20th to the end of the month the readings were, with but two exceptions, above the average.

A very remarkable halo and mock moon were seen in Northumberland, and many other parts of the country, on the 17th.

North Sunderland.—The first half of the month was characterised by mild dull weather: the latter part by high gales of wind with rain. On the 26th, 27th, and 28th, there was a terrific storm of wind from N., and very cold.

Wallington.—The weather from the 1st to the 15th was dry and fine. On the 16th there was a heavy gale of wind from 7 to 10 P.M. The morning of the 17th was calm but very frosty. Between 8 and 9 P.M. a lunar halo was observed at a considerable distance from the moon, and two mock moons in the centre of the ring on each side, in a line passing through the centre of the moon's disc. The two next days there was rain, sleet, snow (the first fall this autumn), and a sharp cold frosty gale of wind from the N.W. On the 26th the thermometer fell to 25°, with such a bitter cold wind as to stop out of door work.

Whitfield.—The mercury was below freezing point on ten nights. The coldest night was that of the 26th, when the temperature fell to 22°.

Wylam.—The first part of the month very mild and fine; after the 12th it became daily cooler; and in a day or two the wind set in from the N. very strong, and bitterly cold. There were disastrous storms on the E. coast, nearly daily, from the 16th to the 30th.

Barometer—Mean height at 8 A.M. 29·999; highest, 30·465 on the 22nd; lowest, 29·143 on the 16th.

Thermometer—Mean, 48·40°; mean of fourteen years, 48·09°; excess of 1869, 0·31°; highest, 72° on the 10th; lowest, 27° on the 27th. Mean of wet bulb, 43·85°; of dry bulb, 45·43°.

Rainfall—2·13 inches; greatest, 0·48 inch on the 29th; days of fall, fourteen.

Height of river, 1·9 feet; highest, 3·5 feet on the 19th.

Wind—Resultant, W., 7° N.

Horsley near Wylam.—On the 16th a strong gale of wind from the N.W. at night. The next morning the ice on the pools was $\frac{1}{8}$th of an inch thick.

North Shields.—The maximum temperature was 69° on the 9th. The minimum 29° on the 27th. On three nights the temperature fell below 32° on the grass. The rainfall was 0·47 inch below the average of the years 1860–65. The greatest fall was 0·86 inch on the 28th.

Whitley.—On the 16th the wind was light in the early part of the day, and there was a heavy fall of rain. In the afternoon the wind gradually increased in violence, and about 8 P.M. blew a strong gale from the N.E. Considerable damage was done to the shipping entering the river, but the casualities were much less than might have been expected. The "Sea Horse" and "The Friends," both of Aberdeen, were driven ashore at South Shields. The "Blue Jacket," from the Tyne, was lost off the coast of Lincolnshire, and various losses were reported from North Sunderland, Newbiggen, Blyth, Marsden, Sunderland, Hartlepool, and elsewhere on the N.E. coast.

The gale lasted with great violence until the 20th.

Seaham.—On the 17th the barometer fell during the day. In the afternoon there was a fall of rain succeeded by a gale of wind. During the night the thermometer fell to 32°. The ground was frozen hard, and the first ice of the season was seen.

On the evening of October 23rd, at about 6·30, a meteor, of unusual size and brilliancy, was seen at Seaham. It appeared from behind a bank of clouds to the east and travelled perpendicularly. When first seen it was in appearance about the size of a large cricket ball, and was of a pale lilac colour, with a stream of white and most intensely brilliant light. It lasted about four or five seconds and then blazed up to twice its original size and disappeared.

Hartlepool.—The mean force of the wind (Beaufort's scale, 1–12) was 4·22. The maximum force was 11. The highest temperature recorded was 67°, the lowest 30°. The heaviest rainfall was 0·62 inch. The mean height of the sea in feet above the general level was 1·16. The maximum height 4. The maximum force in cwts. per square foot was 28.

Solar Halos were seen at Byrness on the 6th and 29th; at Rothbury on the 7th, 29th, and 31st; at Sunderland on the 6th, 7th, 10th, 21st, 29th, and 31st.

Lunar Halos were seen at Rothbury on the 23rd; at Sunderland on the 17th and 22nd; at Middlesbro' on the 24th.

Auroræ Boreales were seen at Sunderland on the 6th, 12th, 23rd, 25th, and 31st.

Rainbows were seen at Rothbury on the 30th; at Sunderland on the 13th, 23rd, and 29th.

Thunderstorms occurred at Allenheads on the 2nd; at Middlesbro' on the 20th.

Thunder was heard, but Lightning was not seen, at Rothbury on the 1st; at Bywell on the 2nd; at Horsley near Wylam on the 1st, 2nd, and 12th; at Middlesbro' on the 1st.

Lightning was seen, but Thunder was not heard, at Allenheads on the 3rd; at North Shields on the 28th.

Snow fell at Byrness on the 19th; at Rothbury on the 18th and 19th; at Horsley near Wylam on the 26th; at Sunderland on the 19th, 25th, 26th, 27th, and 28th; at Seaham on the 19th; at Darlington on the 28th; at Middlesbro' on the 19th and 28th.

Hail fell at Rothbury on the 26th; at Middlesbro' on the 19th and 28th; at Seaham on the 19th.

November.—

"An early winter a surly winter."—*Old Proverb.*

Greenwich.—At the beginning of November the weather was mild for a few days, then cold again, and thus alternated for two or three days together, those of low temperature predominating. During the month a remarkable change of temperature took place; the 10th, 11th, and 12th were of a wintry character, with very low temperatures; whilst those of the 13th, 14th, 15th, and 16th were of very high temperatures, with heavy gales of wind. Cold weather again set in on the 17th, and so continued until the end of the year.

The mean temperature of November was 43°, being 0·6° higher than the average of 98 years, higher than in 1868 and 1867, when 41·5° and 41·4° respectively recorded, but lower than the four preceding years, viz., 1863 to 1866.

During the early part of November low readings of the barometer were generally recorded, followed by an increase on the 10th, and the readings then continued above the average till the 21st, when a very rapid fall took place from 30·18 inches to 29·03 inches on the 22nd. This was followed by a gradual increase, but, with one exception, the mean daily values remained in defect of the average till the end of the month.

The mean pressure of the air for the month was that of the average. Heavy gales of wind occurred on the 2nd and 4th, a pressure of thirty pounds to the square foot being recorded. The fall of rain was the same as the average.

North Sunderland.—A stormy month with a low temperature. There was a remarkable prevalence of westerly winds. On only two days the direction was from any other quarter. On the 24th from the north, and 25th from the south.

Rothbury.—A very remarkable meteor was seen on November 6th, not only in the North, but nearly all over England. The colour was reported from nearly every place where it was observed, as being either dazzling white, blue, or bluish white; the one exception being Birmingham, where it is described as being "yellowish red, then lurid red, then vivid green, violet, and orange." But it has been remarked, "the state of the atmosphere at Birmingham generally will be an amply sufficient cause for the difference between that and other localities."

Sir William Armstrong thus describes the appearance at Rothbury:—"At five minutes before seven on Saturday evening, November 6th, while walking with my back towards the South I was startled by a brilliant red light behind me, and on turning I saw a magnificent meteor descending from the eastward at an angle of about 45° to the southern horizon. Its colour was a bluish white, and it left a train which looked exactly like that of a large rocket, but which did not remain visible to my view for more than about fifteen seconds. The meteor did not appear to me to burst, although pieces seemed to separate from it before it expired. At the moment of extinction it was about 12° or 14° above the horizon, and its direction was then S.S.W. I am quite sure as to the time of the occurrence to a minute, because, although I could not see to read my watch at the moment (a chronometer on which I can depend, and which I know was right), I hastened to the nearest light, about 400 yards distant, when I ascertained that the time was one minute to seven, which, allowing four minutes for walking 400 yards, would make the time of the appearance five minutes to seven....A co-observer, Mr. J. A. Cayley, in the neighbourhood of Bristol, witnessed the phenomenon at a distance of 260 miles from where I saw it in Northumberland. As viewed by him it appeared to descend from the zenith to about 20° above the *western* horizon, while I, as already stated, saw it in the *south*. His description of the meteor differs from mine only in regard to the train, which is described as continuing visible to him for fifteen minutes, a difference which may be attributed to its being nearer and more overhead to him than to me.

"I will not hazard even an approximate calculation of distance from the data I have given, but I confess my inability to reconcile the different angles under which this object was seen at opposite ends of a base line, having Bristol at one end and Rothbury at the other, with the supposition that its height did not exceed that which is ordinarily assigned to the atmosphere.

"At all events, if the atmosphere exists at the height of this meteor, it will be more attenuated than in the exhausted receiver of the most perfect air-pump, and it is difficult to conceive how air so rarified can so oppose the flight of a solid body as to produce the intense ignition exhibited in a meteor. Yet it seems impossible to attribute the incandescence of these bodies to any other cause than the resistance opposed by the atmosphere to to their prodigious velocity."

Wallington.—This was a cold month. Frost on sixteen nights. The lowest reading of the thermometer was on the 10th, when 15° of frost were recorded. There were several strong gales of wind. Snow fell on the 28th.

Whitfield.—The temperature was below 32° on twenty-one nights. The coldest night was the 29th, when the mercury fell to 20°. In the valley, 100 feet below the level of the village, it was down to 15°.

Wylam.—A dull cold month, with a good deal of wind.

Barometer—Mean height at 8 A.M., 29·818; highest, 30·307 on the 20th; lowest, 29·537 on the 4th.

Thermometer—Mean, 41·35°; mean of fourteen years, 41·11°; excess of 1869, 0·24°; highest, 59° on the 19th; lowest, 25° on the 11th. Mean of wet bulb, 36·97°; of dry bulb, 38·92°.

Rainfall—2·97 inches; greatest, 0·86 inch on the 14th; days of fall, fifteen.

Height of river, 4·3 feet; highest, 16·5 feet on the 14th.

Wind—Resultant, W., 6° N.

North Shields.—The maximum temperature was recorded on the 14th and 18th 58°, and the minimum 29° on the 10th. On six nights the temperature fell below 32° on the grass. The rainfall was 0·25 inch above the average of the years 1860–65.

Hartlepool.—The mean force of the wind for the month was 4·51 (Beaufort's scale, 1–12). The maximum force was 9. The highest temperature recorded was 56°, the lowest 29°. The greatest fall of rain in any one day was 0·86 inch. The mean height of the sea above the general level in feet was 0·67. The maximum height was 2. The maximum force in cwts. per square foot was 20.

SOLAR HALOS were seen at Rothbury on the 11th and 28th; at Sunderland on the 3rd, 5th, 6th, 8th, 12th, 14th, 25th, 27th, and 29th.

LUNAR HALOS were seen at Otterburn on the 14th; at Rothbury on the 15th, 19th, and 23rd; at Sunderland on the 12th, 14th, 17th, 20th, and 26th.

RAINBOWS were seen at Rothbury on the 3rd; at Sunderland on the 19th.

A METEOR was seen at Rothbury on the 6th.

Auroræ Boreales were seen at Sunderland on the 1st and 2nd.

Lightning was seen, but Thunder was not heard, at Sunderland on the 6th.

Snow fell at Byrness on the 10th: at Horsley near Wylam on the 10th; at Sunderland on the 9th and 10th; at Darlington on the 10th and 30th; at Seaham on the 10th and 29th; at Middlesbro' on the 10th and 30th; at Greta Bridge on the 10th and 30th.

December.—

"A warm Christmas, a cold Easter,
A green Christmas, a white Easter."
—*German Proverb.*

On the 24th a very remarkable storm is reported as having occurred at Dunbar, Scotland, which "wrought destruction on the east coast of Scotland comparable only to what we hear of tornadoes in the East. The townsfolk of Dunbar passed the night in fear and trembling, and they seem to have had a wonderfully narrow escape from destruction. In the neighbouring grounds of Broxmouth Park, the seat of the Duke of Roxburgh, the ravages of the storm were terrific. Great trees were torn up and snapped in pieces. Cattle-sheds were unroofed, and the tiles scattered far and wide; whole plantations were rooted up; ricks of hay were lifted bodily and hurled away. The whirlwind took a particular path which can be traced by the line of destruction. On either side of this path, which extends for miles, there is not a branch broken."—*Daily News, January 26th*, 1870.

Greenwich.—The mean temperature of December was 37·9°, being 1·3° lower than the average of 98 years, lower than in 1868 by 8·1°, higher than in 1867 by 0·4°, but lower than in any previous year as far back as 1860.

The oscillations of the barometer during December were very large, and succeeded each other rapidly, especially between the 8th and 28th. The range of readings during the month amounted to 1·62 inches.

There were heavy gales of wind on the 13th, 16th, 17th, 18th, 19th, and 30th.

The rainfall was 0·9 inch in excess of the average.

North Sunderland.—An unsettled stormy month. From the 4th to the 10th the days were unusually dark. The temperature was low but equable. There were several heavy gales of wind after the 10th. A snow storm began on the 24th, and a thaw set in on the afternoon of the 29th.

Alnwick Castle.—On the 13th the anemometer registered a velocity of 65¼ miles an hour, which was the greatest velocity by ten miles recorded on any occasion since the erection of the self-acting anemometer.

On the 22nd, between 8 A.M. and 9 A.M., the wind made six complete circuits of the points of the compass, and between 2 P.M. and 11 P.M. of the same day five complete circuits.

Wallington.—This month was remarkable for the great and sudden fluctuations of the barometer. The weather was very changeable, alternating rapidly between frost, open weather, snow, and rain. The first fall of snow, which remained for any time on the ground, fell on the 24th. Christmas Day was clear and frosty in the morning and afternoon. About 6 P.M. a high wind began to blow from N.E., accompanied by heavy showers of snow and hail, the hailstones being very large. At 9 A.M. the following morning the snow had fallen to a depth of from four to six inches. On the 27th the snow measured ten to twelve inches in depth, and a strong gale of wind blowing during the night the snow drifted greatly and the roads were in many places blocked up. The wind veered to N.W. The snow storm ceased, and there was a severe frost for three nights afterwards. The lowest temperature registered during the month was on the 28th, when the mercury fell to 15°.

On the 29th the wind changed to S.W., and blew strongly. A thaw set in, the snow rapidly disappeared, and the year went out with a shower of rain—fresh and calm weather.

On reviewing the phenomena of the year it was marked by a mild winter, a late spring, and a rather dry but fine summer. The agricultural crops of all kinds were good. The autumn taken on the whole was not unfavourable for cattle feeding.

Whitfield.—On only one night in the month was the temperature above 32°. The coldest night was the 27th, when the thermometer fell to 10°. From eight to ten inches of snow fell on the 27th. On the 13th the barometer (corrected for sea level) fell to 28·45. There was a heavy gale of wind.

Wylam.—A coarse dull month, with a great deal of wind.

Barometer—Mean height at 8 A.M., 29·751; highest, 30·706 on the 6th; lowest, 28·992 on the 13th.

Thermometer—Mean, 36·42°; mean of fourteen years, 39·92°; deficiency of 1869, 3·50°; highest, 55° on the 19th; lowest, 13 on the 28th. Mean of wet bulb, 34·27°; of dry bulb, 35·83°.

Rainfall—2·77 inches; greatest, 0·32 inch on the 5th; days of fall, eighteen.

Height of river, 3·06 feet; highest, 8 feet on the 11th.

Wind—Resultant, W., 7° N.

It will be observed that the barometer attained 30·706, the highest point during the year, on the 6th; and the thermometer fell as low as 13°, which was the lowest temperature of the year, on the 28th of this month.

I think 1869 was more windy than the average of years.—*G. C. A.*

North Shields.—The maximum temperature was 56° on the 18th, and the minimum 18·7 on the 28th. On eleven nights the temperature fell below 32° on the grass. The rainfall was 0·61 inch in excess of the average.

Gainford.—On the 27th the snow was on the ground to a depth of nine inches where it had *not* drifted.

Hartlepool.—The mean force of the wind was 4·94 (Beaufort's scale, 1–12). The maximum force was 10. The highest temperature recorded was 53°, the lowest 24°. The greatest fall of rain in any one day was 0·48 inch. The mean height of the sea in feet above the general level was 1·03. The maximum height was 4. The maximum force in cwts. per square foot was 2·6.

Solar Halos were seen at Rothbury on the 14th; at Sunderland on the 12th, 14th, 16th, 21st, and 25th.

Lunar Halos were seen at Rothbury on the 14th and 17th; at Sunderland on the 11th, 12th, 14th, 17th, 18th, and 21st; at Middlesbro' on the 17th.

Rainbows were seen at Rothbury on the 13th; at Sunderland on the 13th; at Greta Bridge on the 19th.

Thunderstorms occurred at Rothbury on the 26th; at Bywell on the 26th; at North Shields on the 26th.

Lightning was seen, but Thunder was not heard, at Allenheads on the 26th; at Rothbury on the 9th; at Sunderland on the 14th, 15th, and 26th; at Greta Bridge on the 14th.

Hail fell at Horsley near Wylam on the 27th; at Seaham on the 24th; at Darlington on the 25th.

Snow fell at Otterburn on the 3rd, 4th, and 25th; at North Sunderland on the 24th, 25th, 26th, 27th, and 28th; at Rothbury on the 19th, 24th, 25th, and 26th; at Horsley near Wylam on the 24th, 25th, and 26th; at Sunderland on the 25th, 26th, and 27th; at Seaham on the 1st and 25th; at Darlington on the 3rd and 27th; at Middlesbro' on the 1st, 3rd, 25th, 26th, and 27th.

The Registrar General reports that the northern counties generally had a death-rate of 22·83 per thousand. Darlington, Stockton, Tanfield, Chester-le-Street, Newcastle-on-Tyne, and Tynemouth, suffered much from scarlet fever. Measles and typhus prevailed in South Shields.

The death-rate of 26·36 per thousand, it is gratifying to observe, indicated a considerable improvement in the health of Newcastle-on-Tyne. The deaths for the corresponding quarter of the three previous years were—1866, 36·70; 1867, 29·20; 1868, 27·03.

The estimated population of the largest towns in Northumberland and Durham, and the respective death-rates for the last quarter of 1869, was as follows:—

	Estimated Population.	Deaths.	Average Rate to 1000 living for last three months, 1869.
Newcastle (Borough boundaries) ...	130,503	857	26·36
Sunderland (Municipal boundaries)	111,520	618	21·99
South Shields ditto ..	65,363	459	27·86
Gateshead ditto ...	42,928	334	30·87
Tynemouth ditto ...	40,003	237	23·51

The subject of the registration of disease is one of daily growing interest and importance, and the following remarks, by Dr. Philipson of Newcastle, in whose very valuable monthly reports "on the health and meteorology of Newcastle" a fund of most trustworthy information is gradually being stored up for future use, will be read with the interest which their great importance deserves:—

"The study of epidemic diseases calls for our best energies, but it is yet quite in its infancy...........In a measure the scanty results may have been caused by some of the inquirers having only prosecuted their researches during the time when an epidemic was prevalent, and not also when absent. It is absolutely necessary that the inquiry should be continued after the epidemic has passed away. When an epidemic disease unhappily visits a neighbourhood, all the community become excited; all thoughts are roused; some facts may possibly be observed, and the cause of the visitation conjectured; but when the mortality again declines, and the health of the locality returns to its former condition, those thoughts which had been occupied with such fearful forebodings become engaged with other subjects, and all the distressing circumstances are soon forgot, or certainly remembered as of the past."............

In some more "favoured district an official inquiry is instituted, and after a certain time occupied in eliciting evidence and the examination of witnesses, a report is published, which necessarily cannot be very complete, because the most important element for its perfection is wanting, namely, reliable *data* upon which to base the inductions."

"Season has a great influence upon certain diseases. Of all the seasons, the Registrar General thinks 'that summer is the healthiest, winter the most unhealthy.' This is the reverse of what was the case in former times, when the number of deaths occurring in the summer always greatly exceeded those in the winter. At the present time the winter mortality is by far the greatest, unless an epidemic outbreak have occurred to swell the list of summer deaths. Here is an evidence of the good effect of legislative interference in the establishment of sanitary measures in most of the large towns."............

"There exists a national system of registration of the causes of death; so there might be a corresponding national system of registration of the actual cases of disease, which might justly be called 'vital statistics,' and which would indicate the resistance of one portion of the community against disease as compared with another. Undoubtedly, the statistics of a single town are instructive; far more instruction, however, will be gained from the compared statistics of various and many towns. In addition, also, it would tend to throw light upon the causes of diseases, on the means of their prevention, and the right understanding of their etiology, the greatest reward of the worker in the wide expanse of 'the great science of medicine.'"

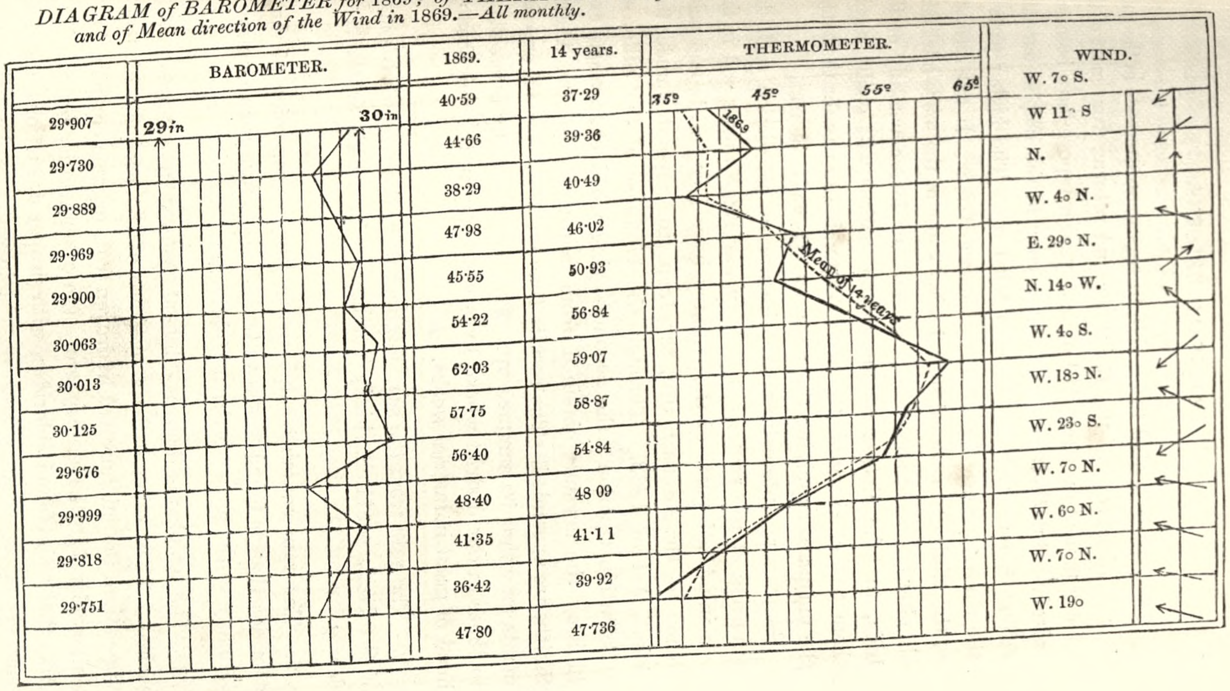
The following table and diagram has been prepared by Mr. G. C. Atkinson, and they show at a glance the fluctuations of the barometer, thermometer, &c., at Wylam, for the past year, and also the deviation from the average of the fourteen preceding years. These tables, repeated as they are from year to year, form a very ready and valuable means of comparing at a glance the varying atmospheric conditions at the same place.

	* BAROMETER.					THERMOMETER.								Wind, by Clouds overhead.	Rain and Melted Snow.		TYNE height at Wylam Bridge.
	Mean at 8 A.M.	Range during Month.				Mean of 1869.	Range during Month.				Mean of 14 years, 1869 inclusive.	Excess	Def. of 1869.		Amt.	Days	
		Min.	Date.	Max.	Date.		Min.	Date.	Max.	Date.							
January......	29·807	28·725	29th	30·394	18th	40 59°	21°	1st	55°	10th	37·29°	3·30°	...	W. 7° S.	1·97	12	3·6 ft.
February ...	29·730	28·687	1st	30·255	15th / 22nd	44·66°	29°	13th	62°	6th	39·36°	5·30°	...	W. 11° S.	1·56	13	4·9 ,,
March.........	29·889	28·908	2nd	30·429	25th	38·29°	25°	11th	53°	27th	40·49°	...	2·20°	N.	1·89	18	2·8 ,,
April	29·969	29·074	16th	30·576	29th	47·98°	29°	1st	76°	12th / 14th	46·02°	1·96°	...	W. 4° N.	2·07	10	2·4 ,,
May...........	29·900	29·123	7th	30·389	14th	45·55°	30°	29th	62°	2nd	50·93°	...	5·38°	E. 29° N.	3·86	16	2·1 ,,
June	30·063	29·406	16th	30·413	28th	54·22°	33°	1st	77°	27th	56·84°	...	2·62°	N. 14° W.	1·45	7	1·3 ,,
July	30·013	28·850	5th	30·420	11th	62·03°	40°	1st	84°	22nd	59 07°	2·96°	...	W. 4° S.	·29	7	1·2 ,,
August	30·125	29·510	9th	30·445	17th	57·75°	37°	31st	91°	29th	58·87°	...	1·12°	W. 18° N.	1·25	10	1·6 ,,
September ...	29·676	29·029	12th	30·453	1st	56·40°	41°	22nd	71°	9th / 10th	54·84°	1·56°	...	W. 23° S.	2·94	17	2·6 ,,
October	29·999	29·143	16th	30·465	22nd	48·40°	27°	27th	72°	10th	48·09°	·31°	...	W. 7° N.	2·13	14	1·9 ,,
November ...	29·818	29·537	4th	30·307	20th	41·35°	25°	11th	59°	19th	41·11°	·24°	...	W. 6° N.	2·97	15	4·3 ,,
December ...	29·751	28·992	13th	30·706	6th	36·42°	13°	28th	55°	19th	39·92°	...	3·50°	W. 7° N.	2·77	18	3·1 ,,
Means and Totals ...	29·895					47·80°					47·736°			W. 19° N.	25·15	157	2·65 ,,

Highest, 17·5 ft. on February 8th.

Barometer, highest 30·706, on December 6th; Lowest, 28·725, on January 29th.
Thermometer do., 91° on August 29th; Do. 13° on December 28th.
Rainfall (Rain and Snow) greatest in one month, 3·86, in May; in 24 hours, 1·12, on May 7th.
Highest Flood in Tyne, 17·5 ft., on 8th February. * Barometer corrected and reduced to sea level.

DIAGRAM of BAROMETER for 1869; of THERMOMETER for 1869, and for an average of 14 years (including 1869); and of Mean direction of the Wind in 1869.—All monthly.



RAINFALL RETURNS.

The editor is glad to be able to report an increase in the number of observers of the Rainfall; and returns from most of the places named on page 240 of last year's report have been promised. But there are still some gaps in the map of our rainfall stations which need to be filled up. The higher parts of the Cheviot range form one of these districts. If any members of the Club can succeed in inducing some of the more intelligent shepherds, or others who are more or less constantly on the hills, to take charge of guages, the editor will gladly supply them free of charge if the men are unable to pay for them, and the means of supplying them cannot otherwise be met.

Some very interesting experiments in connection with the condition of the rain, as it falls in our large towns and in the less inhabited parts of the country have been made and published by Dr. Angus Smith, the Inspector appointed under the Alkali Act of 1863. Through the kindness of the editor of "Scientific Opinion" the accompanying wood engravings, exhibiting the crystals obtained from rain-water by Dr. Angus Smith, are appended. The results thus far of the various experiments may thus be summed up. They are especially interesting to those in our district whose lives are spent in the neighbourhood of great industrial works.

1.—The rain from the sea, obtained from the western islands of Scotland, contains chiefly common salt, which crystalizes clearly.

2.—The rain contains sulphates in larger proportion to the chlorides than is found in sea water. This is true from Central Germany to the most northern Hebrides.

3.—The sulphates increase inland before large towns are reached. They seem to be a measure of the products of decomposition, the sulphuretted hydrogen from organic compounds being oxydised in the atmosphere. (In other words, Dr. Smith thinks that as he found chlorides, with proper deductions, to be a measure of the sewage, however old in water, so he believes sulphates to be a measure of the sewage in air, unless when coal interferes too much to permit allowance to be made.)

4.—The sulphates rise very high in large towns, because of the amount of sulphur in the coal used as well as decomposition.

5.—As sulphuretted hydrogen and sulphate of ammonium oxydise in the atmosphere, the sulphates may be expected to increase in proportion to the amount of decomposing organic matter containing sulphur, such as albuminoid compounds, called conveniently by a name now less used, protein.

6.—When the sulphuric acid increases more rapidly than ammonia the rain becomes acid.

7.—When the rain has so much acid that two or three grains are found in a gallon of the rain water, or forty parts in a million, there is no hope for vegetation in a climate such as we have in the northern parts of the country.

8.—The acid is calculated as dry sulphuric, but to some extent the agent may be hydrochloric rendered free by the sulphuric decomposing the common salt.

9.—Sulphate of soda increases in the rain as coals are burnt, and if the salts are heated, chloride of ammonium comes off and sulphate of soda remains.

10.—Chlorides increase with the burning of the coal to a perceptible extent, although not so much as in places where salt is decomposed, whether in alkali or other works.

11.—Free acids are not found with certainty where combustion or manufactures are not the cause.

12.—The chlorides and sulphates may be found neutralized even where there are manufactures.

13.—By attending to these facts it may be found if the plants in any place are hurt by acid, and by which acid. Other acids may probably be found as readily as the two mentioned.

14.—By attending to the amount only of the sulphates and chlorides great injustice may be done. The acidity and the average of the district must be known.

15.—Ammonical salts increase in the rain as towns increase. They come partly from coal and partly from albuminoid substances or protein decomposed.

16.—The albuminoid substances may be found in the rain even by the rude experiment of burning the residue, which renders unmistakable their peculiar odour, but they may also be recognized by the method used by Wanklyn for potable water.

17.—Experiments in the direction here indicated may enable us to study and express in distinct language the character of a climate, and certainly the influences of cities on the atmosphere.

RAIN.—HYDROCHLORIC ACID.

Relation to the average of that from Row, Dumbartonshire, taken as 100.

Row, Dumbartonshire	100·00	1
Birkenhead	461·87	$4\frac{1}{2}$
Near an Alkali Work	495·83	5
Whiston, near Liverpool (from covered tank)	512·24	5
Newcastle-on-Tyne..............	1158·77	$11\frac{1}{2}$
Manchester	1438·00	$14\frac{1}{3}$
Liverpool...........................	1684·30	17
Waterloo, ditto	5214·30	52

RAIN.—SULPHURIC ACID.

Relation to that from Row, Dumbartonshire, taken as 100.

Row, Dumbartonshire	100·00	1
Waterloo, Liverpool	229·34	$2\frac{1}{4}$
Whiston, ditto	398·28	4
Birkenhead	464·47	$4\frac{1}{2}$
Liverpool...........................	706·02	7
Newcastle-on-Tyne..............	891·43	9
Manchester	973·00	$9\frac{3}{4}$
Near an Alkali Work	1470·00	$14\frac{7}{10}$

RAIN.—TOTAL ACID.

Relation to that in rain from Row, Dumbartonshire, taken as 100.

Row, Dumbartonshire	100·00	1
Whiston, near Liverpool	470·67	$4\frac{3}{4}$
Birkenhead	528·29	$5\frac{1}{4}$
Liverpool...........................	938·21	$9\frac{2}{5}$
Waterloo, ditto	961·98	$9\frac{1}{2}$
Newcastle-on-Tyne	1054·78	$10\frac{1}{2}$
Manchester	1175·54	$11\frac{3}{4}$
Near an Alkali Work	1539·27	$15\frac{2}{5}$

"These tables show at once a difference in such a climate as that of Manchester and Gareloch. These numbers do not represent *all* the difference, but they represent a difference caused by manufactures and processes of life. At Waterloo, near the sea, hydrochloric acid appears high, but it must be remarked that in none of the cases is all the acid free; the numbers represent that which is both free and combined. At Waterloo it is combined, or simply salt from the sea. At Blackpool it was not shown to be high, as the wind was not from the sea.

"It comes out clearly that there is a certain amount of chlorides in the air beyond what the sea sends, even when no alkali or glass works are near. The exact source of these is not directly ascertained; probably it is from coals, although analyses usually made do not show in coal sufficient to account for this. It is in all probability the common salt from the ancient seas in which the coal plants grew or fell. The amount does not, however, by the analyses increase proportionately with the coal; and "if" Dr. Angus Smith's "observations of 1851 are correct, it has not increased much since, whereas the sulphuric acid has increased very greatly, and evidently with the coal."

AMMONIA, SALTS, &c., IN RAIN WATER.

	Date.		Ammonia, parts in 1,000,000.	Ammonia of Albumen.
Row near Helensburg ...	Jan. 16,	1869	0·00	0·0
Clydeford, Glasgow	,,	,,	1·25	0·0
London Hospital	Feb.	,,	2·00	0·3
Ditto	,,	,,	2·20	0·3
Ditto	,,	,,	3·00	0·4
Glasgow, St. Rollox......	Dec.	1868	3·75	0·0
Ditto, Netherfield	Jan.	1869	5·50	0·0
Manchester	Dec.	1868	6·00	1·0
Newcastle-on-Tyne	,,	,,	5·00 & 0·6	0·0

"Here we have it clearly put before us that the towns contain a great deal of ammonia. This comes, it may be supposed, mainly from the coal burnt, and the larger quantity in Manchester air agrees with other results. The second column however gives the ammonia from albumen, and we see that the Manchester amount is in that respect greatest also.

"If these results are confirmed by many cases all over the country, it will be difficult to avoid drawing very distinct conclusions affecting several sanitary questions.".........

The appended drawings show the different appearances when a drop of the concentrated rain is allowed to evaporate on a piece of glass.

"The crystals appear different in all places tried. When the air around works is examined it is necessary to keep such information as this in mind. The question regarding the effect of such substances on health is one which cannot receive a very ready answer."

"A specimen is under examination from North Uist. The crystals are large cubes of common salt only. At Row they are clearly common salt, but the crystals less complete. Before great towns are reached the land changes the rain."

"It seems certain that chlorides come directly from the sea, or, in other words, that salt is continually floating in the air, so that we must not be too certain that chemical works are doing

RAIN-WATER CRYSTALS.

FIG. 1.—*London Rain—Fixed: London Hospital.*

FIG. 2.—*Sublimate from London Rain.*

FIG. 3.—*Row Rain, Gareloch, Clyde.*

FIG. 4.—*Manchester Rain.*

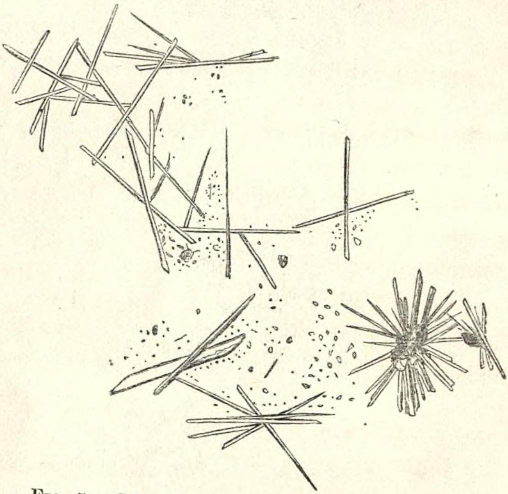


FIG. 5.—*Manchester Rain; Fixed Residue, Oxide of Iron removed.*

FIG. 6.—*Newcastle Rain.*

the evil whenever we find chlorides in rain water. It is only by a careful examination of the quantity that we can judge."

"With the above results from the rain before us we see the advantage of examining the air chemically, instead of merely by trials on our own health or on plants. The rain does in reality give us the washings of the air: with pure air we have pure rain."

The editor abstains from entering on the subject of other bodies contained in the air as not coming so strictly within his present subject. The very popular remarks of Professor Tyndale, "On dust and disease," which have been made so widely known of late, will have brought that part of the subject very fully before most of us.

DISTRIBUTION OF RAIN IN 1869.

As regards the rainfall throughout England generally during the past year, Mr. Symons reports that the proportion of places in which the rainfall was in excess of the average to those in which it was below it were as thirty-five to sixteen, say, two to one, "and therefore that the fall in England was rather above the average. Closer scrutiny shows that (with two or three exceptions, due probably to records not kept with perfect accuracy,) the geographical distribution of the rainfall of 1869 is readily understood."

"There was a marked deficiency in the extreme south-west, in Devon and Cornwall, and a slighter one in the north-eastern counties. Between these two localities very considerable excesses prevailed; in fact, all over the Midland counties the rainfall was above the mean, by amounts ranging from one to twenty-five per cent, and averaging fifteen per cent. At a great many stations the fall was within one or two per cent. of the mean, and taking the average of all English stations, we find the average of the year to have been five per cent. above the mean."

In Scotland "the deficiency was greatest in the south-east part of the country, and extended some distance northward, but was less marked. In Ross-shire the deficiency was trifling, and in the Orkneys there was an excess."

As regards Ireland, "At Cork there was a deficiency, in the Middle there was an excess, and in the North again a deficiency."

For "the British Isles, taken as a whole, the fall was about one per cent. above the average."

As regards our own district the tables will show the result at a glance.

The following table, taken from Mr. Symons' very valuable work, "The British Rainfall for 1869," will be read with interest.

EXTREMES OF RAINFALL FOR 1869.

ENGLAND.—GREATEST.

	Inches.
The Stye, Cumberland	198·19
Taylor's Gill, Cumberland	179·07
Seathwaite in Borrowdale, Cumberland	150·11
Stye Head, Cumberland	133·70
Sprinkling Tarn, Cumberland	126·95
Langdale	118·50

LEAST.

North Sunderland	20·09
Bedford	20·34
Aston Rowan	20·42
Shoeburyness	20·59
Acol, near Margate, Kent	28·60
North Shields: Clementhorpe	20·70

WALES.—GREATEST.

Rhiwbrifdir	107·55
Brithdin	77·24
Mardy, Aberdare	70·35

LEAST.

Great Orme's Head	27·96
Wrexham	28·74
Lynn Onn	31·22

SCOTLAND.—GREATEST.

Upper Glencoe	121·50
Arrochar, Dumbarton	117·30
Glengyle	91·00

LEAST.

East Linton, Haddington	15·77
Meadowfield	19·02
Inveresk	19·68

IRELAND.—GREATEST.

Kenmare, Killarney	59·47
Galway	52·19
Mount Shannon	48·79

LEAST.

Coollattine Park	24·05
Phœnix Park, Dublin	27·57
Drumcashel	28·23

The following return of the monthly depth of wells at Low Lights, North Shields, has been furnished by J. R. Procter, Esq., in continuation of that for 1868. The returns illustrate the effect of the rainfall in the different months:—

1869.	A. New Shed Well, 11 ft. deep.	B. Beam House Well, 23 ft. deep.	C. Well near House, 15 ft. deep.	REMARKS.
January ... 4	8·2	20· 8	13· 2	The annexed depths are a pretty fair representation of the average depths measured weekly.
February ... 1	8·2	20· 6	12· 1	
March 1	8·1	19· 7	11· 0	
April 5	8·2	19· 6	10· 7	
May 10	8·2	20· 0	12· 2	
June 7	7·9	19· 1	8· 8	
July 5	7·4	18·10	8· 3	
,, ...26	6·8	18· 3	7· 4	
September 6	5·8	17· 8	6· 3	
October ... 4	6·1	17· 9	6·11	
November 1	8·1	19· 7	9· 6	
December 6	8·2	19·10	12· 3	
,, 27	8·2	20· 1	12· 2	
13	98·8	251· 4	130· 4	
Means	7·7	19· 4	10·03	

TEES DISTRICT.

PLACE............	DINSDALE RECTORY, near Darlington.		DARLINGTON, South End.		BRINKBURN, Darlington.		HARTLEPOOL.	
Height of Guage above sea level	50 Feet.		40 Feet.		50 Feet.			
Above Ground ...	1ft. 6in.		4 Feet.		1 Foot.			
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	3·08	15	Monthly Return not furnished.	Monthly Return not furnished.	2·85	10	1·52	17
February......	1·69	11			1·28	9	2·28	15
March	1·82	18			1·65	12	1·64	22
April	1·26	7			1·20	5	1·18	10
May............	3·27	16			3·05	9	2·32	17
June	1·14	6			1·25	8	1·16	9
July............	0·81	6			1·00	5	0·59	...
August	1·48	8			1·55	7	1·56	...
September ...	3·35	21			4·02	8	3·07	...
October	2·57	14			2·80	8	2·87	...
November ...	2·47	13			2·25	9	2·69	...
December ...	3·38	20			2·85	12	3·62	...
1869.........	26·32	155	24·03	125	25·75	102	24·50	...
1868.........	24·96	187	37·25	...	21·75	97	...	...
1867.........	26·66	175	40·79	...	...	...	...	...
1866.........	29·25	...	38·71	...	...	...	...	...
1865.........	22·50	...	27·05	...	...	...	...	...
1864.........	...	...	22·11	...	...	...	...	...
1863.........	...	...	19·26	...	...	...	...	...
1862.........	...	...	21·24	...	...	...	...	...
1861.........	...	...	32·83	...	...	...	...	...
1860.........	...	...	31·86	...	...	...	...	...
1859.........	...	...	27·65	...	...	...	...	...
1858.........	...	...	...	...	...	...	...	...
1857.........	...	...	...	...	...	...	...	...
1856.........	...	...	...	...	...	...	...	...
Average of Years ...	25·93 5 yrs.	172 3 yrs.	29·34 11 yrs.	125 1 yr.	23·75 2 yrs.	99 Days.	...	...
Difference in 1868 from mean	+ 0·39 Inches.	— 17 Days.	— 5·31 Inches.	...	+ 2 Inches.	+ 3 Days.	...	...

TEES DISTRICT (Continued).

PLACE	GRETA BRIDGE.		EAGLESCLIFFE, near YARM.		SEDGEFIELD, DURHAM COUNTY ASYLUM.		GAINFORD.	
Height of Guage above sea level	431 Feet.		80 Feet.		360 Feet.		250 Feet.	
Above Ground	1ft. 6in.		1 Foot.		5 Inches.		7 Feet.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	4·00	12	2·13	18	1·575	14	3·31	...
February	2·10	11	1·25	14	2·210	18	1·40	...
March	2·14	9	1·41	20	1·950	23	2·07	...
April	1·30	8	·95	8	1·620	9	1·54	...
May	4·06	10	2·63	19	3·740	13	3·49	...
June	0·99	6	1·26	8	1·170	8	1·01	...
July	0.39	5	1·68	8	1·720	8	0·45	...
August	1·57	11	1·29	12	2·635	13	1·45	...
September	5·98	19	3 02	23	3 805	21	3·89	...
October	1·71	10	2·89	15	2·960	25	1·92	22
November	2.88	15	2·38	17	2·255	15	2·70	13
December	3·36	13	2·85	24	3·240	27	3·52	26
1879	30·98	129	23·74	186	28·88	194	26·75	...
1868	28·89	...	20·38	167	26·93	206	...	...
1867	22·24	...	23·23	175	25·56	238	...	...
1866	29·42	...	26·67	...	30·27	...	...	...
1865	26·73	...	......	...	25·57	...	...	...
1864	24·26	...	......	...	......	...	...	...
1863	26·25	..	......	...	......	...	...	...
1862	25·84	...	......	...	......	...	...	...
1861	24·54	...	......	...	......	...	...	...
1860	30·28	...	......	...	......	...	...	...
1859	26·74	...	......	...	......	...	...	...
1858	21·56	...	......	...	......	...	...	...
1857	23·93	...	......	...	......	...	...	...
1856	27·30	...	......	...	......	...	...	...
Average of Years	26·35 14 yrs.	129 1 yr.	23·50 4 yrs.	176 3 yrs.	27·44 5 yrs.	212 3 yrs.	26·75 1 yr.	... ...
Difference in 1869 from mean	+4·63 Inches	...	+0·24 Inches	+10 Days.	+1·44 Inches	—18 Days.	...	...

WEAR DISTRICT.

PLACE	STANHOPE CASTLE.		ST. JOHN'S WOLSINGHAM.		WOLSINGHAM.	
Height of Guage above sea level	670 Feet.		927 Feet.		463 Feet.	
Above Ground	3 Feet.		1ft. 1in.		1 Foot.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	4·75	...	4·44	16	4·68	17
February	5· 0	...	3·41	20	3·35	20
March	2·65	...	1·66	21	2·37	24
April	3·50	...	1·79	10	1·98	9
May	4·00	...	4·26	14	3·87	16
June	·40	...	1·68	8	2·66	6
July	·30	...	0·65	7	0·58	7
August	6·11	...	1·21	8	1·20	9
September	3 40	...	1·97	12	5·15	21
October	3·40	...	2·14	14	2·36	14
November	3·40	...	3·14	16	3·54	12
December	7·25	...	4·52	21	4·96	22
1869	44·16	...	30·87	167	36·70	177
1868	39·68	...	38·33	199	......	...
1867	32·33	...	32·53	192	......	...
1866	41·24	...	36·90	218	......	...
1865	......	...	28·91	199	......	...
1864	......	...	......	...	......	...
1863	......	...	......	...	......	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	39·35 4 years.	...	33·50 5 years.	195 5 yrs.	36·70 1 year.	177 1 yr.
Difference in 1869 from mean	+ 4·81 Inches.	...	—2·63 Inches.	—28 Days.	......	...

WEAR DISTRICT (Continued).

PLACE	USHAW COLLEGE, DURHAM.		DURHAM* OBSERVATORY.		SUNDERLAND The Hall, Bpwearmouth.		SUNDERLAND West Hendon House.	
Height of Guage above sea level	600 Feet.		335 Feet.		83 Feet.		132 Feet.	
Above Ground	10 Inches.		4ft. 6in.		1ft. 5in.		1 Foot.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·69	17	2·740	13	1·980	14	1·73	15
February	1·26	13	2·203	17	1·113	14	1·00	15
March	1·74	22	2·150	20	1·974	21	1·71	18
April	1·67	9	1·662	13	1·470	9	1·40	9
May	3·04	14	3·295	13	2·863	15	2·64	17
June	1·39	7	1·420	5	1·268	5	1·09	7
July	0·71	8	0·944	7	1·085	5	·96	...
August	1·61	12	2·234	13	1·575	10	1·41	11
September	4·76	20	4·033	17	3·679	17	3·42	16
October	2·41	10	2·529	17	3·012	13	2·65	15
November	2·68	15	3·026	13	2·176	10	2·92	14
December	2·86	16	3·328	21	3·160	17	3·32	20
1869	26·82	163	29·564	169	25·355	150	24·25	160
1868	25·75	174	30·77	191	23·51	154	21·29	...
1867	25·85	159	19·45	...	24·50	134	...	...
1866	31·26	190	25·10	...	...	...	...	...
1865	29·73	168	24·51	...	...	...	...	...
1864	24·59	...	23·24	...	...	...	...	...
1863	28·90	...	24·09	...	...	...	...	...
1862	22·95	...	21·82	...	...	...	...	...
1861	26·03	...	24·28	...	...	...	...	...
1860	...	...	30·33	...	...	...	...	...
1859	...	...	21·57	...	...	...	...	...
1858	...	...	18·73	...	...	...	...	...
1857	...	...	26·55	...	...	...	...	...
1856	...	...	29·65	...	...	...	...	...
Average of years	26·87 9 yrs.	170	24·74 14 yrs.	180 2 years	23·85 3 yrs.	146 3 years	22·27 2 yrs.	160 1 year.
Difference in 1869 from mean	—·5 Inches	—7 Days.	+4·82 Inches	—11 Days.	+1·50 Inches	—4 Days.	...	...

*The average Rainfall recorded at the Durham Observatory for 20 years is 20·23 Inches

COAST DISTRICT.

PLACE	NORTH SUNDERLAND.		CRESSWELL.		WHITLEY, near North Shields.	
Height of Guage above sea level	60 Feet.		100 Feet.		82 Feet	
Above Ground	1 Foot.				9 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
						...
January	2·61	17	2·110	...	2·23	...
February	0·77	14	0·987	...	1·44	...
March	1·00	16	1·115	...	1·37	...
April	0·76	9	1·500	...	1·97	...
May	1·99	14	2·280	...	2·59	...
June	1·56	10	1·005	...	1·41	...
July	0·64	8	0·770	...	0·87	...
August	1·37	9	1·400	...	1·19	...
September	3·48	19	2·120	...	2·87	...
October	2·03	18	2·880	...	2·37	...
November	1·85	18	2·350	...	2·68	...
December	2·03	21	1·100	...	2·04	...
1899	20·09	173	19·617	...	23·03	...
1868	23·23	162	19·82	...	25·37	...
1867	24·40	170	19·95	...	23·45	...
1866	25·75	189	......	...	28·35	...
1865	32·47	...	......	...	26·99	...
1864	......	...	......	...	26·64	...
1863	......	...	......	...	......	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	25·18 5 years.	173 4 years	19·79 3 years.	...	25·64 6 years.	...
Difference in 1868 from mean	—5·09 Inches.	0 Days.	—·18 Inches.	...	—2·61 Inches.	...

COAST DISTRICT (Continued).

PLACE	HOWICK.		EARSDON.		TYNEMOUTH Pier Works.		SEAHAM HALL.	
Height of Guage above sea level	120ft. 6in.		185 Feet.		61ft. 10½in.		80 Feet.	
Above Ground ...	10 Inches.		2ft. 10in.		1ft. 2in.		1 Foot.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January.........	1 90	13	1·70	...	1·82	17	1·75	14
February	1·36	10	1·73	...	1·49	12	1·10	11
March	1·59	9	1·21	...	1·40	15	1·74	18
April	1·27	10	2·04	...	1·76	11	1·27	7
May	2·26	11	2·65	...	2·31	16	3·18	12
June	1·79	7	1·65	...	1·03	8	1·45	7
July	0·43	6	0·62	...	0·91	9	0·78	6
August	1·65	7	1·34	...	1·12	12	1·30	7
September......	3·31	16	2·32	...	2·65	18	3·44	16
October.........	2·39	11	2·51	...	2·85	22	2·38	11
November	2 39	12	2·44	...	2 55	15	3·70	11
December	2·32	18	1 64	...	2·79	19	2·13	12
1869.........	22·66	130	21·85	129	22·68	174	24·22	132
1868.........	25·22	124	...	...	21·05	170	22·56	145
1867.........	24·98	159	...	...	24·22	...	23·61	151
1866...... ...	28·88	168	...	...	23·68	...	28·32	154
1865.........	28·64	...	...	...	23·47	...	26·07	...
1864.........	22·01	...	...	...	...	...	22·74	...
1863.........	18·34	...	...	...	...	...	26·15	...
1862.........	19·30	...	...	...	...	...	...	...
1861.........	18·30	...	...	...	...	...	...	...
1860.........	27·48	...	...	...	...	...	...	...
1859...... ...	18·84	...	...	...	...	...	...	...
1858.........	22·51	...	...	...	...	...	...	...
1857.........	20·77	...	...	...	...	...	...	...
1856.........	22·58	...	...	...	...	...	...	...
Average of Years......	22 60 14 yrs.	140 4 years	21·85 1 year.	129 1 year.	23·02 5 yrs.	172 2 years	24·81 7 yrs.	145 4 years
Difference in 1869 from mean	+ 0·6 Inches.	— 10 Days.	...	...	—0·34 Inches.	+ 2 Days.	— ·59 Inches.	— 13 Days.

TYNE DISTRICT.

PLACE	BYRNESS.		OTTERBURN.		HALT-WHISTLE—Unthank Hall.		WHITFIELD.	
Height of Guage above sea level	700 Feet.		500 Feet.		380 Feet.		866 Feet.	
Above Ground ...	2 Feet.		1 Foot.		6 Inches.		1ft. 5in.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	4·356	23	4·185	...	...	...	4·23	19
February	3·844	23	3·325	...	5·02	17	7·62	20
March	1·221	18	1·645	...	1·06	19	2·47	22
April	1·965	8	1·052	...	1·81	12	2·28	10
May	2·925	16	2·600	...	3·33	16	4·20	15
June	2·095	·7	2·040	...	1·49	12	1·55	9
July	1·340	11	1·230	...	0·82	7	0·715	6
August	1 285	2	1·085	...	1 35	6	1·995	9
September ...	4 240	19	4·605	...	5·72	19	7·52	24
October	2 375	14	1·590	...	2 61	15	2·085	12
November......	2·710	6	2 385	...	5·59	18	6·73	16
December	6·000	23	4·140	...	4·27	18	4·45	12
1869.........	34·356	170	29·882	...	3 307	159	45·845	174
1868.........	37·26	187	34·06	145	...	...	...	...
1867..... ...	...	...	31·59	154	...	...	...	...
1866.........	...	...	36·02	...	...	...	...	...
1865.........	...	...	...	...	...	...	...	...
1864.........	...	...	...	...	...	...	...	...
1863.........	...	...	...	...	...	...	...	...
1862.........	...	...	...	...	...	...	...	...
1861.........	...	...	...	...	...	...	...	...
1860.........	...	...	...	...	...	...	...	...
1859.........	...	...	...	...	...	...	...	...
1858.........	...	...	...	...	...	...	...	...
1857.........	...	...	...	...	...	...	...	...
1856.........	...	...	...	...	...	...	...	...
Average of Years......	35·30 2 yrs.	178 Days.	32·87 4 yrs.	149 2 yrs.	...	...	...	...
Difference in 1869 from mean	—0 95 Inches.	— 8 Days.	—3 05 Inches.	...	...	...	...	...

TYNE DISTRICT (CONTINUED).

PLACE	ALSTON.		ALLENHEADS		PARK END, HEXHAM.		HALLINGTON VILLAGE.	
Height of Guage above sea level	1145 Feet.		1360 Feet.		276 Feet.		469 Feet.	
Above Ground ...	4 Inches.		9 Inches.		3 Inches.		6 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	6·04	22	6·10	25	No return received of the monthly fall.	...	1·28	...
February	8·33	24	9·30	28		...	3·76	...
March	1·76	15	2·10	27		...	1·43	...
April	1·34	12	2·40	14		...	2·16	...
May	1·72	16	4·70	23		...	2·72	...
June	1·23	10	1·70	16		...	1·80	...
July	0 93	8	0·90	14		...	0·30	...
August	1·40	13	1·80	16		...	1·69	...
September......	8·00	28	9·00	27		...	4·99	...
October	1·49	9	3·10	25		...	1·90	...
November......	4·78	16	7.40	24		...	3·40	...
December	4·65	20	5·90	28		...	3·11	...
1869.........	41·67	193	54·40	267	33·43	201	28·54	...
1868.........	48·35	211	56·40	266	34·33	203	28·69	...
1867.........	39·27	231	49·45	268	28·53	216	25·07	...
1866.........	54·76	253	56·84	287	41·83	228	33·42	...
1865.........	...	...	44·42	248	29·80	...	...	...
1864.........	...	...	43·24	258	29 02	...	...	...
1863.........	...	...	54·01	...	41·77	...	...	...
1862.........	...	...	44·20	291	34·76	...	...	...
1861.........	...	...	49·35	282	31 07	...	...	...
1860.........	...	...	59·15	297	31·04	...	...	..
1859.........	...	...	47·70	259	...	...	...	...
1858.........	...	...	37·21	229	26·00	...	...	...
1857.........	...	...	41·79	...	25·68	...	...	...
1856.........	...	...	45·48	...	45·87	...	...	...
Average of years	46 01 4 yrs.	222 4 yrs.	48·83 14 yrs.	269 11 yrs.	33·31 13 yrs.	212 4 yrs.	28·93 4 yrs.	...
Difference in 1869 from mean	4·34 Inches.	— 29 Days.	+ 5·63 Inches.	— 2 Days.	+ 0 12 Inches.	— 11 Days.	— 0 39 Inches.	...

TYNE DISTRICT (Continued).

PLACE	Whittle Dene Reser-voirs.	FAWCETT.		WOODFORD.		CAMPHILL, GUNNERTON.	
Height of Guage above sea level		563 Feet.		500 Feet.		676 Feet.	
Above Ground		6 Inches.		6 Inches.		6 Inches.	
MONTH.	Quantity. Inches.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January......	1·16	1·35	...	1·37	...	1·27	...
February ...	2·02	3·29	...	3 38	...	3·80	...
March	1·45	1·29	...	1·36	...	1·44	...
April	2·39	2·18	...	2·61	...	2·57	...
May	3·13	2·55	...	2·62	...	2·68	...
June	1·69	1·63	...	1 82	...	1·78	...
July	0·33	0·40	...	0·38	...	0·46	...
August	1·40	1·64	...	1·75	...	1·70	...
September...	3·19	4·89	...	5·31	...	5·72	...
October......	1·31	2·00	...	1·65	...	1·58	...
November...	2·78	2 70	...	3·22	...	3·08	...
December ...	2·21	3·03	...	3·89	...	3·82	...
1869......	23·06	26·95	...	29·36	...	29·90	...
1868......	......	27·08	...	29·17	...	30·60	...
1867......	......	25·66	...	29·65	...	29·95	...
1866......	......	31·35	...	33·84	...	34·18	...
1865......	......	......	...	......	...	......	...
1864......	......	......	...	......	...	......	...
1863......	......	......	...	......	...	......	...
1862......	......	......	...	......	...	......	...
1861......	......	......	...	......	...	......	...
1860......	......	......	...	......	...	......	...
1859......	......	......	...	......	...	......	...
1858......	......	......	...	......	...	......	...
1857......	......	......	...	......	...	......	...
1856......	......	......	...	......	...	......	...
Average of Years ...	......	27·86 4 years.	...	30·50 4 years.	...	31·15 4 years.	...
Difference in 1868 from mean......	......	+0·81 Inches.		—1·14 Inches.		—1·65 Inches.	

TYNE DISTRICT (Continued).

PLACE	GREENCRAG.		VALLEY of NORTH TYNE.		HORSLEY, near BYWELL.	
Height of Guage above sea level	800 Feet.				386 8 Feet.	
Above Ground	6 Inches.				6 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	1·40	...	1·31	...	1·67	13
February	3·92	...	4·21	...	2·02	14
March	1.26	...	1·34	...	1·37	12
April	2·18	...	2·38	...	2·08	13
May	2·61	...	2·57	...	3·20	12
June	1·64	...	1·23	...	1·58	9
July	0·63	...	0·48	...	0·33	5
August	1·91	..	1.79	...	1·35	9
September	6·23	...	5·54	...	3·21	20
October	1·56	...	1·68	...	1·38	11
November	3·27	...	3·32	...	2·61	16
December	3·98	...	3·35	...	1·88	16
1869	30·59	...	29·20	...	22·68	150
1868	29·89	...	30·11	...	23·77	160
1867	28·49	...	26·97	...	23·39	...
1866	34·28	...	33·45	...	......	...
1865	......	...	......	...	......	...
1864	......	...	......	...	......	..
1863	......	...	......	...	......	...
1862	......	...	......	...	......	...
1861	......	...	......	...	......	...
1860	......	...	......	...	......	...
1859	......	...	......	...	......	...
1858	......	...	......	...	......	...
1857	......	...	......	...	......	...
1856	......	...	......	...	......	...
Average of Years	30·81 4 years.	...	29·93 4 years.	...	22·46 3 years.	155 2 years
Difference in 1869 from mean	— 0·22 Inches.	...	— 0·73 Inches.	...	+ 0·22 Inches.	— 5 Days.

TYNE DISTRICT (Continued).

PLACE	BYWELL.		WYLAM.		SHOTLEY HALL.		STAMFORDHAM GROUND.	
Height of Guage above sea level	86ft. 6in.		96 Feet.		312 Feet.		400 Feet.	
Above Ground......	6 Inches.		5 Feet.		3 Inches.		1 Foot.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·40	17	1·97	12	2·85	14	2·28	...
February	1·80	21	1·56	13	1·57	11	2·34	...
March	1·70	23	1·89	18	2·07	14	1·57	...
April	1·70	10	2·07	10	1·60	8	1·93	...
May	3·60	20	3·86	16	3·96	16	3·47	...
June	1·40	13	1·45	7	1·15	5	1·94	...
July	0·30	8	0·29	7	0·45	8	0·40	...
August	1·20	11	1·25	10	1·29	10	1·18	...
September......	2·47	25	2·94	17	3·72	20	3·44	...
October.........	1·80	22	2·73	14	2·11	11	1·64	...
November ...	2·50	18	2·97	15	2·93	14	1·70	...
December	3·10	16	2·77	18	2·52	17	3·04	...
1869.........	24·97	204	25·15	157	26·22	148	24·93	...
1868.........	27·70	199	26·43	131	28·01	149	25·41	...
1867.........	27·55	227	22·38	144	...	...	25·53	...
1866.........	29·19	230	29·81	173	...	...	30·09	...
1865.........	29·82	186	29·67	156	...	...	27·41	...
1864.........	28·81	188	27·57	206	...	...	26·93	...
1863.........	28·49	198	28·39	185	...	...	28·60	...
1862.........	26·49	199	24·68	211	...	...	26·00	...
1861.........	23·80	213	23·54	...	...	...	26·22	...
1860.........	38·00	259	31·38	...	...	...	35·26	...
1859.........	27·34	182	25·15	...	...	...	27·85	...
1858.........	21·88	165	18·20	...	...	...	29·19	...
1857.........	27·55	...	24·47	...	...	...	28·86	...
1856.........	29·82	...	29·25	...	...	...	35·06	...
Average of Years......	27·95 14 yrs.	204 Days.	26·15 14 yrs.	170 8 yrs.	27·11 2 yrs.	148 2 yrs.	28·38 14 yrs.	...
Difference in 1868 from mean	—2·08 Inches.	0 Days.	—1·00 Inches.	—13 Days.	—0·89 Inches.	...	—3·45 Inches.	...

TYNE DISTRICT (CONTINUED).

PLACE	STAMFORD-HAM CHURCH TOWER.		NEWCASTLE, Deaf and Dumb Institution.		NEWCASTLE,* Lit. and Phil Institution.		WALLSEND.	
Height of Guage above sea level	452 Feet.		200ft. 9in.		106 Feet.		100 Feet.	
Above Ground ...	42 Feet.		6 Inches.		1ft. 5in.		6 Inches.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	1·65	...	2·22	15	2·19	11	1·869	10
February	1·73	...	1·15	9	1·66	12	1·412	6
March	0·80	...	1·45	14	2·19	20	1·497	6
April	1·39	...	2·10	10	2·38	14	1·857	7
May	2·80	...	2·98	16	3·33	18	2·783	7
June	1·71	...	1·57	9	2·35	8	1·431	6
July	0·30	...	0·49	7	0·48	3	0·655	5
August	0·74	...	1·37	8	1·00	8	1·331	8
September......	3·06	...	3·13	21	3·83	19	2·700	13
October	0·75	...	2·74	14	3·17	14	2·661	9
November......	1·43	...	2·85	13	3·51	16	2·870	7
December	2·00	...	2·73	19	3·92	17	3·288	7
1869.........	18·36	...	24·78	155	30·01	160	24·354	91
1868.........	...	...	24·51	154	26·25	175	24·49	113
1867.........	...	...	...	...	22·29	134	25·24	...
1866.........	...	...	...	...	22·19	169	26·65	...
1865.........	...	...	...	...	21·24	124	27·29	...
1864.........	...	...	...	...	...	...	27·82	...
1863.........	...	...	...	...	...	...	26·24	...
1862.........	...	...	...	...	...	...	25·68	...
1861.........	...	...	...	...	19·58	...	24·62	...
1860.........	...	...	...	...	27·40	...	34·12	...
1859.........	...	...	...	...	18·41	...	23·51	...
1858.........	...	...	...	...	13·29	...	...	...
1857.........	...	...	...	...	16·43	...	...	...
1856.........	...	...	...	...	21·22	...	...	...
Average of Years......	...	...	24·65 2 yrs.	155 2 yrs.	21·66 11 yrs.	152 Days.	26·36 11 yrs.	103 Days.
Difference in 1869 from mean	...	...	+ 0·13 Inches.	...	+ 8·35 Inches.	+ 8 Days.	— 2·01 Inches	— 12 Days.

* Owing to the peculiarity of the Rain Guages in use previously to 1868 about 10 per cent., it is stated, should be added to the quantities as published above.

TYNE DISTRICT (Continued).

PLACE	NORTH SHIELDS, Rosella Place.		NORTH SHIELDS, Clementhorpe.		NORTH SHIELDS. Low Lights.		TYNEMOUTH. Pier Works.	
Height of Guage above sea level	124 Feet.		150 Feet.		12 Feet.		61ft. 10in.	
Above Ground ...	1 Foot.		1 Foot.		3ft. 1in.		1ft. 2in.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January.........	2·281	16	2·10	14	2·26	15	1·82	17
February	1·315	11	1·17	13	1·26	13	1·49	12
March	1·301	13	1·17	17	1·25	15	1·40	15
April	1·763	10	1·66	11	1·65	10	1·76	11
May	2·575	16	2·40	13	2·47	15	2·31	16
June	1·266	9	0·99	8	1·15	7	1·03	8
July	0·770	6	0·65	7	0·66	7	0·91	9
August	1·285	9	1·10	10	1·08	7	1·12	12
September......	2·815	20	2·57	20	2·74	19	2·65	18
October.........	2·810	17	2·40	16	2·89	17	2·85	22
November......	2·946	16	2·40	14	2·69	15	2·55	15
December	2·811	23	2·09	20	2·32	20	2·79	19
1869.........	23·938	166	20·70	163	22·42	160	22·68	174
1868.........	23·35	173	20·92	174	22·46	171	21·05	170
1867.........	23·61	163	...	...	22·49	175	24·22	...
1866.........	26·39	188	...	...	26·62	192	23·68	...
1865.........	26·89	130	...	...	25·56	142	23·47	...
1864.........	26·00	...	...	...	27·60	...	...	...
1863.........	24·70	...	...	...	24·74	224	...	...
1862.........	28·01	...	...	...	28·01	260	...	...
1861.........	24·76	...	...	...	24·76	264	...	...
1860.........	32·19	...	...	...	32·18	290	...	...
1859.........	...	...	...	...	...	...	...	...
1858.........	...	...	...	...	...	...	...	...
1857.........	...	...	...	...	...	...	...	...
1856.........	...	...	...	...	...	...	...	...
Average of Years ...	25·58 10 yrs.	164 5 yrs.	20·81 2 yrs.	168 2 yrs.	25·68 10 yrs.	208 9 yrs.	23·02 5 yrs.	172 2 yrs.
Difference in 1869 from mean	— 2·05 Inches.	+ 2 Days.	— 0·11 Inches	— 5 Days.	— 3·06 Inches.	— 48 Days.	— 0·34 Inches.	+ 2 Days.

COQUET, WANSBECK, AND ALNE DISTRICT.

PLACE	WALLINGTON.		CRAGSIDE, ROTHBURY.		LILBURN TOWER.	
Height of Guage above sea level	398ft. 6in.		400 Feet.		300 Feet.	
Above Ground	1 Foot.				6 Feet.	
MONTH.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.
January	2·59	19	1·95	2	2·132	...
February	3·01	22	1·68	8	1·228	...
March	2·36	21	3·41	7	1·809	...
April	2·12	11	1·87	9	0·887	...
May	3·17	18	3·60	10	2·606	...
June	1·95	8	2·35	4	2·248	...
July	1·00	8	0·23	1	0·772	...
August	1·19	8	1·72	7	1·433	...
September	4·38	23	2·25	10	3·722	...
October	1·83	16	2·78	11	2·031	...
November	2·46	18	1·89	8	2·110	...
December	3·19	21	3·21	0	2·993	...
1869	29·25	193	26·94	86	23·971	...
1868	31·47	209	25·54	79	27·42	...
1867	28·99	198	16·25*	...	26·61	...
1866	......	...	......	...	30·02	...
1865	......	...	......	...	30·39	...
1864	......	...	......	...	31·97	...
1863	......	...	......	...	25·86	...
1862	......	...	......	...	30·04	...
1861	......	...	......	...	26·17	...
1860	......	...	......	...	......	...
1859	......	...	......	...	25·98	...
1858	......	...	......	...	24·27	...
1857	......	...	......	...	27·11	...
1856	......	...	......	...	32·90	...
Average of Years	29·97 3 years.	200 3 years	26·24 3 years.	83 dys. 2 yrs.	27·89 13 years.	...
Difference in 1869 from mean	—0·72 Inch.	—7 Days.	+0·70 Inch	+3 Days.	—3·92 Inches.	...

* Rothbury—The Return in 1867 was for only 8 Months.

COQUET, WANSBECK, AND ALNE DISTRICT, (CONTINUED).

PLACE	BRINK-BURN PRIORY.	GLANTON PYKE.		MILFIELD, near WOOLER.		MIDDLETON HALL, near BELFORD.	
Height of Guage above sea level	200 Feet.	534 Feet.		200 Feet.		240 Feet.	
Above Ground	1 Foot.	4ft. 3½in.		6 Inches.		2 Feet.	
MONTH.	Quantity. Inches.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell.	Quantity. Inches.	Days on which Rain fell
January.......	Monthly Return not furnished.	3·14	...	2·44	...	2·525	...
February ...		1·89	...	0·94	...	1·265	...
March		1·65	...	1·66	...	1·125	...
April		1·26	...	1·22	...	2·075	...
May		2·66	...	2·78	...	2·995	...
June		2·20	...	2·23	...	0·445	...
July		0·99	...	0·82	...	0·030	...
August		1·42	...	1·28	...	2·650	...
September...		3·48	...	3·89	...	3·715	...
October		2·05	...	2·10	...	1·615	...
November ...		1·75	...	1·69	...	2·870	...
December ...		2·64	...	2·28	...	1·895	...
1869......	25·24	25·14	...	23·34	...	23·205	...
1868......	26·69	30·15	...	27·51	...	......	...
1867......	33·68	27·82	...	28·45	...	......	...
1866......	33·87	35·06	...	32·18	...	......	...
1865......	32·45	34·26	...	28·65	...	......	...
1864......	29·54	28·69	...	......	...	......	...
1863......	......	30·09	...	......	...	......	...
1862......	......	27·12	...	......	...	......	...
1861......	......	27·10	...	......	...	......	...
1860......	......	......	...	......	...	......	...
1859......	......	......	...	......	...	......	...
1858......	......	......	...	......	...	......	...
1857......	......	......	...	......	...	......	...
1856......	......	......	...	......	...	......	...
Average of Years ...	30·24 In. 6 years.	29·77 8 years.	...	28·02 5 years.	...	......	...
Difference in 1869 from mean......	— 5 Inches.	— 4·63 Inches.	...	— 4·68 Inches.	...	......	...

TEMPERATURE.

The following results of a series of investigations carried out by Mr. Glaisher on the temperature of the different months and seasons of the year, and extending over a very long period, will be read with interest, as they throw so much light on a subject which forms the subject of discussion more or less amongst all classes of Englishmen.

The actual table is much too long to republish in this report, but the conclusions to which Mr. Glaisher came are summed up by him as follows :—

"These numbers do not at all confirm the idea that a hot summer is either preceded or followed by a cold winter, or *vice versâ;* on the contrary, it would seem that any hot or cold period has been mostly accompanied by weather of the same character. The cold year of 1771 was followed by two cold years. The hot year of 1779 was preceded by one warm year and followed by two others. In 1780 the extreme cold of January was counterbalanced by the extreme heat of March. The cold year of 1782 was followed by a long series of cold years. The very cold year of 1799 was followed by a cold autumn and winter. The warm year of 1806 was preceded by a warm winter. The very cold year of 1814 was preceded by a cold summer, autumn, and winter. The hot year of 1818 was preceded by a moderate winter, and was followed by a warm one.

"The hot year of 1822 was preceded by a warm winter, and was followed by a moderately cold one. The hot year of 1834 followed a very mild winter, and was followed by another. The hot year of 1846 was preceded by a warm winter, and was followed by a moderate one. The warm yeaı 1848 was both preceded and followed by warm periods.

"The mean temperatures of the years 1771, 1782, 1784, 1786, 1799, and 1814 were all below 46° : the coldest was 1784, and its value was 45·1°.

The mean temperatures of the years 1779, 1818, 1822, 1834, and 1846 were all above 50·5° : the year of highest temperature was 1846, and its value was 51·3°.

The 79 years, from 1771 to 1849 inclusive, gives a mean temperature (in the latitude of London) of 48·3°, with a variation between one year and another from 45·1° in 1784 to 51·3° in 1846. The difference is 6·2°."

Again: the mean temperatures of the different seasons of the year, as deduced from the records examined for the conclusions stated above, is as follows:—

"The mean temperature of the spring months, March, April, and May, is ....46·4°.

"The mean temperature of the summer months, June, July, and August, is ....60·0°.

"The mean temperature of the autumn months, September, October, and November is ....49·3°.

"The mean temperature for the winter months, December, January, and February is ....37·6°.

"The mean temperature for the whole year ....48·3°."

The cold of last November gave rise to many speculations as to the probable character of the coming winter. In a paper read before the Manchester Philosophical Society, in 1864, Mr. G. V. Vernon summed up the results of a very close examination of the records of the temperature of November extending over 91 years in the following words:—

"Careful investigation of the mean monthly temperatures for the long period made use of shows that no safe conclusions of any kind can be based upon the character of any particular month. Cold winters succeeding a warm November were very few in number, and in most cases these winters were preceded by a November not much above the average temperature, as in 1783, 1794, and 1799, when the mean temperature of November was only 0·5°, 0·9°, and 0·5° respectively above the mean.

"November 1822 and 1846 were the only two Novembers much above the average which were followed by a cold period immediately afterwards."

The following statement of the average temperature of the different months has been drawn out by Mr. Glaisher from the records of the Royal Observatory at Greenwich, extending over a period of ninety-eight years, 1771–1869.

The editor places side by side the average temperature of Wylam for fourteen years, as drawn from Mr. Atkinson's observations.

The two series will show, to some extent, the difference of temperature for each month between the North and South of England at a glance. The editor has no series of observations extending over a longer period than Mr. Atkinson's at his disposal.

	Greenwich.	Wylam.		Greenwich.	Wylam.
January	36·2°	37·29°	July	61·4°	59·07°
February	38·4°	39·36°	August	60·7°	58·87°
March............	41·0°	40·49°	September	56·5°	54·84°
April	46·0°	46·02°	October	49·7°	48·09°
May	52·6°	50·93°	November	42·4°	41·11°
June	58·2°	56·84°	December	39·2°	39·92°

It thus appears that the average temperature of the three winter months, December, January, and February, is higher in each case at Wylam than at Greenwich.

TABLES OF TEMPERATURE.

	NORTH SUNDERLAND.				
Height above Sea	125 Feet.				
	Min.	Max.	Mean.	Dry Bulb.	Wet Bulb.
January	37·4	43·9	40·5	41·2	40·9
February	38·7	47·5	43·1	42·6	41·0
March	35·4	45·9	39·8	39·2	36·5
April	40·2	57·2	48·1	45·7	42·9
May	40·7	53·0	46·6	44·2	39·5
June	47·2	63·7	55·4	51·0	49.8
July	52·6	70·3	61·5	57·9	56·4
August	51·4	66·3	59·1	54·6	53·9
September	50·6	61·5	56·3	54·0	53·4
October..........................	43·5	53·8	48·8	48·5	46·8
November.......................	38·5	46·4	42·4	42·1	41.3
December	35·4	41·9	38·6	39·2	38·5
Average—1869	42·6	54·2	48·4	46·6	45·0
1868	44·0	54·2	49·1	......	......

	ALNWICK CASTLE.				
	Min.	Max.	Mean.	Highest temperature recorded.	Lowest temperature recorded.
January	No observations taken.				
February					
March					
April					
May					
June					
July					
August					
September					
October (for 29 days only)	41·8	50·9	46·3	68° on 11th	30° on 26th
November	37·3	46·2	41·7	59° on 13th	28° on 9th & 29th
December (for 30 days only)	33·4	40.3	36·8	50° on 14th	25° on 28th

	WALLINGTON.				
Height above Sea	398 Feet.				
	Min.	Max.	Mean.	Highest temperature recorded.	Lowest temperature recorded.
January	30·0	37·2	33·6	49° on 5th	15° on 1st
February	31·4	40·9	36·1	51° on 5th	24° on 3rd, 20th, & 28th
March	25·4	37·8	31·7	45° on 23rd	18° on 3rd, 7th, & 17th
April	31·4	51·2	41·3	70° on 11th	21° on 1st
May	32·7	48·8	40·7	60° on 1st	22° on 9th
June	38·4	58·4	48·4	70° on 26th	24° on 1st
July	42·2	65·9	54·0	78° on 21st	31° on 1st
August	38·8	62·3	50·5	80° on 28th	25° on 31st
September	39·1	53·6	40·3	63° on 6th	31° on 5th
October	33·2	46·2	39·7	62° on 9th	20° on 27th
November	29·4	38·3	33·8	47° on 22nd	20° on 23rd
December	28·4	36·6	32·5	48° on 13th	15° on 28th
Average—1869	33·3	48·1	40·7	......	......
1868	36·4	51·2	43·8	......	......
1867	37·5	51·4	44·5	......	......

Warmest days—July 4. Mean Temperature, 60·8°. Wind, W.
Aug. 28. " 62·3°. Wind, N.E.
Coldest days—Jan. 1. " 21·5°. Wind, N.E.
Dec. 28. " 19·7°. Wind, N.W.

CRAGSIDE.—(ROTHBURY).*

Height above Sea	400 Feet.						
	Dry Bulb. 9 A.M.	Wet Bulb. 9 A.M.	Min.	Max.	Mean.	Highest temperature recorded.	Lowest temperature recorded.
January	37·5°	36·3°	33·6°	45·2°	39·4°	52° on 11th	22° on 1st
February	42·9°	41·5°	39·8°	50·2°	45°	55° on 7th & 27th	32° on 18th & 20th
March	35·2°	39·7°	33·2°	48·9°	41°	65° on 26th	25° on 11th
April	48·5°	46·2°	38°	55·1°	46·5°	67° on 26th	29° on 19th
May	45·7°	47·5°	35·9°	52·7°	44·3°	64° on 2nd	29° on 14th
June	54·9°	51·2°	42°	64°	53°	78° on 26th	31° on 1st
July	63·1°	60·1°	49·2°	71·2°	60·2°	85° on 21st	41° on 29th
August	59·8°	58·2°	46·7°	69·2°	57·9°	89° on 28th	39° on 9th & 12th
September	54·7°	54·2°	46·7°	63°	54·8°	70° on 9th	39° on 22nd
October	47·2°	45·6°	39·7°	55·5°	47·6°	71° on 11th	27° on 21st & 28th
November	39·4°	38·1°	32·9°	46·8°	39·8°	56° on 2nd & 18th	23° on 23rd
December	34·6°	34·1°	29·6°	40·6°	35·1°	55° on 18th	18° on 3rd
Average	46·9°	46·0°	38·9°	55·2°	47·0°	....	....

* Negretti & Zambra's instruments, on stands 4 feet 6 inches high, N. aspect.

	ALLENHEADS.					
Height above Sea	1360 Feet.					
	Mean of all the highest.	Mean of all the lowest.	Mean temperature of Air.	Dew Point.	Elastic force of Vapour.	Humidity. Saturation = 100.
January	41·9	32·8	37·1	35·0	·204	92
February	45·0	35·1	39·2	36·9	·219	92
March	39·9	29·3	33·2	30·0	·167	88
April	53·5	37·3	43·8	37·7	·226	78
May	50·1	35·9	40·9	36·4	·215	85
June	60·5	44·5	50·3	44·6	·295	81
July	64·6	51·5	57·7	50·1	·362	76
August	......	45·5	......	......	......	......
September	58·2	46·6	50·9	46·6	·318	86
October	51·5	38·9	44·0	40·9	·256	89
November	43·3	32·0	36·7	33·6	·193	89
December	36·5	27·3	32·0	29·0	·160	88
Average—1868	52·0	39·6	44·8	39·8	·251	83
1867	49·6	36·6	43·2	37·5	·238	84
1866	50·7	37·7	44·2	......	......	......

	BYWELL.					
Height above Sea	86½ Feet.					
	Mean of all the highest.	Mean of all the lowest.	Mean temperature of Air.	Dew Point.	Elastic Force of Vapour.	Humidity Saturation = 100.
					INCH.	
January	46·4	34·9	40·6	35·8	·210	84
February	50·3	38·1	43·9	37·6	·225	78
March	46·1	32·3	37·9	32·7	·186	82
April	......	......	......	......	......	......
May	......	......	......	......	......	......
June	64·2	46·9	54·0	45·5	·305	73
July	72·8	53·7	61·7	50·2	·364	67
August	69·2	49·7	57·4	52·3	·393	83
September	63·7	49·6	55·1	48·3	·339	78
October	56·1	42·2	47·4	42·4	·271	84
November	48·3	35·8	41·1	35·0	·204	79
December	41·8	31·5	36·6	32·5	·184	86
Average—1868	58·62	42·8	49·4	41·3	.266	75

	NORTH SHIELDS.				
Height above Sea	124 Feet.				
	Mean.	Highest.	Lowest.	Range.	Lowest on the Ground.
January	41·4	55·5	26·6	28·9	25·4
February	44·7	59·0	30·0	29·0	28·5
March	39·7	54·0	26·8	27·2	25·5
April	49·1	72·5	32·2	40·3	30·0
May	47·4	59·0	35·7	23·3	34·0
June	54·3	73·0	38·0	35·0	37·8
July	62·6	78·8	45·2	33·6	44·8
August	57·5	81·0	40·3	40·7	39·0
September	56·6	69·5	43·0	26·5	41·8
October	49·1	69·0	29·0	40·0	27·0
November	43·0	58·0	29·0	29·0	27·0
December	38·3	56·0	18·7	37.3	16·8
Average	48·6	65·4	32·9	32·6	31·5

	SHOTLEY HALL.		
Height above Sea	312 Feet.		
	Min.	Max.	Mean.
January	37·8	43·3	40·5
February	43·8	48·5	46·1
March	......	......	......
April	42·4	58·1	50·2
May	41·7	56·2	48·9
June	48·8	63.9	56·3
July	55·0	70·4	62·7
August	51·0	68·1	59·5
September	50.9	60·8	55·8
October	41·4	52·0	46·7
November	35·9	46·8	41·3
December	32·2	40·1	36·1

	DURHAM OBSERVATORY.			
Height above Sea	352·4 Feet.			
	Mean of all Maximum Readings.	Mean of all Minimum Readings.	Mean temperature of the Month.	Mean of previous 10 years.
January	43·16	34·56	38·86	36·77
February	47·61	37·82	42·72	38·90
March	42·86	32·22	37·54	39·14
April	57·06	38·97	48·02	45·72
May	51·73	39·29	45·51	50·63
June	63·56	44·83	54·20	56·18
July	73·01	51·13	62·07	58·85
August	66·94	48·07	57·51	57·87
September	61·56	48·60	55·08	54·72
October	53·82	41·78	47·80	48·42
November	46·54	35·97	41·26	41·20
December	39·86	31·42	35·64	38·78
Mean for Year	......	......	47·18	47·26

HYGROMETRICAL RESULTS.

	Mean temperature of the Air.	Mean temperature of evaporation.	Mean temperature of dew point.	Relative Humidity.
January	39·57	38·06	36·11	87·9
February	42·94	40·53	37·64	81·5
March	37·08	35·17	32·48	83·8
April	47·34	44·14	40·59	77·9
May	44·64	42·13	39·19	81·2
June	52·68	49·00	45·29	76·6
July	60·86	56·43	52·58	74·3
August	56·83	52·86	49·21	76·0
September	54·61	51·41	48·31	78·8
October	47·20	45·10	42·74	85·5
November	41·60	39·50	36·90	84·1
December	36·57	34·98	32·75	86·7
Mean for Year	46·82	44·11	41·15	81·2

These results are reduced from the readings of the dry and wet bulb thermometers, corrected for diurnal range by Glaisher's tables; the observations being taken at 10 a.m. and 10 p.m.

Durham, Hygrometrical Results (Continued).

	Weight of vapour in a cubic foot of air.	Weight required for Saturation.	Weight of a cubic foot of air.	Elastic force of vapour.	Mean pressure of dry air reduced to the sea level
	Grains.	Grains.	Grains.	Inches.	Inches.
January	2·48	0·34	547·2	0·213	29·651
February	2·60	0·59	541·5	0·225	29·535
March	2·15	0·42	550·0	0·184	29·671
April	2·91	0·82	540·2	0·253	29·696
May	2·76	0·64	541·6	0·239	29·630
June	3·45	1·05	536·0	0·303	29·747
July	4·41	1·53	526·1	0·397	29·613
August	3·94	1·24	532·1	0·351	29·749
September	3·79	1·02	526·2	0·339	29·299
October	3·18	0·54	540·3	0·274	29·691
November	2·56	0·48	543·0	0·219	29·545
December	2·19	0·34	549·6	0·186	29·519
Mean for Year	3·04	0·75	539·5	0·265	29·612

SEAHAM HALL.

Height above Sea	80 Feet.				
	Min.	Max.	Mean.	Highest temperature recorded.	Lowest temperature recorded.
January	34·5	43·1	38·8	53° on 31st	24° on 26th
February	35·4	48·6	42·0	57° on 5th	27° on 12th
March	31·3	44·8	38·0	52° on 26th	24° on 16th
April	37·8	58·5	48·1	75° on 11th	30° on 18th
May	39·6	55·3	47·4	64° on 30th	31° on 12th and 13th
June	44·4	65·7	55·0	74° on 26th	39° on 14th
July	49·9	73·1	61·5	83° on 16th	35° on 1st & 2nd
August	47·5	67·0	57·2	88° on 28th	36° on 30th
September	47·6	63·5	55·5	71° on 8th	42° on 27th
October	40·1	53·6	46·8	67° on 11th	31° on 28th
November	34·4	44·1	39·2	55° on 1st & 2nd	25° on 30th
December	31·6	40·7	36·1	52° on 18th	20° on 27th
Average for Year	39·5	54·8	47·1	......	......

Warmest days of year—June 25th, mean temperature 64·0°, wind S.W.
July 16th, ,, 68·0°, ,, W.
Aug. 28th, ,, 69·0°, ,, S.

Coldest days—Jan. 24th, 25th, & Feb. 28th ,, 30·1°, ,, W.
November 30th, ,, 28·1°, ,, N.
December 27th, ,, 25·0°, ,, E.

	* SEDGEFIELD.				
Height above Sea	360 Feet.				
	Dry Bulb. 9 A.M.	Wet Bulb. 9 A.M.	Dry Bulb. 9 P.M.	Wet Bulb. 9 P.M.	Mean of Minimum.
January	38·7°	38·0°	38·8°	38·1°	35·0°
February	43·5°	41·6°	40·9°	39·8°	37·9°
March	39·0°	37·4°	34·6°	33·9°	32·3°
April	50·9°	46·9°	44·0°	42·6°	40·0°
May	47·4°	43·5°	41·5°	39·9°	40·1°
June	57·5°	52·0°	48·4°	46·9°	45·7°
July	66·5°	59·6°	56·2°	53·8°	51·5°
August	61·5°	55·8°	52·4°	50·5°	48·5°
September	54·5°	53·4°	52·3°	50·5°	48·7°
October	48·1°	46·1°	45·9°	44·7°	41·7°
November	41·0°	38·6°	40·3°	38·8°	37·0°
December	35·6°	34·7°	35·5°	34·3°	32·5°
Average for Year	48·6°	45·4°	44·2°	42·8°	40·9°

	SEDGEFIELD (Continued).			
Height above Sea ...	360 Feet.			
	Mean of Maximum.	Mean of two Readings.	Highest temperature recorded.	Lowest temperature recorded.
January	42·5°	38·7°	54° on 31st	18° on 1st
February	46·7°	42·3°	54° on 5th & 6th	29° on 23rd
March	43·1°	37·7°	49° on 26th	26° on 3rd
April	55·6°	47·7°	74° on 11th	31° on 1st & 19th
May	50·0°	45·1°	61° on 1st	33° on 13th
June	61·9°	53·8°	79° on 26th	35° on 1st
July	72·1°	61·4°	83° on 18th	42° on 13th
August	66·7°	57·4°	91° on 28th	42° on 3rd & 30th
September	62·6°	55·8°	70° on 6th, 8th, and 9th	40° on 22nd
October	53·2°	47·7°	68° on 9th & 11th	28° on 20th
November	45·7°	41·3°	55° on 14th	28° on 10th, 11th and 21st
December	39·6°	36·0°	53° on 18th	19° on 29th
Average for Year ...	53·3°	47·0°	....	....

* Casella's Standard Instruments—certified at Kew.

The warmest days of the year, as recorded at Sedgefield, were June 26th, with a mean temperature of 65.8°, wind S.E.; July 18th, mean temperature 70·5°, wind W.; August 28th, mean temperature 70·8°, wind S. The highest temperature recorded was 91° on 28th August. The coldest days of the year were January 1, mean temperature 27·2°, wind S.E.; December 26, mean temperature 28°, wind E.; December 28th, mean temperature 25·3°, wind W.

	HARTLEPOOL.				
Height above Sea					
	Mean Max. of each day.	Mean Min. of each day.	Mean	Highest temperature recorded.	Lowest temperature recorded.
January	43·1°	37·6°	41·2°	52° on 6th	23° on 1st
February	47·9°	40·8°	44·1°	55° on 7th	31° on 28th
March........................	41·1°	35·2°	38·4°	49° on 27th	29° on 3rd
April	53·1°	43·3°	47·8°	67° on 12th	34° on 3rd & 9th
May.....	48·9°	43·1°	45·5°	60° on 22nd	40° on 3rd, 4th 8th, & 28th
June	59·7°	48·9°	52·9°	76° on 7th	42° on 1st & 16th
July	67·2°	55·8°	60·4°	80°	50°
August	63·0°	48·9°	56·2°	78°	42°
September	58·0°	51·9°	55·2°	69°	45°
October	52·8°	44·5°	48·3°	67°	30°
November	46·9°	38·3°	42·6°	56°	29°
December	40·9°	34·5°	32·8°	53°	24°
Mean of Year	51·8°	43·5°	47·6°	63·5°	34·9°

	HARTLEPOOL (Continued).				
Height above Sea					
		Degrees of Dryness.			
	Range.	Mean.	Maximum.	Minimum.	Range.
January	29·0°	1·7°	5° on 30th	0·0° on 28th	5°
February	24·0°	2·3°	5° on 11th	1° on 8 days	4°
March	20·0°	2·1°	5° on 5th & 12th	0·0° on 11th, 12th, & 13th	5°
April	33·0°	3·1°	7° on 23rd	1° on 4 days	6°
May	20·0°	3·1°	5° on 6 days	0·0° on 10th & 12th	5°
June	34·0°	3·5°	7° on 9th	0·0° on 24th	7°
		Mean diff. of Wet Bulb.	Maximum difference of Wet Bulb.	Minimum difference of Wet Bulb.	
July	30·0°	4·0°	8·0°	2·0°	
August	36·0°	2·7°	7·0°	1·0°	
September	24·0°	3·2°	7·0°	1·0°	
October	37·0°	2·0°	5·0°	0·0°	
November	27·0°	2·4°	5·0°	0·0°	
December	29·0°	1·8°	4·0°	0·0°	
Mean for Year	28·3°	......	......	......	...

	BRINKBURN—(DARLINGTON).				
Height above Sea	50 Feet.				
	Min.	Max.	Mean.	Highest temperature recorded	Lowest temperature recorded.
January	32·6°	41·9°	33·9°	50° on 8th & 9th	10° on 1st
February	35·3°	67·6°	42·0°	57° on 5th	22° on 22nd
March	28·8°	44·0°	36·5°	52° on 23rd	14° on 9th
April	37·3°	58·8°	44·8°	76° on 10th	26° on 1st
May	33·9°	54·0°	45·7°	65° on 1st	28° on 5th
June	42·6°	71·0°	54·5°	82° on 7th	36° on 12th
July	48·9°	77·1°	59·5°	88° on 16th & 18th	38° on 1st
August	46·6°	72·2°	59·2°	95° on 28th	31° on 31st
September	45·4°	66·4°	55·9°	78° on 9th	36° on 22nd
October	40·0°	57·2°	44·8°	75° on 11th	30° on 25th, 26th, & 27th
November	34·1°	45·2°	39·6°	58° on 1st	24° on 30th
December	27·0°	38·3	33·9°	55° on 18th	11° on 27th
Average for Year	37·7°	57·8°	47·7°	......	......

* Negretti and Zambra's instruments, on stand 5 feet above ground.

Coldest days—January 1, mean temperature 18·5°, wind N.W.
November 30, „ 29·5°, „ N.W.
December 28, „ 20·0°, „ N.W.

Warmest days—June 7, mean temperature 66·5°, wind S.W.
July 16, „ 74·0°, „ W.
August 28, „ 75·0°, „ W.

RELATIVE PREVALENCE OF WINDS FROM DIFFERENT QUARTERS IN 1869.

Stations	Acklam Hall, Middlesbro'.	Darlington.	Seaham Hall.	Seaham.	Sunderland.	Whitley.	Horsley, near Wylam.	Wallington.	Cragside, Rothbury.	North Sunderland.
Quarters.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
North	45	25	81	57	34	29	8	22	30	68
North-East	46	92	53	31	27	61	53	50	23	17
North-West	51	40	26	34	52	65	62	74	74	19
South	26	28	65	66	41	19	45	23	26	77
South-East	11	13	8	16	20	34	45	20	24	21
South-West	114	83	20	30	66	77	70	56	49	49
East	20	9	28	36	28	15	7	29	16	18
West	52	75	84	95	97	65	75	91	123	96
	365	365	365	365	365	365	365	365	365	365

MONTHS.	HARTLEPOOL. Days and Direction.		HARTLEPOOL. Estimated mean force 1-12.	HARTLEPOOL. Max. force 1-12.	DURHAM.* Days and Direction.		DURHAM.* Per Centage	DURHAM.* Velocity.	DURHAM.* Estimated force, 0·10	SEDGEFIELD. Days and Direction.		SEDGEFIELD. Estimated Average Force, 0·8	NORTH SHIELDS. Days and Direction.	
January	North	70	5·5	8	North	71	9·73	12·82	1·70	North	12	1·7	North	92
February	North-East	43	6·0	10	North-East	69	9·45	16·91*	2·55	North-East	26	1·8	South	84
March	North-West	45	5·8	9	North-West	82	11·23	12·12*	1·63	North-West	12	1·6	East	61
April	South	31	3·6	8	South	166	22·74	11·04	1·58	South	73	1·6	West	128
May	South-East	17	4·0	7	South-East	27	3·70	9·49	1·37	South-East	16	1·6		..
June	South-West	58	3·2	7	South-West	105	14·38	7·82	1·16	South-West	73	1·1		..
July	East	42	3·5	6	East	44	6·03	9·67	1·48	East	42	1·7		..
August	West......	49	3·3	7	West......	144	19·73	6·55	0·90	West......	111	1·2		..
September		..	4·3	8	Calm	22	3·01	11·43	1·70		..	1·6		..
October		..	4·2	11		..	..	11·17	1·63		..	1·6		..
November		..	4·5	9		..	..	15·27	2·06		..	2·0		..
December		..	4·9	10		..	..	14·43	2·14		..	1·6		..
Average of year		365	4·4	8·3		...	..	10·80	1·66		365	1·7		365

* On February 13th the Anemometer was broken in a storm. It was not repaired till March 13th, consequently these months are defective. This table gives the number of times the wind is noted to have blown from each quarter. The direction of the wind it noted twice a day, viz., 10 a.m. and 10 p.m. There is an error in the Tyneside Club Meteorological Report of last year. The number of days of wind from each quarter should have been N.E. 33·3, N.W. 34, S. 86 S.E. 14·5, S.W. 59, E. 23·5, W. 74, Calm, 15·5. Total, 366.

MONTHS.	NORTH SHIELDS. Prevailing Winds.	NORTH SHIELDS. Estimated average force, 0·6.	BYWELL Days and Direction.		BYWELL Estimated force, 0·6.	WYLAM. Wind, by Clouds overhead.	ALLENHEADS. Days and Direction.		ALLENHEADS. Estimated force, 0·6	ALNWICK.* Days and Direction.		ALNWICK.* Average Velocity in miles.
January	S.W.	1·6	North	66	1·3	W. 7° S.	North	74	1·6	North	3	....
February	S.W.	1·9	South	54	1·6	W. 11° S.	South	89	2·4	North-East	1	....
March	N.E.	1·8	East	84	1·3	N.	East	53	1·6	North-West	11	....
April	S.W.	1·5	West......	131	1·2	W. 3° N.	West......	149	1·8	South	9	....
May	N.E.	1·4		..	1·0	E. 29° N.		..	1·8	South-East	6	....
June	N.E.	1·4		..	1·2	N. 14° W.		..	1·4	South-West	23	....
July	S.W.	1·6		..	1·3	W. 4° S.		..	2·2	East	2	....
August	S.W. & N.W.	1·4		..	1·2	W. 18° N.		..	1·5	West	25	....
September	S.W.	2·2		..	1·4	W. 23° S.		..	2·3		..	....
October	S.W. & N.W.	2·0		..	1·2	W. 7° N.		..	1·8		..	19·5
November	N.W. & W.	1·9		..	1·2	W. 6° N.		..	1·7		..	20·6
December	S.W. & N.W.	2·2		..	1·2	W. 7° N.		..	1·9		..	36·8
Average of year	S.W.	1·7		335	1·25	W. 19° N.		365	1·91		..	....

* ALNWICK.—The return only embraces the period from October 11th to December 31st, when the self-acting Anemometer was first set to work. October 15th and 16th not registered for direction. November 22nd not registered for velocity. Calmest days: October 14th, November 23rd, and December 2nd. Days of greatest velocity: October 26th, November 12th and 18th, and December 13th. On December 13th, a velocity of 65 miles was registered. From 3 a.m. to 9 a.m., on December 22nd, the wind made six complete circuits, and from 2 p.m. to 11 p.m. of 22nd, five complete circuits.

BAROMETER.

MEAN READINGS FOR 1869.

	*NORTH SUNDERLAND.				ALNWICK CASTLE.
Feet above the level of Sea	60 Feet.				?
	Mean Readings. 9 A.M.	Range. 9 A.M.	Mean Readings. 9 P.M.	Range. 9 P.M.	Mean Readings.
	Inches.		Inches.		Inches.
January	29·96	1·55	28·79	1·58	No observations taken.
February	29·00	1·58	29·02	1·18	
March	29·17	1·43	29·12	1·25	
April	29·76	1·39	29·78	1·38	
May	29·72	1·24	29·70	1·17	
June	29·84	0·92	29·86	0·86	
July	29·80	0·69	29·85	0·72	
August	30·16	1·42	29·95	0·73	
September	29·46	1·37	29·44	1·66	
October	29·22	1·04	29·82	1·62	29·72
November	29·88	1·04	29·51	1·02	29·47
December	29·49	2·15	29·50	2·04	29·45

	†WALLINGTON.		CRAGSIDE. (ROTHBURY).	‡ALLENHEADS.	
Feet above the level of Sea	398 Feet.		400 Feet.	1360 Feet.	
	Mean Readings. 9 A.M.	Mean Readings. 9 P.M.	Mean Readings.	Mean Readings.	Range.
	Inches.	Inches.	Inches.	Inches.	
January	29·43	29·43	29·52	28·361	1·547
February	29·33	29·34	29·58	28·281	1·385
March	29·46	29·50	29·49	28·366	1·423
April	29·24	29·58	29·68	28·470	1·382
May	29·49	29·49	29·60	28·381	1·157
June	29·65	29·63	29·69	28·580	0·964
July	29·62	29·61	29·61	28·557	0·672
August	29·67	29·71	29·53	28·637	0·876
September	29·54	29·43	29·53	28·193	1·445
October	29·56	29·58	29·57	28·499	1·251
November	29·38	29·37	29·47	28·314	1·093
December	29·33	29·30	29·44	28·444	1·770
Average for Year	......	......	29·56	24·426	1·247

* Not corrected. † Not corrected. ‡ Corrected for temperature and to sea level.

BAROMETER (CONTINUED).

	* HORSLEY.	† BYWELL.		WYLAM.†
Feet above the level of Sea......	386·8 Feet.	86 Feet 6 Inches.		82 Feet.
	Mean Readings. 9 A.M.	Mean Readings.	Range.	Mean Readings.
	Inches.	Inches.		Inches.
January	29·37	29·753	1·582	29·807
February	29·28	29·642	1·478	29·730
March	29·38	29·742	1·504	29·889
April	29·49	29·849	1·436	29·969
May	29·43	29·775	1·244	29·900
June	29·62	29·932	1·054	30·063
July	29·60	29·883	0·712	30·013
August	29·66	29·982	0·938	30·125
September	29·22	29·601	1·512	29·676
October	29·51	29·919	1·068	29·999
November	29·29	29·682	1·048	29·818
December	29·22	29·627	1·930	29·751
Average of Year	......	29·781	1·292	29·895

* Not corrected. † Corrected for temperature and sea level.

	* NORTH SHIELDS.				† SHOTLEY HALL.	
Feet above the level of Sea	124 Feet.				312 Feet.	
	Mean.	Highest.	Lowest.	Range.	Mean Readings. 9 A.M.	Mean Readings. 9 P.M.
	Inches.	Inches.	Inches.		Inches.	Inches.
January	29·89	30·37	28·77	1·59	29·53	29·55
February	29·77	30·15	28·70	1·45	‡29·40	‡29·50
March	29·90	30·33	28·85	1·47	29·59	30·26
April	29·98	30·52	29·06	1·45	29·96	29·28
May	29·91	30·30	29·07	1·23	29·54	29·50
June	30·08	30·29	29·41	0·88	29·71	29·76
July	30·07	30·33	29·61	0·71	29·67	29·70
August	30·13	30·34	29·44	0·89	......	......
September	29·67	30·42	28·94	1·47	29·25	29·33
October	29·99	30·33	29·08	1·25	......	......
November	29·77	30·23	29·16	1·07	29·46	29·42
December	29·74	30·61	28·59	2·02	29·38	29·34
Mean of Year	29·91	30·32	29·05	1·29	......	......

* Corrected for temperature and to sea level.
† Not corrected for temperature or sea level. ‡ 27 days only.

BAROMETER (Continued).

	DURHAM OBSERVATORY.*			SEDGEFIELD.†	
Feet above the level of Sea ...	352 Feet 4 Inches.			360 Feet.	
	Means.	Means of previous 20 years.	Range.	Mean. 9 A.M.	Mean. 9 P.M.
	Inches.	Inches.		Inches.	Inches.
January	29.480	29·371	1·580	29·897	29·849
February	29·376	29·516	1·446	29·764	29·765
March	29·471	29·476	1·474	29·831	29·861
April	29·565	29·538	1·468	29·953	29·982
May	29·485	29·546	1·309	29·859	29·840
June	29·666	29·544	0·982	30·030	30·043
July	29·626	29·518	0·733	30·009	29·981
August	29·716	29·502	0·914	30·084	30·097
September	29·254	29·520	1·456	29·645	29·630
October	29·581	29·441	1·225	29·986	29·955
November	29·380	29·507	1·158	29·786	29·747
December	29·321	29·462	1·195	29·721	29·698
Average of Year	29·493	29·495	......	29·880	29·871

* Corrected for temperature and sea level.
† Kew standard.—Corrected for temperature and sea level.

	SEAHAM HALL.*		SEAHAM.*		HARTLEPOOL.†	
Feet above the level of Sea	80 Feet.		74 Feet.		50 Feet. ?	
	Mean Readings. 9 A.M.	Mean Readings. 9 P.M.	Mean Readings. 9 A.M.	Mean Readings. 5 P.M.	Mean Readings.	Range.
	Inches.	Inches.	Inches.	Inches.	Inches.	
January	29·821	29·831	29·81	29·86	29·79	1·66
February	29·669	29·689	29·78	29·74	29·70	1·10
March	29·740	29·750	29·74	29·07	29·79	1·42
April	29·850	29·850	30·00	30·01	29·62	1·29
May	29·660	27·770	29·87	29·80	29·80	1·23
June	29·930	29·980	30·04	30·06	29·95	0·81
July	29·800	29·920	30·04	30·04	29·93	0·68
August	30·020	30·020	30·11	30·12	29·99	0·81
September	29·550	29·520	29·67	29·64	29·58	1·39
October	29·840	30·150	29·94	29·95	29·86	1·21
November	29·660	29·540	29·78	29·78	29·70	1·08
December	29·600	29·620	29·68	29·70	29·64	1·81
Average of Yr.	......	......	......	......	29·77	1·20

* Not corrected for temperature or sea level. † Corrected for temperature and to sea level.

NOTES ON THE FLOWERING OF PLANTS, &c.

January.—

Wallington.—The month of January was marked by open weather, and the preceding December having also been warm, many flowers were in blossom early on. On January 1st tussilago fragrans, helleborus niger, and the common primrose. On the 8th double red hepatica. On the 30th winter aconite.

February.—

Wallington.—On the 1st the first crocus was seen in bloom. The gardens were very gay throughout the month with crocuses, snowdrops, and other spring flowers.

Wylam.—Vegetation very forward. Primroses in flower on the 7th. Apricot on cold wall in garden on the 17th. Ribes in flower on the 19th.

North Shields.—Yellow and purple crocus in flower during the first week.

Seaham.—Lychnis sylvestris in beautiful bloom in the woods on February 8th.

Brinkburn, Darlington.—Rhododendrons in full flower in the second week in February. The situation of the bed was much exposed to east and west winds.

March.—

Wylam.—Blackthorn in flower on the 19th. Pear trees on cold wall in flower on the 26th.

April.—

Lilburn Tower.—The warm weather of the early part of April caused the plants and corn to grow very rapidly. They received a great check towards the end of the month and the leaves were not fully developed until June.

The crops, notwithstanding the frequent alternations of heat and cold throughout the season, were on the whole good and abundant in the autumn of 1869.

Wylam.—Standard pear and plum trees in flower on the 4th. The wood anemone in bloom on the 9th. Apple tree on cold wall in blossom on the 11th. The laurel in flower in immense profusion on the 15th. Strawberries and white thorn in blossom on the 26th and 27th. The oak leaves were as large as a shilling on the 27th, and the ash was in leaf. The Gloire de Dijon rose was in flower on the 29th.

May.—

Wylam.—Peas in flower on the 13th.

North Shields.—Strawberries in blossom on the 11th. Globe Ranunculus, lilly of the valley, double red campion, and white and purple lilac about the same time.

June.—

Wylam.—The wild rose was in flower on the 13th. The first ripe strawberries were gathered on the 20th. Honeysuckle in flower on hedges on the 27th, and the Portugal laurel blossomed in great profusion on the 27th. The first dishes of peas and of grapes were gathered on the 29th.

North Shields.—Strawberry ripe on the 29th. St. Bernard lily, French roses, branching larkspur, perennial lupin, perennial aster, yellow milfoil, sweet William, white and purple fraxinella, gladiolus, African marigold, and ranunculus in flower between the 4th and 29th.

Whitley.—First dish of peas gathered on the 30th.

July.—

Wallington.—The first dish of peas was gathered on July the

4th, eighteen days later than in 1868. The first dish of strawberries on July 13th, or twenty-one days later than in 1868.

Wylam.—Great abundance of hazel nuts in 1869. Hay cut on the 5th. On the 6th the first dish of strawberries was gathered.

Whitley.—First dish of strawberries gathered on the 3rd.

September.—

Wylam.—There has been a great deal of fruit on the cold walls this season. One hundred and fifty-five dozens of apricots were gathered from five trees, and two of those trees were small ones.

October.—

Bywell.—The potato and turnip crops are good this year and free from disease.

November.—

Wallington.—Hardy shrubs and trees have seldom been observed so profusely covered with fruit as they were this autumn. Several varieties of holly, cotoneasters, hawthorn, mountain ash, sweet brier, the common rose, and many others, were all very ornamental. This profusion of berries was considered to be indicative of a hard winter of frost and snow, and the fruit would then be of great service to many of the small birds.

Beech trees were loaded to excess and bent down with nuts, greatly to the astonishment of every one who saw them.

John Coppin, Esq., has again furnished the Club with a list of the wild and cultivated plants observed by him near Tynemouth. The list is subjoined and not combined with the general tables in order to facilitate comparison. The careful and continued observations of Mr. Coppin renders these returns year by year of great value.

WILD PLANTS GROWING WITHIN THREE MILES OF TYNEMOUTH, 1869.

	Date of Flowering.
Lamium album (white dead nettle)	Jan 1.
Tussilago farfara (coltsfoot)	Jan. 23.
Ranunculus ficaria (pilewort)	Jan. 23.
Lamium purpureum (red dead nettle)	Jan. 28.
Veronica hederifolia (ivy-leaved speedwell)	Feb. 9.
Primula vulgaris (primrose)	Mar. 3.
Ribes grossularia (gooseberry)	Mar. 18.
Glechoma hederacea (ground ivy)	Mar. 27.
Taraxacum officinale (dandelion)	Jan. 17.
Viola canina (dog violet)	Mar. 22.
Prunus spinosus (blackthorn)	Mar. 30.
Primula veris (cowslip)	April 11.
Veronica chamædrys (germander speedwell)	April 23.
Cratægus oxyacantha (hawthorn)	April 29.
Trifolium pratense (purple clover)	April 25.
Potentilla anserina (silver weed)	May 4.
Broom	May 10.
Mountain ash	May 10.

PLANTS GROWING IN GARDENS NEAR NORTH SHIELDS, 1869.

	Date of Flowering.		Date of Flowering.
Snowdrop	Jan. 19.	Blue hyacinth	April 16.
Crocus—purple	Feb. 7.	Apple tree (Keswick codling)	April 20.
Crocus—yellow	Feb. 8.	Black currant	April 22.
Crocus—white	Feb. 11.	London pride	April 26.
Red flowering currant against a wall	Jan. 28.	Lily of the valley	April 29.
Red flowering currant standard	Feb. 23.	Purple lilac	April 30.
Daffodil	Mar. 4.	Strawberry	May 1.
Gooseberry	Mar. 31.	Laburnum	May 14.
Red currant	April 10.	Chrysanthemum	Oct. 30.
Cherry	April 10.	Gazania and scarlet geranium survived the winter of 1868, and flowered in the summer.	
Yellow auricula	April 11.		
Jargonelle pear	April 12.		

FOREST TREES AND SHRUBS.

FOREST TREES, SHRUBS, &c.	MIDDLESBRO'.—ACKLAM HALL.			
	In Bud.	In Leaf.	In Blossom	Divested of Leaves.
Alder	March 28	April 15	Feb. 16	Oct. 29
Ash	April 12	April 28	April 10	Nov. 1
Barberry	March 1	April 4	May 12	Nov. 26
Beech	April 8	April 26	April 30	Oct. 23
Birch	March 4	April 20	March 29	Nov. 10
Black thorn	March 12	April 12	March 26	Nov. 2
Bramble	Feb. 23	April 7	June 20	Dec. 21
Broom	Feb. 16	April 1	April 12	....
Elder	Jan. 28	March 22	June 5	Nov. 1
Elm	March 24	April 18	Feb. 5	Oct. 26
Flowering currant	Feb. 10	March 21	Feb. 18	Nov. 5
Hawthorn	Feb. 22	April 9	April 27	Nov. 3
Hazel	March 20	April 12	Feb. 8	Oct. 27
Holly	April 17	April 27	May 1	....
Honeysuckle	Jan. 26	Feb. 24	June 19	Nov. 10
Laburnum	Feb. 19	April 12	April 30	Nov. 8
Larch	Feb. 24	April 6	March 16	Nov. 12
Lilac	Feb. 10	April 8	April 27	Nov. 9
Lime	March 30	April 20	June 22	Nov. 4
Mountain ash	March 26	April 16	May 4	Oct. 25
Oak	April 12	April 27	April 27	Oct. 28
Poplar	March 12	April 20	Feb. 16	Oct. 23
Privet	Feb. 22	April 4	June 26	Dec. 19
Rose	Feb. 18	March 31	June 16	Nov. 19
Sallow	March 15	April 19	Feb. 21	Oct. 30
Sycamore	March 30	April 16	April 25	Nov. 11
Whin	Feb. 12	April 1	Jan. 1	....

FOREST TREES, SHRUBS, &c.	SEAHAM.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	April 9	May 10	Feb. 20	Most of the Forest trees commenced to shed their leaves about Sept. 24th, owing partly to the dry summer.
Ash	May 6	May 20	April 20	
Barberry	April 11	May 6	....	
Beech	April 11	May 6	....	
Birch	April 13	May 6	....	
Black thorn	April 4	May 1	April 7	
Bramble	April 13	April 20	May 1	
Broom	April 16	....	....	
Elder	Feb. 1	April 7	June 24	
Elm	April 14	April 22	April 4	
Flowering currant	Feb. 6	April 18	April 1	
Hawthorn	Feb. 25	April 10	May 8	
Hazel	Feb. 25	May 5	Feb. 25	
Holly	....	....	May 30	
Honeysuckle	Jan. 20	Feb. 14	May 24	
Laburnum	April 4	May 8	May 24	
Larch	March 2	April 7	....	
Lilac	Feb. 8	April 28	May 8	
Lime	March 14	May 6	July	
Mountain ash	April 5	April 28	May 26	
Oak	April 20	May 20	May 30	
Poplar	April 6	April 18	Feb. 28	
Privet	April 13	May 1	June 30	
Rose	Jan. 14	Feb. 10	May 4	
Sallow	April 12	April 19	March 6	
Sycamore	Feb. 13	April 22	May 6	
Whin	....	....	All through the winter.	

FOREST TREES AND SHRUBS (CONTINUED).

FOREST TREES, SHRUBS, &c.	GRETA BRIDGE.—BARNARD CASTLE.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	....	....	....	....
Ash	May 6	May 30	....	....
Barberry	....	....	....	....
Beech	April 20	April 30	....	Nov. 20
Birch	....	....	....	Nov. 20
Black thorn	....	April 23	April 10	....
Bramble	....	April 25	June 30	....
Broom	....	....	May 16	....
Elder	....	....	June 25	....
Elm	....	....	....	....
Flowering currant	....	....	April 20	....
Hawthorn	....	....	May 28	....
Hazel	....	April 16	....	....
Holly	....	....	May 9	....
Honeysuckle	....	April 23	....	....
Laburnum	May 1	May 23	May 20	....
Larch	April 1	....	....	....
Lilac	Feb. 7	April 22	May 15	....
Lime	....	....	....	....
Mountain ash	....	....	Sept. 2	....
Oak	May 1	May 22	Blossoms unusually plentiful.	....
Poplar	....	....		....
Privet	....	....		....
Rose	....	....		....
Sallow	....	....		....
Sycamore	....	April 18	May 8	Nov. 11
Whin	....	....	Jan. 1	....

FOREST TREES, SHRUBS, &c.	BRINKBURN GARDEN.—DARLINGTON.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	....	....	....	....
Ash	....	....	....	....
Barberry	....	....	....	....
Beech	....	....	....	....
Birch	....	....	....	....
Black thorn	....	....	....	....
Bramble	....	....	....	....
Broom	....	....	....	....
Elder	....	....	....	....
Elm	....	....	....	....
Flowering currant	First week in February.	....	....	....
Hawthorn	Ditto	....	....	....
Hazel	....	....	....	....
Holly	....	....	....	....
Honeysuckle	....	....	....	....
Laburnum	....	....	....	....
Larch	First week in February.	....	....	....
Lilac	Ditto	....	....	....
Lime	....	....	....	....
Mountain ash	....	....	....	....
Oak	....	....	....	....
Poplar	....	....	....	....
Privet	....	....	....	....
Rose	First week in February.	....	....	....
Sallow	....	....	Last week in January.	....
Sycamore	....	....	....	....
Whin	....	....	Jan. 9	....

FOREST TREES AND SHRUBS (CONTINUED).

FOREST TREES, SHRUBS, &c.	NORTH SHIELDS.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	....	....	....	....
Ash	....	....	April 11	....
Barberry	....	....	....	....
Beech	....	....	....	....
Birch	....	....	....	....
Black thorn	....	....	March 30	....
Bramble	....	....	....	....
Broom	....	....	May 10	....
Elder	....	....	....	....
Elm	....	....	March 25	....
Flowering currant	....	....	Feb. 23	....
Hawthorn	....	....	April 29	....
Hazel	....	....	....	....
Holly	....	....	....	....
Honeysuckle	....	....	....	....
Laburnum	....	....	May 14	....
Larch	....	....	....	....
Lilac	....	....	April 30	....
Lime	....	....	....	....
Mountain ash	....	....	May 10	....
Oak	....	....	....	....
Poplar	....	....	....	....
Privet	....	....	....	....
Rose	....	....	....	....
Sallow	....	....	....	....
Sycamore	....	....	April 25	....
Whin	....	....	....	....

FOREST TREES, SHRUBS, &c.	WALLINGTON.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	March 21	April 22	April 26	Nov. 8
Ash	April 10	May 6	April 19	Oct. 26
Barberry	March 12	April 8	May 4	Nov. 16
Beech	March 22	April 16	May 10	Nov. 6
Birch	April 2	April 24	May 6	Nov. 17
Black thorn	Feb. 4	April 10	April 14	Nov. 10
Bramble	Feb. 1	April 1	July 20	
Broom	Feb. 8	April 20	May 16	Nov. 10
Elder	Jan. 1	Feb. 4	June 25	Nov. 8
Elm	April 6	May 6	April 2	Nov. 12
Flowering currant	Feb. 1	March 4	April 2	Oct. 1
Hawthorn	Feb. 4	April 5	May 21	Nov. 12
Hazel	Feb. 2	April 26	Feb. 6	Nov. 16
Holly	April 4	May 12	June 7	July 24
Honeysuckle	Jan. 1	Feb. 1	May 29	Dec. 10
Laburnum	March 13	April 24	May 29	Nov. 8
Larch	Feb. 8	March 25	April 4	Nov. 16
Lilac	Feb. 2	March 25	May 12	Nov. 18
Lime	April 1	May 8	July 15	Nov. 4
Mountain ash	April 1	April 15	June 1	Nov. 20
Oak	April 22	May 21	June 7	Dec. 1
Poplar	Feb. 6	March 22	....	Oct. 18
Privet	March 10	April 7	July 15	....
Rose	Jan. 20	Feb. 10	July 1	Dec. 8
Sallow	March 25	April 22	Mar. 15	Nov. 22
Sycamore	March 22	April 18	April 24	Nov. 6
Whin	Feb. 1	May 4	Jan. 1	Nov. 20

FOREST TREES AND SHRUBS (Continued).

FOREST TREES, SHRUBS, &c.	ROTHBURY.—Cragside.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	April 14	....	....	....
Ash	May 20	....	....	Oct. 28
Barberry	....	....	....	....
Beech	....	May 10	....	....
Birch	April 24	....	....	....
Black thorn	....	....	....	....
Bramble	....	....	July 4	Abundant crop
Broom	....	....	....	....
Elder	....	....	....	....
Elm	....	May 20	....	Sept. 30
Flowering currant	....	....	....	....
Hawthorn	....	....	....	....
Hazel	....	....	....	....
Holly	....	....	....	....
Honeysuckle	....	....	....	....
Laburnum	....	....	....	....
Larch	....	....	....	....
Lilac	May 29	....	....	....
Lime	....	....	....	....
Mountain ash	....	....	....	....
Oak	....	May 24	....	Nov. 8
Poplar	....	....	....	....
Privet	....	....	....	....
Rose	....	....	....	....
Sallow	....	....	....	....
Sycamore	....	....	....	....
Whin	....	....	....	....

FOREST TREES, SHRUBS, &c.	LILBURN.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	Feb. 20	April 28	May 6	Oct. 20
Ash	March 2	May 11	May 25	Nov. 15
Barberry	April 10	May 9	May 21	Oct. 18
Beech	Feb. 28	April 20	May 18	Nov. 5
Birch	March 12	April 23	April 30	Oct. 23
Black thorn	March 3	April 19	May 1	Oct. 20
Bramble	April 12	May 21	June 10	Nov. 1
Broom	March 5	March 22	April 17	Nov. 24
Elder	March 8	April 14	June 22	Oct. 19
Elm	Feb. 20	April 12	May 18	Oct. 23
Flowering currant	Jan. 28	Feb. 8	Feb. 28	Oct. 17
Hawthorn	April 12	April 29	May 18	Oct. 20
Hazel	Feb. 5	Feb. 20	Feb. 10	Oct. 21
Holly	May 2	....	May 27	Sept. 23
Honeysuckle	May 18	June 13	July 4	Oct. 15
Laburnum	April 10	May 10	June 3	Oct. 17
Larch	March 15	March 28	April 13	Oct. 18
Lilac	April 9	April 21	May 1	Oct. 16
Lime	March 16	April 16	June 20	Oct. 25
Mountain ash	May 10	May 18	June 10	Oct. 20
Oak	March 18	May 3	June 12	Nov. 18
Poplar	Feb. 6	Feb. 27	April 3	Nov. 15
Privet	May 12	June 10	July 6	Dec. 10
Rose	May 7	May 28	June 2	Nov. 23
Sallow	March 6	March 29	April 4	Oct. 14
Sycamore	March 3	April 15	June 11	Oct. 21
Whin	Jan. 10	Jan. 28	Feb. 4	Nov. 18

FOREST TREES AND SHRUBS (Continued).

FOREST TREES, SHRUBS, &c.	NORTH SUNDERLAND.			
	In Bud.	In Leaf.	In Blossom.	Divested of Leaves.
Alder	....	....	....	....
Ash	....	....	....	....
Barberry	....	....	....	....
Beech	....	....	....	....
Birch	....	....	....	....
Black thorn	....	....	....	....
Bramble	....	....	....	....
Broom	....	....	....	....
Elder	....	March 25	......	....
Elm	....	....	March 27	....
Flowering currant	....	....	....	....
Hawthorn	....	April 5	April 27	....
Hazel	....	....	....	....
Holly	....	....	....	....
Honeysuckle	....	Feb. 10	....	....
Laburnum	....	....	....	....
Larch	....	April 5	....	....
Lilac	....	....	....	....
Lime	....	....	....	....
Mountain	....	....	....	....
Oak	....	....	....	....
Ontario Poplar	....	March 25	....	....
Privet	....	....	....	....
Rose	....	....	....	....
Sallow	....	....	....	....
Sycamore	....	....	....	....
Whin	....	Feb. 15	....	....

WILD PLANTS.

WILD PLANTS.	ACKLAM HALL, Middlesbro'	BRINK-BURN, Darlington	GRETA BRIDGE, B. Castle.	SEAHAM.
	In Blossom.	In Blossom.	In Blossom.	In Blossom.
Anemone	April 19	......	Mar. 30.	April 12.
Bulbous crowfoot	May 15.	......	......	May 1.
Coltsfoot	Feb. 16.	......	......	Feb. 1.
Cowslip	April 19.	......	April 20.	April 11.
Dandelion	Jan. 4.	Jan. 9.	April 11.	Mar. 6.
Forget-me-not	May 12.	......	April 20.	April 30.
Garlic	May 17.	......	May 12.	May 8.
Hyacinth	May 13.	......	April 22.	April 26.
Lily of valley	April 29.	......	......	May 24.
Marsh marigold	April 30.	......	......	April 11.
Pilewort	Feb. 15.	......	......	Feb. 26.
Primrose	Feb. 13.	......	Feb. 13.	Feb. 18.
Red poppy	June 7.	......	July 25.	June 4.
Stitchwort	April 9.	......	May 5.	April 18.
Snowdrop	Jan. 22.	Jan. 18.	Jan. 15.	Jan. 19.
Strawberry	April 28.	......	May 12.	April 28.
Veronica chamædrys	April 22.	......	......	April 30.
Violet	Feb. 16.	......	April 12.	Feb. 18.

WILD PLANTS (Continued).

WILD PLANTS.	NORTH SHIELDS. In Blossom.	STAMFORD-HAM. In Blossom.	WALLINGTON. In Blossom.
Anemone	......	......	April 6.
Bulbous Crowfoot	April 22.	Jan. 17. (?)	May 12.
Coltsfoot	Jan. 23.	Mar. 12.	Feb. 16.
Cowslip	April 11.	......	April 6.
Dandelion	Jan. 17.	Mar. 6.	April 7.
Forget-me-not	......	April 29.	June 26.
Garlic	......	......	Aug. 20. (Garden)
Hyacinth	......	......	May 13.
Lily of valley	April 29.	......	May 6.
Marsh marigold	April 17.	Mar. 27.	April 1.
Pilewort	Jan. 23.	......	April 2.
Primrose	Mar. 3.	......	Jan. 1.
Red poppy	......	......	......
Stitchwort	......	......	May 26.
Snowdrop	Jan. 19.	Jan. 2.	Jan. 16.
Strawberry	......	......	April 8.
Veronica chamædrys	April 23.	......	May 28.
Violet	Mar. 22.	......	Mar. 13.

WILD PLANTS.	ROTHBURY. In Blossom.	LILBURN. In Blossom.	NORTH SUNDERLAND. In Blossom.
Anemone	April 6.	June 20. (Garden).	......
Bulbous crowfoot	......	July 3.	......
Coltsfoot	......	May 18. (?)	Mar. 27.
Cowslip	......	Mar. 18.	......
Dandelion	......	April 12.	......
Forget-me-not	......	......	......
Garlic	......	July 14. (Garden). (?)	......
Hyacinth	......	June 18.	......
Lily of valley	......	May 3.	......
Marsh marigold	......	......	......
Pilewort	......	......	......
Primrose	Mar. 14.	Mar. 18.	Mar. 22.
Red poppy	......	......	June 26.
Stitchwort	......	......	......
Snowdrop	......	Feb. 10.	Jan. 18.
Strawberry	......	May 8.	April 3.
Veronica chamædrys	......	......	......
Violet	......	Mar. 12.	......

NOTES ON BIRDS AND INSECTS.

February.—

Wylam.—A thrush's nest with four eggs in it was found on the 4th. Thrushes, blackbirds, and robins were in full song at the beginning of the last week in January.

Newcastle.—On the 13th frog spawn was observed, and partridges coupled.

Tynemouth.—Large white butterfly seen on the 7th.

March.—

Wallington.—On the 6th, which was a very fine day, a tortoiseshell butterfly was seen; but no others were observed flying about for more than a month.

April.—

Wylam.—The black cap warbler and the willow wren appeared on the 18th.

May.—

Newcastle.—The wood wren arrived on the 8th.

June.—

Byrness.—The humming-bird hawk-moth was observed on the 7th and for several days afterwards.

July and August.—

Wallington.—The bees made abundance of honey during the fine weather of these two months, but after they were taken up to the Moors the weather proved very unfavourable and the crop was poor.

Wasps this season were very numerous, their combs large, many being from fifteen to eighteen inches in diameter. They were later than usual in attacking the garden fruit, but fully made up for their early forbearance by the after destruction they wrought amongst the cherries, plums, and grapes. Of the latter nearly one hundred bunches were eaten in a very short time. The nests of these insects were diligently sought after and upwards of seventy were destroyed within a radius of a mile from the garden.

One reason which has been suggested for the wasps not earlier attacking the fruit was the great abundance of honey dew which they were constantly seen feeding on and supplying their nests with.

Aphides were extremely plentiful on forest trees and shrubs.

The caterpillars of the Death's-head moth were more plentiful than commonly is the case in Northumberland. They were found feeding in the potato fields.

September.—

Newcastle.—Jack snipe arrived on the 30th.

October.—

North Shields.—On the 1st a woodcock was shot at Arcot, and two quails were shot near Earsdon on the 7th.

A very handsome specimen of the long-billed and crested Hoopoe was shot in some gardens at the top of Norfolk Street.

Seaham.—The woodcock, redwing, and fieldfare were seen for the first time this year on the 17th, at 8 A.M. Woodcocks have been seen ten days earlier in this locality.

Newcastle.—A Sclavonian grebe was shot on the 25th on Newcastle Town Moor.

Wasps were very numerous and destructive in the autumn.

Lilburn Tower.—The thrush was in full song on January 18th, earlier than it is remembered to have been heard in any previous year.

Seaham.—*Aphis.*—"The year 1869 has been very remarkable for the abundance of aphis and honey dew. So numerous were the aphides on vetches that when a man was loading a cart he was covered, and the crop was partly destroyed by them. In some localities peas and other like crops shared the same fate. I observed a species of aphis, of a mealy colour, on the lower stems of willows in autumn. These insects were visited by wasps so frequently that I thought their nest was among the willows; but I found large quantities of wasps lying under and on the branches seemingly in a state of stupefaction. These wasps I found passed the night under the bushes. I found a kind of honey dew under the willows and thought the wasps were making a meal of the insects, afterwards it proved to be the case that their object was the honey dew. I sent some specimens to Mr. Bold for identification, and he kindly informed me that they were a species called *Lachnus hyalinus*, Koch., both wingless and winged females; the genus differing from that of aphis in wanting the tubes of the abdomen for the emission of honey dew. I mention the instance about the stupified manner of these aphides having read a case about wild bees being found in this state. The writer says: 'Is it certain that this secretion is innocuous to the bees themselves? This year I observed on two occasions, in two lime tree avenues twenty-five miles apart, the ground strewn with thousands of wild bees, and a large sprinkling of hive bees, dead or dying, and no external injury could be detected on these, even with the help of the microscope. I kept a few to make sure it was not mere temporary stupefaction, but there was no revival.' "—*R. Draper.*

The editor would feel grateful for further and fuller "notes" for this part of the yearly report. The regular observation of the habits of birds and insects would be found a subject of the greatest interest by many persons who, having the powers and opportunities of observation, have never been in the habit of noting down from time to time the facts which come under their notice. The trouble is far less than perhaps might be previously expected.

MIGRATORY BIRDS.

MIGRATORY BIRDS.	ACKLAM HALL.—MIDDLESBRO'		
	Arrival.	Departure.	Prevalence.
Black cap	4th April	12th August.	Not many.
Chiff chaff	......	......	......
Corncrake	26th May.	15th June.	Very little heard here.
Cuckoo	10th May.	14th June.	Seldom heard.
Fieldfare	......	......	......
Flycatcher	......	......	......
Martin	30th April.	20th Sept.	Not many.
Redstart	......	......	......
Redwing	......	......	......
Sand martin	......	......	......
Sedge warbler	......	......	......
Snow bunting	......	......	......
Swift	1st May.	22nd Sept.	Very few.
Swallow	27th April.	30th Sept.	Numerous.
Wheatear	......	......	......
Whitethroat	......	.....	......
Whinchat	......	......	......
Willow wren	......	......	......
Woodcock	......	......	......
Yellow wagtail	......	......	......

MIGRATORY BIRDS.	SEAHAM.		
	Arrival.	Departure.	Prevalence.
Black cap	13th April.	19th Sept.	Common.
Chiff chaff	13th April.	30th Sept.	......
Corncrake	19th June.	......	Very rarely heard.
Cuckoo	28th April.	......	......
Fieldfare	20th Oct.	20th Feb.	Not common.
Flycatcher	......	......	......
Martin	26th April.	Sept.	Not common.
Redstart	18th April.	28th Sept.	Not common. Only seen in 1868 in November.
Redwing	17th Oct.	......	......
Sand martin	......	......	......
Sedge warbler	......	......	Not common.
Snow bunting	20th Nov.	......	......
Swift	6th May.	1st Sept.	......
Swallow	18th April.	2nd Oct.	Average.
Wheatear	20th April.	Sept.	......
Whitethroat	......	......	......
Whinchat	......	Sept.	Common.
Willow wren	13th April.	Feb. 14 & Apr. 7.	Average.
Woodcock	......	......	......
Yellow wagtail	3rd April.		

MIGRATORY BIRDS (CONTINUED).

MIGRATORY BIRDS.	GRETA BRIDGE, BARNARD CASTLE.	NEWCASTLE.	
	Arrival.	Arrival.	Departure.
Black cap	......	7th May.	......
Chiff chaff	......	13th April.	......
Corncrake	......	27th April.	......
Cuckoo	24th April.	25th April.	......
Fieldfare	......	27th Oct.	25th April.
Flycatcher	......	2nd May.	......
Martin	......	8th May.	......
Redstart	......	18th April.	......
Redwing	......	27th Oct.	......
Sand martin	......	......	......
Sedge warbler	......	10th May.	......
Snow bunting	......	......	......
Swift	......	......	......
Swallow	......	14th April.	......
Wheatear	......	14th April.	......
Whitethroat	......	2nd May.	......
Whinchat	......	......	......
Willow wren	......	17th April.	......
Woodcock	......	20th Oct.	......
Yellow wagtail	......	......	......

MIGRATORY BIRDS.	NORTH SHIELDS.	STAMFORDHAM.	WALLINGTON.	
	Arrival.	Arrival.	Arrival.	Departure.
Black cap	......	......	......	......
Chiff chaff	......	......	......	......
Corncrake	27th April.	......	4th May.	......
Cuckoo	23rd April.	23rd April.	25th April.	20th June.
Fieldfare	20th Sept.	......	......	......
Flycatcher	......	......	......	......
Martin	......	......	15th May.	......
Redstart	......	......	23rd April.	14th July.
Redwing	14th Sept.	......	......	......
Sand martin	......	......	......	......
Sedge warbler	......	......	......	......
Snow bunting	......	......	......	......
Swift	......	11th April.	......	......
Swallow	22nd April.	14th April.	15th April.	4th Oct.
Wheatear	......	......	......	......
Whitethroat	......	......	......	......
Whinchat	......	......	......	......
Willow wren	......	......	14th April.	26th Aug.
Woodcock	30th Sept.	......	......	......
Yellow wagtail	26th March	......	22nd April.	......
Pied wagtail	......	......	8th April.	4th Aug.

MIGRATORY BIRDS (Continued).

MIGRATORY BIRDS.	ROTHBURY. Arrival.	ROTHBURY. Departure.	ROTHBURY. Prevalence.
Black cap	......	......	......
Chiff chaff	......	......	......
Corncrake	......	......	......
Cuckoo	22nd April.	......	......
Fieldfare	......	......	......
Flycatcher	......	......	......
Martin	23rd April.	......	Scarce.
Redstart	......	......	......
Redwing	......	......	......
Sand martin	......	......	......
Sedge warbler	......	......	......
Snow bunting	......	......	......
Swift	......	......	......
Swallow	25th April.	......	Scarce.
Wheatear	......	......	......
Whitethroat	......	......	......
Whinchat	......	......	......
Willow wren	......	......	......
Woodcock	......	......	......
Yellow wagtail	......	......	......

MIGRATORY BIRDS.	LILBURN. Arrival.	NORTH SUNDERLAND. Arrival.	NORTH SUNDERLAND. Departure.	BYRNESS. Arrival.
Black cap	......	......	......	......
Chiff chaff	......	......	......	......
Corncrake	26th May.	17th May.	......	21st May.
Cuckoo	30th April.	......	......	25th April.
Fieldfare	......	......	......	......
Pied flycatcher	......	11th May.	......	......
Martin	......	......	......	......
Redstart	......	......	......	......
Redwing	......	......	......	......
Sand martin	......	......	......	......
Sedge warbler	......	......	......	......
Snow bunting	......	......	......	......
Swift	15th April.	......	......	......
Swallow	18th April.	20th Apr.	Abt. Sep. 15. saw none after the 29th.	11th April.
Wheatear	......	......	......	......
Whitethroat	......	......	......	......
Whinchat	......	......	......	......
Willow wren	......	6th May.	......	......
Woodcock	......	16th Oct.	About March 20.	......
Yellow wagtail	......	......	......	......

The following dates of the nesting of birds for 1869, have been supplied by Mr. Thos. Thompson:—

March 22	Eggs of	long-earred owl.
,, 26	,,	tawny owl.
,,	,,	cushat and rook.
,, 28	,,	common thrush.
,, 30	,,	peewit.
April 3	,,	missel thrush and dipper.
,, 11	,,	woodcock.
,, 15	,,	snipe and pheasant.
,, 17	,,	blackbird and common wren.
,, 18	,,	curlew and jackdaw.
,, 20	,,	chaffinch.
,, 25	,,	robin redbreast and long-tailed tit, golden-crested wren.
May 1	,,	golden plover, pied wagtail and ring ouzel.
,, 9	,,	partridge and creeper. kestrel and sparrow-hawks.
,, 10	,,	marsh tit and grass warbler.
,, 16	,,	French linnet, black headed gull. grey wagtail and twite.
,, 22	,,	common sandpiper.
,, 25	,,	wood wren and cole tit.
June 10	,,	corncrake and night hawk.

GRAIN AND ROOT CROPS.

GRAIN, ROOT CROPS, &c.	ACKLAM, NEAR MIDDLESBRO'.			GRETA BRIDGE, BARNARD CASTLE.	
	Sown.	Cut or Gathered.	Yield.	Sown.	Cut or Gathered.
Barley	Apr. 13.	Aug. 28.	Rather light.	......	......
Beans	Mar. 19.	Sept. 13.	Moderate.	......	......
Hay	......	June 20.	Good Crop.	......	July 10.
Mangold	Apr. 22.	Oct. 14.	Moderate.	......	......
Oats	Apr. 1.	Aug. 27.	Moderate.	......	......
Peas	Mar. 16.	Aug. 10.	Fair Crop.	......	......
Potatoes	Apr. 12.	Oct. 8.	Good Crop.	......	......
Turnips (Sw.)	May 4.	Oct. 28.	Very Good.	......	......
Wheat	Spring sown Apr. 3.	Aug. 14.	Good.	......	......

GRAIN AND ROOT CROPS (Continued).

Grain, Root Crops, &c.	Seaham.			North Shields.	
	Sown.	Cut or Gathered.	Yield.	Sown.	Cut or Gathered.
Barley	......	......	Very good.	......	Aug. 13.
Beans	......	......	Good.	......	Sept. 20.
Hay	......	......	Good.	......	......
Mangold	......	......	Various.	......	......
Oats	......	......	Good.	......	Aug. 13.
Pease	......	......	Good.	......	......
Potatoes	Feb. 26.	......	Good.	......	......
Turnips	......	......	Good.	......	......
Wheat	......	......	Good.	......	Aug. 21.

Grain, Root Crops, &c.	Wallington.			Lilburn.		
	Sown.	Cut or Gathered.	Yield.	Sown.	Cut or Gathered.	Yield.
Barley	......	......	......	Apr. 4.	Aug. 11.	Very good.
Beans	......	......	......	Mar. 2.	Aug. 31.	Good.
Hay	......	June 30.	Good.	July 8.	......	Good.
Mangold	......	......	......	May 10.	Nov. 18.	Very good.
Oats	......	......	......	Mar. 28.	Aug. 18.	Light.
Pease	......	......	......	Mar. 2.	Aug. 31.	Good.
Potatoes	May 14.	Oct. 22.	Good.	Apr. 28.	Oct. 14.	Very good.
Turnip	......	......	......	May 14.	Sept. 25.	Extra good
Wheat	......	......	......	Jan. 14.	Aug. 28.	Fair Averg.

Grain, Root Crops, &c.	North Sunderland.		
	Shot.	Cut or Gathered.	Yield.
Barley	June 28.	Aug. 10.	Good.
Beans	......	......	......
Hay	......	......	......
Mangold	......	......	......
Oats	.....	began to cut, Aug. 10.	Good.
Pease	......	......	......
Potatoes	......	......	......
Turnips	......	......	......
Wheat	June 26.	Aug. 12.	Good av. crop.

INSECTS.

INSECTS.	ACKLAM, NEAR MIDDLESBRO'.		SEAHAM.	
	Appearance.	Prevalence.	Appearance.	Prevalence.
Sm. W. butterfly	Apr. 27.	Plentiful.	Apr. 10.	Common.
Holly blue do.......	July 28.	Rather scarce.	......	......
Lesser heath do....	......	......	......	......
Orange tip do. ...	May 5.	Very few.	......	......
Painted lady do.	......	......	......	......
Red admiral do. ...	......	......	May	......
Tortoise shell do.	Apr. 9.	Abundant.	Apr. 12.	......
Brimstone moth ...	Aug 4.	Not many seen.	......	......
Currant do..........	......	......	......	......
Ghost do............	.....	......	......	......
Sm. dagger do. ...	......	......	......	......
Cockchafer	... .	......	Apr. 11.	Common.
Hive bee	Apr. 22.	Very few.	Feb. 1.	Good season.
Humble bee.........	Mar. 24.	In abundance.	Apr. 11.	......
Wasp	April 15.	Rather numerous in early summer. Very few afterwds.	Apr. 13.	Very numerous.

INSECTS.	NORTH SHIELDS.	STAMFORDHAM.	WALLINGTON.	
	Appearance.	Appearance.	Appearnce.	Prevalence.
Sm. W. butterfly	......	Apr. 3.	Apr. 7.	Plentiful.
Holly blue do.......	......	......	June 26.	Scarce.
Lesser heath do....	......	......	June 12.	Plentiful.
Orange tip do. ...	......	......	Apr. 27.	Do.
Painted lady do....	......	.....	July 16.	Only two seen.
Red admiral do. ...	......	......	Apr. 20.	Scarce.
Tortoise shell do.	.....	Apr. 10.	Mar. 5.	Very Abundant.
Brimstone moth ...	......	......	May 15.	Plentiful.
Currant do..........	......	......	July 18.	Do.
Ghost do............	......	......	June 20.	Do.
Sm. dagger do. ...	......	......	Apr. 20.	Moderate.
Cockchafer	......	......	......	......
Hive bee	......	Jan. 9.	Jan. 29.	Swarm on June 3rd.
Humble bee.........	Mar. 24.	Apr. 7.	Apr. 7.	Numerous.
Wasp	Apr. 21.	Apr. 15.	Apr. 10.	Do.

INSECTS (CONTINUED).

INSECTS.	LILBURN.	NORTH SUNDERLAND.	
	Appearance.	Appearance.	Prevalence.
Sm. W. butterfly ...	May 9.	Mar. 6.	Very numerous.
Holly blue do.	......	......	......
Lesser heath do. ...	......	......	......
Orange tip do.	June 10.	......	......
Painted lady do. ...	......	......	......
Red Admiral do. ...	......	......	......
Tortoise shell do. ...	April 12.	......	......
Brimstone moth......	......	......	......
Currant do............	......	......	......
Ghost do.	......	......	......
Sm. dagger do.	......	......	......
Cockchafer	......	......	......
Hive bee..............	June 2.	......	......
Humble bee	Mar. 28.	......	......
Wasp	Apr. 4.	......	Very numerous.

STANDARD FRUIT TREES.

STANDARD FRUIT TREES, &c.	ACKLAM, NEAR MIDDLESBRO'.		GRETA BRIDGE, BARNARD CASTLE.	
	In Blossom.	Yield.	In Blossom.	Ripe.
Apple	Apr. 23.	Very moderate.	May 16.	......
Cherry	Apr. 17.	Moderate.	April 20.	July 16.
Pear	Apr. 15.	Some kinds abundant.	......	......
Plum	Mar. 29.	Rather scarce.	April 12.	......
Currant	Apr. 14.	Plenty, but much mildewed.	April 10.	July 20.
Gooseberry	Apr. 5.	Moderate.	April 4.	July 30.
Raspberry ...	May 28.	Abundant.	May 30.	Aug. 1.
Strawberry	Apr. 28.	Very bad crop; fruit indifferent.	May 21.	July 26.

STANDARD FRUIT TREES, &c.	SEAHAM.		NORTH SHIELDS.
	In Blossom.	Yield.	In Blossom.
Apple	April 30.	Good.	April 20.
Cherry	April 16.	Good.	April 10.
Pear	April 21.	Good.	April 12.
Plum	......	Good.	......
Currant	April 13.	Good.	April 12.
Gooseberry	April 6.	Very Good.	Mar. 31.
Raspberry	June 18.	Good.	......
Strawberry	April 28.	Bad.	May 1.

STANDARD FRUIT TREES, &c.	WALLINGTON.		LILBURN.	
	In Blossom.	Yield.	In Blosson.	Yield.
Apple	April 20.	Half a crop.	April 26.	Large crop.
Cherry	April 19.	Fair Average.	April 2.	Middling.
Pear	April 22.	Good crop.	April 18.	Extra good.
Plum	April 11.	Good crop.	April 12.	Heavy crop.
Currant	April 18.	Heavy crop.	April 9.	Very heavy crop.
Gooseberry	April 10.	Heavy crop.	Mar. 27.	Large crop.
Raspberry	June 7.	Heavy crop.	April 13.	Good.
Strawberry	May 12.	Heavy crop.	April 28.	Middling.

STANDARD FRUIT TREES, &c.	NORTH SUNDERLAND.	
	In Blossom.	Yield.
Apple	......	Very good.
Cherry	......	......
Pear	......	Good.
Plum	......	......
Currant	......	......
Gooseberry	Mar. 27.	Large crop.
Raspberry	......	......
Strawberry	......	Ripe June 24. Very scarce from drought.

The observations recorded in the Meteorological Report and Climatological Tables have this year been supplied by the following contributors :—

Allenheads and Bywell	T. Sopwith. Esq., F.R.S. Mr. John Dawson.
Alston	Joseph Dickenson, jun., Esq., Alston.
Belford	T. J. Leather, Esq., Middleton Hall.
Byrness	Rev. J. Nicholson.
Brinkburn, Morpeth	C. H. Cadogan, Esq.
Cresswell	Rev. J. E. Leefe.
Darlington	Mr. John Richardson, Southend. Mr. Henry Ward, Brinkburn Gardens.
Dinsdale Rectory, near Darlington,	Rev. J. W. Smith, M.A.
Durham	Rev. Dr. Gillow, Ushaw College.
Durham Observatory	John J. Plummer, Esq.
Elsdon	Mr. R. Robson.
Eaglescliffe, near Yarm	Rev. Canon Hull, M.A.
Earsdon	John Taylor, Esq.
Gainford	A. Atkinson, Esq.
Glanton Pike	F. W. Collingwood, Esq.
Greenwich	James Glaisher, Esq.
Hartlepool	T. Dyke, Esq., C.E.
Haltwhistle	Rev. Dixon Brown, M.A., Unthank Hall.
Hexham (Park End)	M. A. Ridley, Esq.
Howick	Earl Grey, K.G., per Mr. F. Morie.
Horsley, near Wylam	Mr. John Bew.
Lilburn Tower	Mr. John Deas.
London	J. G. Symons, Esq.
Middlesbro' (Acklam Hall)	Mr. Hebblethwaite.
Millfield, near Wooler	G. A. Grey, Esq.
Newcastle-on-Tyne	Dr. Philipson. G. Lyall, Esq., Lit. & Phil. Society. Mr. W. Neill, Deaf & Dumb Institution. Mr. Thomas Thompson.
North Shields	J. R. Procter, Esq. R. Spence, Esq. John Coppin, Esq.
North Sunderland	Rev. F. R. Simpson.
Otterburn	Rev. T. Wearing.
Rothbury	Sir W. G. Armstrong, D.C.L.

Seaham	Mr. R. Draper, Seaham Hall Garden. Mr. G. W. Lax, Londonderry Office.
Sedgefield, Durham	Robert Smith, Esq., M.D.
Shotley	Mr. Coulson, Shotley Hall.
Stamfordham	Rev. J. F. Bigge, M.A.
Stanhope	Mr. Thomas Surtees, Stanhope Castle.
Sunderland	T. W. Backhouse, Esq., West Hendon House. Rev. George Iliff, The Hall.
Thorpe Grange, Greta Bridge	T. Dodgson, Esq.
Tynemouth	P. J. Messent, Esq.
Wallington	Mr. Hedley, Wallington Hall Gardens.
Wallsend	J. W. Dees, Esq.
Whitfield	Rev. J. M. Mason, M.A.
Whitley	Rev. R. F. Wheeler, M.A.
Whittle Dene Company's Reservoirs,	D. D. Main, Esq.
Wolsingham (St. John's)	C. J. Backhouse, Esq.
Woolsingham	Amos Mitchell, Esq.
Wylam	G. C. Atkinson, Esq., Wylam Hall.

ERRATA OF WYLAM REPORTS IN "NOTES OF THE MONTHS."

On page 386, wind should be 7° S., instead of 7° N.

,, 391, the highest temperature for March should be 53° on the 27th, instead of 52° on the 19th.

,, 400, the lowest temperature for May should be 30° on the 29th, instead of 31° on the 9th.

,, 404, the highest temperature for June should be 77° on the 27th, instead of 55° on the 26th.

,, 410, the lowest temperature for August should be 37° on the 31st, instead of 40° on the 3rd.

ADDRESS TO THE MEMBERS OF THE TYNESIDE NATURALISTS' FIELD CLUB,

READ BY THE PRESIDENT, THE REV. R. F. WHEELER, M.A., AT THE TWENTY-FOURTH ANNIVERSARY MEETING, HELD IN THE MUSEUM OF THE NATURAL HISTORY SOCIETY, NEWCASTLE-UPON-TYNE, ON THURSDAY, APRIL 7TH, 1870.

I MUST confess to a feeling of great difficulty and diffidence in approaching the task of preparing the annual address, which, as your President, it is my duty to deliver. If I felt twelve months ago that I was unworthy of the high and distinguished position to which you then so kindly elected me, my experience during the year of office has deepened very much that feeling. Sadly and most imperfectly has my work been done, though my intentions have been of the best; and I feel that I shall need the same kind forbearance which I have hitherto experienced even in this the last act of my year of office.

Every year, indeed, the task which falls to your President becomes one of increasing difficulty. Our rules require that the retiring President should give a *resume* of the year's work, including the Field Meetings. In past years this was a task comparatively easy. Then our summer gatherings were always

"To fresh woods and pastures new."

There was an interest in those pleasant walks which time and repetition render it impossible to reproduce. Then, too, the admirable addresses already given by my predecessors, in which every locality visited by us this year is described with an ability to which I can make no approach, increased the difficulty tenfold. Commencing my review of the year's proceedings with these impressions, I cannot but express my thankfulness at the prosperity and usefulness which have for so many years marked the course of the Club, and which have been at least an equally satisfactory feature of the history of the past year.

Our numbers are now larger than at any former period. Our finances are in a satisfactory state. And I believe that the real work of the Club has made good progress during the year.

The First Field Meeting of the season was as usual in the "merry month of May." The day, though not one of the very brightest, was still pleasant, and one which seemed to make one re-echo the poet's words:—

"When the hour of meeting's nigh,
And thy heart is beating high,
Come to the woods, lad.
And if the boughs are ringing,
With all their minstrels singing,
Do thou, too, rejoice,
And utter a voice
More glad."

A very fair number of members met at the Central Station and proceeded by the recently opened Team Valley line to Lamesley. After inspecting the village Church, we proceeded on to the entrance of the grounds belonging to Beamish Hall, where we were most courteously received by N. Clark, Esq., who acted for John Eden, Esq., the owner. After a very pleasing ramble through the gardens, park, and woods, in which many objects of interest were met with in the course of our progress, we sat down to a well-provided dinner at the "Shepherds' Inn," and returned to Newcastle in good time, well pleased and satisfied with our day's proceedings.

The 17th of June, the day fixed for the Second Field Meeting, broke with many threatening clouds, and the heavy drops of rain which fell from time to time made it seem likely that a thoroughly wet day would mar the pleasure of the excursion to those brave and hopeful spirits who might venture to start for *Staward Peel.* But instead of a small gathering, as some anticipated, a most agreeable surprise awaited us on our arrival at the Central Station and our party, gathering strength as it went, numbered about sixty members when we reached Hexham. The opening of the Hexham and Allendale Railway has rendered this place—one of the most beautiful parts of the North of England—comparatively easy of access. A more charming country can scarcely be found in England—certainly not within the limits of a day's excursion from Newcastle. Through the kindness and courtesy of Mr. Bewick, of Haydon Bridge, unusual facilities were afforded to our party in reaching our destination.

Mr. Bewick, Mr. Blacklock, and Mr. Dinning, of Langley Mills, gave us the invaluable help of their presence and services throughout the day. Leaving the Staward Station we proceeded over the fields to the ancient Peel Tower, and spent a very happy and pleasant hour or so on that most charming spot. While some of our members endeavoured to discuss the points involved in the bygone history of the tower, others searched out the geological character of the country and traced, as far as they could, the great Stublick Dyke which can here be seen, and which intersects the Coal Field for many a mile. Very little of the history of this remarkable Peel Tower seems to be known.

Wallis, in his "History of Northumberland," states that Edward Duke of York, in 1386, granted Staward Peel to the Eremite Friars of Hexham, on condition of their paying an annual rent of five merks for the same.

The lovers of flowers were ably assisted in their search for their old favourites, and were introduced to new ones by Mr. Watson and other botanists; while others, of more artistic turn, were content to sit and gaze on Nature's beauties while they rested and refreshed the inner man. Leaving the old Peel Tower we descended to a mineral spring which bubbles out near the base of the hill, and pours its stream into the Allen. Here we separated into two parties. The one, headed by Messrs. Bewick and Blacklock, keeping to the higher ground, and pursuing an overgrown path, or rather, track, through the lovely woods, reached at length the line of railway, and, having had enough of scrambling, wended their way along it to Allendale Town. A few of the more adventurous spirits, attracted by the beautiful scenery, determined to attempt a passage along the bed of the river itself. Their task proved a much more difficult one than they had anticipated, but their labour was most amply repaid.

Both parties met again around the table of the "Golden Lion," Allendale, and did ample justice to the goodly supplies which the worthy landlord had provided for their well sharpened appetites. The members left Allendale Town a little before seven o'clock. The evening was most charming, and as the train rolled onwards along the beautiful valley of the Tyne, and from time to time a boat was seen putting off from the shore and the salmon net was shot from it in and out across the water, the thoughts of some of us were carried back to days long past, and to the story of the connection of our river with that best of fishes—the salmon. Every one knows the stories which have been afloat long enough as to the superabundance of the salmon in that mythical period, "the good old times"—days which, like the ignis-fatuus, always recede further away the nearer they seem to be to one's grasp.

Probably every member of the Club is aware that the right of His Grace the Duke of Northumberland to the Salmon Fishery, at the mouth of the Tyne, has been recently called in question. The trial, which resulted in the most complete establishment of the duke's claim, was the means of bringing to light many facts of great interest in the history of the fishery, and on the question of the former productiveness of the river.

The Priory or Monastery at Tynemouth dates back the commencement of its existence to the times of the Saxons. Early in the reign of William Rufus it was endowed by Robert de Mowbray, Earl of Northumberland, subject to and dependent as a cell on the great abbey of St. Albans, in Hertfordshire. We next find that King Henry II. made a most extensive grant of land, tithes, and other tenures to this monastery. "He willed and firmly commanded that the church aforesaid and the monks should have and hold all the things above said well and in peace, freely and quietly, wholly and honourably, with all their appurtenances in wood and plain, in meadows and feedings, in ways and paths, in waters and mills, and *fisheries* and *pools* within borough and without, in all things and places, with thol and theam, and soc and sac, and infangenthef and wreck, quit and discharged from all geld and scot and assistance, and from all customs and works, and aids and plaints."

In the reign of Richard I. a charter of confirmation, date 10th

Richard I., granted further and very extensive possessions to the monks. After reciting the various properties, the following very suggestive clause occurs. "And we will not that any man, either *French* or English, shall in any way intromit himself concerning the lands of them or of their men, but themselves or their ministers whom they are willing to trust. And since, as we have granted to God and the Church of St. Oswyn of Tynemouth, and the monks of St. Albans serving God there, for the redemption of the souls of us and of our parents, all liberties and free customs which the royal authority can confer more freely on any church we prohibit upon forfeiture to us that any one in any manner presume to infringe the same. Also we prohibit that any minister, that is to say, steward or butler, chamberlain, dispenser, gatekeeper, or reeve be placed in their lands or houses against their will or assent in the time of us or our successors by the hands of any prince or justice whatsoever."

John and Henry III. both granted confirmatory charters to this monastery.

In the twentieth year of Edward I. (1292) certain disputes arose touching the rights of the monastery of Tynemouth between the prior and the burgesses of Newcastle. Amongst these various matters that of the fisheries occupied no small space. The dispute, after considerable litigation, ended in its being authoritatively decided that *the king* had the rights claimed by the monastery. That he "should recover damages. And that neither at Tynemouth or Shields should there be commonly made any exposure of things for sale as food or drink or other things, and that the quays and other *things* raised by the prior within the flood marks on the soil of the river should be removed at the cost of the prior."

The king afterwards waived these advantages and ended the matter by granting once more to the monastery all the privileges it had ever enjoyed.

The peace of the monastery does not appear to have been disturbed by any open litigation for nearly one hundred and fifty years after this. In the year 1447 a commission was issued to certain persons, of whom the mayor of Newcastle was one, to enquire into certain encroachments by the then prior of Tynemouth. They found that he had encroached upon the soil of the river Tyne; and that he had newly made and erected there certain fish garths, called *Salmonyares*, within the flow of the tide opposite to a certain cell of the abbot of Durham "called Yarrow, in the straitness and narrowness of the port of the Tyne and the ships and boats there who ought to pass through often incur danger and shipwreck to the great injury of the said port and town of Newcastle and the whole people of the king passing through, and had usurped all wreck of the sea and deodands found within the said waters of the Tyne."

In 1464 it would seem that the words and terms used in the earlier charters had become obsolete, and that advantage had been taken of the fact to make encroachments on the privileges of the prior. The monks accordingly besought the king to interpret afresh and give effect to the words of their ancient charters.

This the king (Edward IV.) agreed to do, and at the same time gave them the fullest liberty to trade and *fish* as they might require. These privileges were again confirmed by Henry VIII. in 1511. Twenty-eight years afterwards the monastery was dissolved, and the possessions, estates, and rights belonging to the prior of Tynemouth became and were vested in the crown.

The lands, possessions, and hereditaments of the said monastery were valued at £200 yearly at the time of the dissolution.

Henry VIII. on the 27th March, 1539, granted by letters patent the site of the monastery, with all lands, coal mines, certain tithes, including the tithes of fish of all the vessels and boats fishing at the *shelths* in Tynemouth to Sir Thomas Hilton at certain yearly rents. The rent reserved for the tithe of fish was £4.

In the following year one Thomas Johns is found accounting to the king for the rents, &c., of the property at Shields, and amongst the entries in his accounts is the following:—"Of the ferm of the salmon fishery in the salt waters within the bounds of the township of Sheeles and Tinemouth he (the accountant) answers not here, because the fishermen there are bound to deliver for every twenty salmon so taken one fish to the hands of his bailiff there by *ancient custom*, and *no such fishing* hath been made or had by the time aforesaid."

Coming down to twentieth Elizabeth, 1578, we find in the account of Robert Arderne, bailiff, an entry precisely similar to that of his predecessor some forty years before. In this same year Launcelot Errington, the collector of Benwell, accounts "for the ferm of a fishery for salmon within the water of Tyne within the territories of the Ville of Benwell cvj^{s} viij^{d} and Elswick xij^{s}. In all for the year cxiij^{s} viii^{d}. Denton with Derrington and Walsingham.

"Of the ferm of a fishery of salmon within the waters of the Tyne within the lordship of Denton aforesaid, let for the year iiij^{s}."

In the sixth year of James I., A.D. 1608, a survey was made of the manor of Tynemouth, and at the conclusion of the survey there is the following note :—

"Item: there is a fishing for salmon there in the water of the Tyne, extending from the mouth of the river, where the Tyne falleth into the sea, unto Howden Head, near the territories of Willington, for which there hath been anciently paid iij^{s} iv^{d} (3s. 4d.) by the year, but hath been decayed by many years, yet now may the said yearly rent be revived again, upon a grant of a lease thereof worth by the year iij^{s} iiij^{d}. The yearly value beyond rent, nil."

In the year 1624, in consideration of the sum of £984 13s. 4d. paid by Henry, Earl of Northumberland, an ancestor of the present duke, the king granted to him certain lands and rights which formerly belonged to the monastery of Tynemouth.

In 1625 Charles I. granted to Edward Ramsey, and Robert Ramsey, for a yearly rental of 3s. 4d., "all that salmon fishery in the water of the Tyne, extending from the place where the water of the Tyne falls into the sea unto a place called Howden Head, near the territory of Willington."

Twelve years after the Ramseys transferred their fishery rights, for a due consideration, to George Milburn and William Milburn.

Passing by various transactions of great importance in the history of the title to the fishery, but throwing very little light on its condition or value, we come down to the year 1760 when Hugh, Earl of Northumberland, agreed to let "all that salmon fishery commonly called the Low Lights Fishery, at North Shields, extending from the east end of North Shields aforesaid to the bar mouth for three years from January 1, 1760, at the yearly rental of £5 5s." This rent was regularly paid to 1764. The fishery was then let to Robert Pow for a like sum.

In 1809 we again find the Duke of Northumberland letting this fishery, together with the sparling or smelt fishery at Whitehill Point, to William Methune the Younger, for £5 5s. yearly rent. In 1832 the fishery from Whitehill Point to the mouth of the river was taken by George Pringle at a yearly rent of £25. In 1835 the fishery had become less valuable, for the rent was then reduced to £21. This rental continued in force until 1842, when the Tyne Salmon Fishery Act came into force, and Thomas Aitman, the tenant of the duke, was allowed to retain possession of the fishery from year to year under a verbal agreement, with the understanding that he was to repay the rates assessed upon the duke as owner, in respect of the said fishery. In 1843 a rate of 3s. in the pound was levied under the authority of the Act of question, and the annual value of the fishery was fixed at £2.

In 1862 the General Salmon Fisheries Act came into operation, and the Tyne Act was repealed.

The stake nets, which formerly existed at the mouth of the river, were discontinued about 1833, but were afterwards in 1844 re-established for a short time.

Our next meeting place was at High Force, in Teesdale, on July 21st and 22nd. Never were two days more pleasantly and happily spent than those which were embraced in the period of our stay in this most striking and charming locality. A considerable proportion of the party started from Newcastle on the day previous to the meeting. Others followed on next morning by the first train from Newcastle, and all met at breakfast at the High Force Inn.

That necessary part of our day's work accomplished, all were eager for a start to the higher part of the dale, and to explore the wonders of Falcon Clints, Caldron Snout, Widdy Bank Fell, and other places of interest. There had been but little rainfall for some weeks previously, and so the water in the river was but low. The waterfalls were not so full or grand as they would have been under other circumstances; but who does not feel more than compensated for the absence of the greater volume of water when, on a warm summer's day, they can enjoy the refreshing coolness of the spray, and mark the many beautifully varied tints which the play of the sunbeams produce!

Near and around Falcon Clints especially the botanists found much to interest them. Some of those rare plants peculiar to Teesdale were added to their collection—plants, alas, not so numerous now as in former days; for "the trail of the Tripper" may be detected even in the lonely localities of Upper Teesdale, and with the usual results of mere wanton destruction of whatever is peculiar and valuable.

The more ardent members of the party found themselves at last clambering up the steep sides of Caldron Snout; while one or two pushed on as far as High Cup Nick, in the hope that they might obtain a glimpse of the magnificent panorama which rewards the adventurous rambler, in fine weather, from that remarkable gap in the hills.

The geologists had their toils amply rewarded by the opportunity of investigating the singular effect of the contact of the limestone with the Trap Rock, and in tracing out the Tees bottom Limestone which at length here appears over the Greenstone, and so continues up to Dufton Fell. In some places it is so bleached and recrystalized as to resemble statuary marble. A few of the members ascended the Maize Beck for as great a distance as time allowed to investigate the Greenstone formation over which it flows.

The party wended their way homewards over the moors. Very few birds were seen throughout the day, and only a very sparse number of grouse.

The day's proceedings were brought to a close at the High

Force Inn by the reading of a paper, written by Mr. Albany Hancock and Mr. Thomas Atthey, "*On a new Labyrinthodont Amphibian*," discovered in the Coal-Measures at Newsham Colliery.

The second day was spent in investigating the lower part of the dale. Winch Bridge, Egglestone, with its smelt mills, Deep Dale, and others of the multitude of delightful places which abound so in Teesdale, were visited by different members of the party, who thoroughly enjoyed their ramble along the banks of the Tees

> "Mining its rugged way
> Through solid sheets of marble grey."

But the inexorable demands of a railway return ticket united nearly all the party together again at Barnard Castle, nestling as of old

> "Mid wild wood haunts which sees
> And hears the murmur of the Tees."

And a short time after we found ourselves on the banks of coaly Tyne rejoicing in the pleasant and most profitable excursion we had had, and with a quickened zeal and love for the dear old Club which had been the means of procuring us so much pleasure.

Far different was the scenery of our Fourth Field Meeting at Newbiggen, August 11th. Here we went to enjoy *not* the noise of Tees

> "Thundering o'er Caldron and High Force,"

but the

> ....*ποντιων τε κυματων*
> *ανηριθμον γελᾶσμα* ....
>
> "The many twinkling smile of ocean."

And yet there was a connecting link between the two excursions, hardly thought of at first. The story of the great family of Baliol bound both together—lords of Teesdale, they also owned Newbiggen-by-the-Sea and Woodhorn.

The manor of Woodhorn was regarded by them indeed as one of their fairest possessions. Then too the monks of Tynemouth, by the grant of Richard I., counted amongst their property the tithes of Middleton-in-Teesdale and Woodhorn. So that in truth we were but visiting two parts of the same estate. The tithes of Woodhorn *now* form part of the princely revenues of the Mercers Company of London, and of the endowment of the church at Hampstead.

Leaving Newcastle by the Blyth and Tyne Railway we were met, on our arrival at North Seaton Station, by the Rev. E. N. Mangin, the Rector of Woodhorn, and proceeded forthwith, some on foot and some in carriages, to inspect the ancient and remarkable church at Woodhorn. The manor, after it had passed out of the hands of the Baliols, became successively the property of the De Valences, Dentons, Widdringtons, and the last Earl of Derwentwater. It now belongs to Major Waddilove, of Brunton, near Hexham. While we were engaged in examining the details of the old Norman architecture yet to be found in the church, a small silver drinking cup was handed round to the visitors which bore its silent testimony to the story of days long gone by, and of persecutions which drove so many of the best and cleverest subjects of the monarchy of France from their homes and their country for ever. The cup had been used by a martyred ancestor of the rector's. In 1546 Stephen Mangin was condemned to be burnt as a heretic at Meaux near Paris. While tied to the stake he asked for a cup of water in which he might drink to the success of the holy cause for which he was suffering. It was supplied in the cup shown to the members of the Club, which has always been most carefully cherished as a family relic of the greatest value.

Our party next moved across the fields in the direction of Cresswell. They were met shortly before entering the grounds by the Rev. J. E. Leefe, the Vicar of Cresswell, who most kindly acted as guide. We spent a very happy time in inspecting the large and varied collections contained in the museum at Cresswell, and in seeing over the house. The members were most hospitably entertained at luncheon by Mr. Baker Cresswell. We next wandered through the gardens and grounds, admiring not a little the magnificent evergreen shrubs which form their most striking feature. Many were also greatly interested by the very fine collection of British and other ferns, for which the gardens at Cresswell are celebrated. The skeleton of the large sperm whale, cast ashore at Linmouth in 1822, was carefully examined. At length we came in view of the old Peel Tower, which was once the home of the Cresswells, and their refuge when the country around was being devastated by a raid from over the Scotch border.

Quitting the grounds by the sea gate a most delightful walk along the coast brought us to Newbiggen, where dinner at the "Sea View Inn" had long been waiting our arrival. The day's proceedings were brought to a close by Mr. T. P. Barkas reading a paper "*On the Fish-Reptiles and supposed Mammalian Remains from the Northumberland Coal Strata.*"

The FIFTH FIELD MEETING was at Crag Lough. To my own loss and great regret I was not able to be present on this occasion. I must therefore rely upon the information kindly furnished by others for an account of the day's proceedings. Leaving Newcastle by the first train in the morning the members alighted at Bardon Mill Station, and, under the able guidance of Dr. Bruce, proceeded to Chesterholme, the Roman Vindolana. In the year 1830 some very interesting Roman remains were found here. The beauties of Cheveley Burn proved very attractive as the party wended their way onwards to Crag Lough and from thence to Housesteads (Borcovicus) examining the remains of the Roman Wall as they went. The very clear and interesting explanations of Dr. Bruce threw a life-like interest into the excursion, and more than doubled the pleasure and the profit which it afforded to those who had the opportunity of being present.

St. Mary's Island was the place chosen for our last out-door gathering in October.

The early part of the day proved to be very unfavourable, and but few members found the attractions of Holywell Dene and the sea coast sufficiently powerful to draw them from their counting houses and their homes. As the day wore on the weather became more genial, and by the time we reached Seaton

Delaval it was well nigh all we could desire. Some of the members who accompanied us had never been over the ground before, and were surprised to find so much to enjoy within so short a distance of Newcastle and yet so near to the sea.

Through the kindness of Mr. Chapman, the agent of Lord Hastings, the members were allowed to go over the hall, and see every part of what remains of that once fine structure.

While we were in one of the chief rooms Captain Adamson, of Cullercoats, read a very interesting memoir on the Delaval family, in which he traced their story onwards from the period of their first landing in England to the time (1814) when the property passed to the present owners, the Astleys of Melton Constable, in Norfolk.

It seems, from Captain Adamson's account, that the Delavals took their name from Laval in France, and that the family were related to William the Conqueror through the marriage of his niece Dionysia, daughter of Robert Earl of Montaigne. They were settled in Northumberland very soon after the conquest. The barony of Delaval, which was held of the king in capite, comprised the manors of Seaton, with Newsham, Dissington, and Callerton. Gilbert Delaval was one of the twenty-five barons, in the reign of King John, who were sworn to see to the execution of Magna Charta and the Charta de Foresta.

After continuing for many generations in the rank of knighthood the family was advanced in dignity at the Restoration, when Sir Ralph Delaval was created a baronet. He was member for the county during the entire reign of Charles II. The harbour of Seaton Sluice was contrived and formed by him, and the king made him collector and surveyor of his own port. Admiral Delaval, a cousin of the first baronet, won for himself great distinction by the share he had in the great victory off Cape la Hogue in May, 1692. It was under the auspices of this brave commander that his kinsman, George Delaval, entered the navy, and having risen to the rank of admiral, and been employed in Embassies to Portugal and Morocco, amassed great wealth. It was he who commissioned Sir John Vanburgh to build the hall at Seaton Delaval. In 1822 it was almost destroyed by a fire, for the origin of which various accounts have been given, but is now being gradually restored. No trace of the old feudal castle was left save the chapel, dedicated to the Virgin, a venerable pile of Norman masonry, which still forms one of the most interesting features of Seaton Delaval.

We then made our way through Seaton Sluice, inspecting on our road the port constructed as mentioned in Captain Adamson's paper, to St. Mary's Island, where tea was provided, and the meeting brought to a close by Mr. T. P. Barkas reading a paper "*On the Oral Armature of Coal Measure Fishes.*" And so ended our year's work out of doors.

I fully hope and believe that the very important objects of our Club have been as fully advanced during the past year as in any preceding one. It should be remembered that it is not so much to add to the well-filled stores of our older and better informed members that these Field Meetings are undertaken, but rather to quicken and draw out that latent sympathy for all natural objects which is, more or less, to be found in almost every person, be his station in life what it may. Mind, being brought into contact with mind, as it is in our Field Meetings, may be the means of awakening an interest in some particular branch of Nature's handiwork which may lead to great results hereafter.

An Evening Meeting was held on Thursday, December 9th, at which Thomas Sopwith, Esq., presided, as I was obliged, unfortunately for myself, to be absent. There were between thirty and forty members present. Mr. Albany Hancock and Mr. T. Atthey contributed a "*Note on Anthracosaurus,*" also a paper "*On the generic Identity of Climaxodus and Janassa, two Fossil Fishes related to the Rays.*" Mr. Jos. Wright read a paper "*On the Teeth of the 'Ballan Wrasse;'*" and Mr. G. S. Brady contributed some notes on "*Microzoa, chiefly Entomostraca collected in the Northumberland and Durham District,* 1869."

There seems to be a growing taste for the study of Natural History in all parts of the country; the rapid increase in the number of Field Naturalists' Clubs, founded on principles similar to those which our own Club was amongst the earliest I believe to work out successfully—the increase of the number of periodicals and other publications devoted to the elucidation of Nature and science, all bear testimony to what I have stated.

The days we live in are replete indeed with wonders and new discoveries. The girdle with which the poetic fancy of the greatest dramatist encircled the earth will ere long become an actual reality, and perhaps even in less than the forty minutes, which Puck claimed for his work, it may be possible to convey the tidings which that girdle can carry.

The secrets of the deepest oceans are being unveiled, and few contributions to natural science have ever been communicated to the world of greater interest than the story of the survey carried on last autumn by Dr. Carpenter and Prof. Wyville Thomson, on board H.M.S. "Porcupine." They were able to draw up part of the bottom of the ocean from a depth of two thousand four hundred fathoms, or more than two and three-quarter miles; and to establish the fact, that in a temperature constantly lower than the freezing point at the surface of the earth, not merely the lowest organisms, but highly developed Mollusca, Echinoderms, and Crustacea exist. This is not the place, nor is the occasion a fitting one, to enter into the details of this most memorable expedition.

It may suffice for our present purpose to say that the number of species new to our seas, and procured in this expedition, was one hundred and seventeen. Of these fifty-six were altogether new to science, and eight were supposed to exist as tertiary fossils only. The total number of species of our marine Mollusca is, I believe, about four hundred and fifty-one, so that more than one-fourth has been added by this one expedition, and in the course of a few months. Further investigation and search will, no doubt, show that even this is but the very first ingatherings of a glorious harvest. Some light was also, I think, thrown on geological problems, seemingly almost incapable of a decided solution hitherto. Stony ground did not occur beyond a depth of five hundred and fifty fathoms, the rest of the sea bed was mud or ooze. This superstratum appears to consist chiefly of decomposed animal matter mixed with shells of Pteropods and

Globigerinæ, &c. The water at these great depths must be either perfectly still or the motion must be of the gentlest kind. The prevalence of *light* at even the greatest depths seems to be settled by the fact that colour is not wanting, and that the eyes of Oncopus, for example, are remarkably large, and more highly organized than those of fishes. Dr. Carpenter inclines to the opinion that there is no difference in size between the animals that live in shallow water and those that dwell in the greatest depths.

One question of singular interest is, on what food do these various living organisms exist? It would seem that plant life is confined to a comparatively short distance from the shore, and to that well-known floating Sargasso weed, the existence of which in great masses so troubled the companions of Columbus.

An American expedition of a like character has also been at work. They did not succeed in dredging from so great a depth as in the case of the "Porcupine," not more than eight hundred and twenty fathoms ever having been attained by them. But the discovery of corals at great depths will probably tend to modify not a little the opinions held of late years as to the formation of coral reefs and islands.

Another subject on which some interesting light has been thrown is the depth of the great Pacific Ocean. A careful comparison of the times at which the great earthquake wave of August, 1868, which devastated so large a part of South America, reached the distant shores of Japan, New Zealand, the Sandwich Islands, and other places, with Airy's well-known theory of the velocity and breadth of sea waves, has led to an astonishing correspondence between the fact and the theory. The greatest mean depth would seem to be between Arica and the Sandwich Islands—two thousand five hundred and sixty-five fathoms.

But if this past year has been fruitful in unveiling the secrets of the ocean, not less so has it been in reading to us some of the deeper mysteries of the skies. The wonderful and most interesting discoveries, made by the aid of the spectroscope, as to the nature of the body of the sun, the composition of the nebulæ, and the light of the aurora, furnish materials which cannot but be fruitful of yet vaster and more important revelations.

I cannot pass away from this part of my address without expressing the gratification which I am sure we must all feel at the completion, by Messrs. Cooke of York, of the great refracting telescope, of twenty-five inches aperture, for one of our members, Mr. Newall. Whatever may be the future history of that magnificent instrument we cannot but feel gratified that one in our own immediate neighbourhood should have undertaken such a work, and been willing to devote it to the service of astromers generally in the liberal way in which I understand Mr. Newall intends to do.

But I feel that I have allowed my pen already to wander far beyond the proper limits of your President's Annual Address; and though strongly tempted to touch on other subjects of at least as great an interest to me as those I have already glanced at, I must forbear.

Year by year the work of our Club, and the position it has already gained and is gaining for itself, is of growing importance. Every day fresh recruits are being added to the ranks of science, and surely it is our work, and it will always be our pleasure, to do what we can to strengthen that goodly band. I hope I shall not therefore be considered as out of place in putting before you some suggestions which, if found practicable, will I hope tend to increase the usefulness of the Club and strengthen its position. I know that there *are* difficulties in the way, but I believe that those difficulties are not insuperable. First: I think that it is extremely desirable that some fresh rule or regulations as to the reading of papers at our Field and Evening Meetings should be at once adopted. It is obvious that there cannot *now* be the general understanding and consent of opinion amongst the members which there was in earlier days when the number of members was far fewer.* Again: It has occurred to me very forcibly several times during our excursions this year, that great practical good would result if, at each Field Meeting, one or two gentlemen would undertake to act as guides, or rather referees

* A rule to this effect was subsequently passed at the Annual Meeting.

in that particular branch of Natural History which is their peculiar forte, to those of our members less learned than themselves, but who yet long to drink deeper draughts from Nature's stream. The ornithologist, the botanist, the geologist, would thus often be able to create and foster an interest in their special and favourite study, which none would rejoice more than themselves to see awakened in another. I know, from my own early experience, how hard it is, even with the best of books, and such an extensive library as that of the British Museum at command, to solve difficulties which would vanish often with two minutes verbal explanation from some well skilled friend.

I think, too, that possibly some scheme might be hit upon by which our Club might do more than has been done to *popularize* the study of Natural History in other ways. I have the most pleasing recollections of my old friend (if I may be allowed to call him so) Professor Sedgwick's peripatetic lectures in the Geological Museum at Cambridge, and many an Oxford man yet lives who has wandered with Buckland in his excursions through field and flood and returned a wiser man. Now, if we could manage to organize, in any way, Field Classes for members desirous of following out any particular branch of Natural History, I think that new zeal would be imparted to our work, and a very wide and fruitful field be opened up for the labours of the Club.

I have wished for years past that we could, as a Club, take up the study of the habits of our sea fishes. It is very nearly an unknown subject, strange as the assertion may sound to some; but though we have caught and eaten fish almost from the creation, yet to this hour is an open question, to which no man can give a positive answer, as to whether the cod, the haddock, and other similar fishes shed their spawn on the ground like the salmon, or whether it floats about in the sea like the brood of the oyster! Of course there would be difficulties in carrying out such enquiries; but surely the same energy and perseverance and self-denial, which have led to such wonderful results in other branches of investigation, might well be applied with at least equal success to this, which is a matter of yearly increasing and national importance. Let us pursue our enquiries till not a secret of Nature which can be revealed is unknown. Let us never tire in our search after knowledge, but let us make our enquiries in that reverend and humble spirit which marks always the highest and truest philosophy. Let us remember that we are finite while there is ONE who is Infinite, and that He ruleth over all. It has been well said by one of the very ablest thinkers of our times, "Christianity being stationary and authoritative, thought progressive and independent, the causes which stimulate the restlessness of the latter interrupt the harmony which ordinarily exists between belief and knowledge, and produce crises during which religion is re-examined. Disorganization is the temporary result: theological advance the subsequent. Whatever is evil is eliminated in the conflict; whatever is good is retained. Under the over-ruling of a beneficent Providence antagonism is made the law of human progress."

Intellect has its rights, its privileges, its duties, its triumphs. But that is not, cannot be, the end of the matter. We see laws acting everywhere around us—we see them in their varied courses—now one link of the chain is added to another—a higher and yet higher step is gained, but still, like the traveller in some mountainous region who, when he thinks to be about to surmount the highest point, yet finds some higher peaks beyond where

"Hills peep o'er hills, and Alps on Alps arise."

So it is with the searcher into science. Each fresh step in advance only serves to show the unexplored region beyond more fully. Nature has to be overcome ere she will tell us her secrets, or pour out her riches before us.

THE FIELD MEETINGS for 1870 were arranged to be held as follows:—

MAY	Hartford Bridge.
JUNE	Castle Eden Dene.
JULY	Finchale.
AUGUST	Rothbury. (two days meeting.)
SEPTEMBER	Hareshaw Linn.
OCTOBER	Marsden.

THE Treasurer's report (see p. 513) was read and adopted.

IT was resolved that the next Annual Meeting of the Club should be held in the evening, instead of mid-day, as heretofore, in order to secure if possible a larger attendance of members.

THE following gentlemen were elected officers of the Club for the year 1870–71:—

PRESIDENT.

George S. Brady, Esq., C.M.Z.S.

VICE-PRESIDENTS.

Rev. W. Featherstonhaugh, B.A.
R. B. Bowman, Esq.
Richard Howse, Esq.
George Hodge, Esq.

Ralph Carr, Esq.
Rev. J. F. Bigge, M.A.
D. Embleton, Esq., M.D.
R. Ingham, Esq.
Sir W. C. Trevelyan, Bart.
T. Sopwith, Esq., F.R.S.
Rowland Burdon, Esq.
Rev. H. B. Tristram, LL.D.
George Wailes, Esq.
Rev. W. Greenwell, M.A.
Edward Charlton, Esq., M.D.
Rev. G. C. Abbes, M.A.
Rev. A. M. Norman, M.A.
Rev. J. C. Bruce, LL.D.
Rev. A. Bethune, M.A.
E. J. J. Browell, Esq.
Rev. R. F. Wheeler, M.A.

TREASURER.

Robert Y. Green.

SECRETARIES.

Thomas Thompson.	D. P. Morison.

LOCAL SECRETARIES.

Durham, John Booth.	*Hexham*, Rev. W. T. Shields.

Morpeth, W. Creighton.

COMMITTEE.

Thomas Atthey.	D. O. Drewett.
Joseph Blacklock.	Albany Hancock.
T. J. Bold.	John Hancock.
James Clephan.	A. F. Marecco.
John Coppin.	G. H. Philipson, M.D.
William Dinning.	Joseph Watson, jun.

AUDITORS.

J. S. Foster.	T. P. Barkas.

THE following gentlemen were elected members of the TYNESIDE NATURALISTS' FIELD CLUB during the year 1869–70 :—

At the ANNIVERSARY MEETING, 1869 :—The Rev. R. Broughton, Long Benton ; Messrs. Martin Ryder, Sunderland ; H. M. Morrison and Thomas Ianson, Newcastle.

At the FIRST FIELD MEETING :—Messrs. Daniel Jackson, M.D., Hexham ; J. T. Oliver and John Hope, Newcastle ; Alexander Cruickshank, Gateshead.

At the SECOND FIELD MEETING :—Messrs. Alexander Corder, James Thompson, John Price, and B. C. Abbes, Sunderland ; John L. Lamson, Ryhope ; R. S. Arnold, Gateshead ; Henry Scott, John Milling, H. V. Wilson, W. Hutchinson, W. Moore, and G. B. R. Bousfield, Newcastle ; H. Prodham, Whickham.

At the Third Field Meeting:—Messrs. J. M. Fothergill, Thomas Stephenson, and W. V. Dodsworth, Newcastle; Thos. L. Howarth, Sunderland; Rev. J. L. Low, Forest of Teesdale.

At the Fourth Field Meeting:—Messrs. E. Bacon Grey, Styford; John Kirsop, Heaton Bank; Joseph Cobb and C. H. Angas, Sunderland; James Ward, Richmond; G. G. Laidler, W. Temple, Robert Watson, W. Crossling, and Edward Reed, Newcastle.

At the Fifth Field Meeting:—Messrs. T. Charlton, North Shields; Thomas Todd, Jarrow-on-Tyne; W. D. Robb, Hencotes, Hexham; J. C. Reid, M.D., Newbiggen-by-the-Sea.

THE TREASURER IN ACCOUNT WITH THE TYNESIDE NATURALISTS' FIELD CLUB.

Dr.

1869.	£	s.	d.
To Balance last year	87	7	5
" Subscriptions received	128	5	0
" Sale of "Transactions"	10	12	9
" Natural History Society, at £16 12s. 11d. per 100 Copies	24	4	4
" Half Expense Authors' Papers	2	15	2
	£253	4	8

Cr.

	£	s.	d.
By Printing "Transactions"	109	12	7
" Lithographing	11	9	3
" Commission on collecting Subscriptions	6	3	0
" Printing Circulars, Delivery, and Postage	61	0	1
" Mr. Thompson, Secretary, sundry Expenses at Meetings	12	8	9
March, 1870.			
" Balance in hand	52	11	0
	£253	4	8

Examined and found correct, April 7th, 1870,

T. P. BARKAS, Auditor.

TYNESIDE NATURALISTS' FIELD CLUB.

LIST OF MEMBERS, APRIL 7TH, 1870.

Abbes, Rev. George Cooper, B.A.	Cleadon Hall.
Abbes, Bryan Cooper	Rock Lodge, Roker
Abbes, Henry	Rock Lodge, Roker.
Abraham, John	Liverpool.
Adamson, C. M.	Newcastle.
Adamson, William	Newcastle.
Adamson, Charles H.	North Shields.
Adamson, Henry	North Shields.
Adamson, Horatio	North Shields.
Adamson, L. W.	Newcastle.
Alcock, Samuel, jun.	Sunderland.
Anderson, Joseph	Newcastle.
Anderson, Charles	South Shields.
Angas, C. H.	Sunderland.
Angus, Thomas	Newcastle.
Appleton, J. R.	Durham.
Armstrong, George	Newcastle.
Armstrong, Hugh C.	Newcastle.
Armstrong, Luke, M.R.C.S.	Newcastle.
Armstrong, Leonard	South Shields.
Arnold, R. S.	Gateshead.
Atkin, David	Newcastle.
Atkinson, G. C.	Wylam Hall.
Atkinson, Henry	Newcastle.
Atthey, Thomas	Gosforth Colliery.
Backhouse, Edward	Sunderland.
Backhouse, James Edward	Darlington.
Backhouse, T. W.	Bishopwearmouth.
Bainbridge, E. M.	Newcastle.
Bainbridge, William, jun.	South Shields.

Barkas, T. P.	Newcastle.
Barkus, Benjamin, M.D.	Gateshead.
Barnes, J. W.	Durham.
Barron, James, M.R.C.S.	Bishopwearmouth.
Barry, George	Newcastle.
Bass, Charles	Newcastle.
Bates, J. P.	North Shields.
Bell, Henry	Newcastle.
Bell, J. L.	Newcastle.
Bell, John Thomas	Monkwearmouth.
Bell, Robert	South Shields.
Belt, Thomas	Newcastle.
Benson, William	Hexham.
Bethune, Rev. Angus	Seaham Harbour.
Bewicke, T. J.	Allenheads.
Bigge, Rev. J. F., M.A.	Stamfordham Vicarage.
Bird, Rev. C.	Chollerton Vicarage.
Blacklock, Joseph	Newcastle.
Blain, Thomas	Sunderland.
Bold, Thomas John	Long Benton.
Bolton, Andrew, M.D.	Newcastle.
Booth, George R.	Sunderland.
Bousfield, W. C.	Newcastle.
Bousfield, Rev. G. B. R.	Newcastle.
Bourne, William, M.A., M.D.	North Shields.
Bowman, Hugh	Gateshead.
Bowman, R. B.	Newcastle.
Bowman, Walter	Gateshead.
Bowron, Joseph	Forrest Hall.
Boyd, Edward F.	Durham.
Bramwell, J., M.D.	North Shields.
Brady, G. S., M.R.C.S.	Sunderland.
Brady, Henry B., F.L.S.	Newcastle.
Branford, W. E.	Newcastle.
Briggs, R. S.	Sunderland.
Brignell, William	Durham.
Britton, J. J.	Newcastle.
Bromley, Rev. Francis	Newcastle.
Brooks, J. C.	Wallsend.
Broughton, Rev. Reginald	Long Benton.
Browell, Edward J. J.	East Boldon.
Brown, John	Newcastle.
Browne, J. L.	North Shields.

Brown, Thomas W.	Sunderland.
Brown, Philip, M.D.	Blaydon-on-Tyne.
Bruce, Rev. J. C., LL.D., F.S.A.	Newcastle.
Bruce, Gainsford	London.
Brumell, G. A.	Newcastle.
Buck, Robert	Sunderland.
Bullen, M. W.	Blyth.
Bulman, Rev. G. R.	Durham.
Burdon, Rowland	Castle Eden.
Burnup, M., M.D.	Newcastle.
Burnip, John, jun.	Newcastle.
Burnett, Rev. W. R.	Bishopwearmouth.
Burnett, Jacob	Tynemouth.
Burrell, R. A.	Durham.
Bush, John A.	Newcastle.
Byers, William	Sunderland.
Cadogan, C. H.	Brinkburn Priory.
Cail, Septimus A.	Newcastle.
Campbell, T. H.	Sunderland.
Candlish, John, M.P.	Sunderland.
Carr, Charles	Cramlington Hall.
Carr, Rev. H. B., M.A.	Whickham.
Carr, John	North Shields.
Carr, William C.	Newcastle.
Carr, Ralph	Hedgley.
Challoner, J. S.	Newcastle.
Charlton, Edward, M.D.	Newcastle.
Charlton, Thomas	North Shields.
Charlton, William Henry	Hesleyside.
Charlton, William	Newcastle.
Chartres, William	Newcastle.
Clark, Thomas T.	North Shields.
Clark, William	Gateshead.
Clay, William	Newcastle.
Clayton, John	Newcastle.
Clapham, Henry	Gateshead.
Clapham, R. C.	Walker.
Clephan, R. C.	Newcastle.
Clephan, James	Newcastle.
Clephan, Joseph	Newcastle.
Clephan, William	Stockton-on-Tees.
Cobb, Joseph	Sunderland.

Cooke, M. C.	London.
Cooke, Thomas	Newcastle.
Coppin, John	North Shields.
Corder, Alexander	Sunderland.
Corder, Francis	Sunderland.
Cowen, J. A.	Blaydon Burn.
Cowen, Joseph, jun.	Stella House.
Cox, J. H.	Sunderland.
Coxon, S. B.	Usworth Hall.
Craggs, Thomas	West Cramlington.
Crawford, B. C.	Walker.
Crawshay, Edmund	Bensham.
Creighton, William	Morpeth.
Crookes, St. John	Pensher.
Crossling, Thomas	Newcastle.
Crossling, William	Newcastle.
Cruickshank, Alexander	Gateshead.
Culley, W. T.	Copeland Castle.
Curle, Walter	Monkton.
Daggett, William	Newcastle.
Daglish, John	Newcastle.
Dale, J. B.	South Shields.
Dale, Henry	North Shields.
Dance, T. W.	Gateshead.
Davison, Joseph	Newcastle.
Davison, Edwin C.	Sunderland.
Dawson, B.	South Shields.
Dees, R. R.	Newcastle.
Denham, J. S.	South Shields.
De Mey, W. F., M.D.	Newcastle.
Dickson, William	Alnwick.
Dickenson, J. G.	Newcastle.
Dickinson, Robert	Newcastle.
Dickinson, William	Newcastle.
Dinning, William	Newcastle.
Dixon, A. W.	Seaham Harbour.
Dixon, Henry	Sunderland.
Dixon, William	Sunderland.
Dixon, W. H., M.D.	Sunderland.
Dixon, Robert	Bensham.
Dodd, J. P., LL.D.	North Shields.
Dodds, Edwin	Low Fell.
Dodds, M. S.	Newcastle.

Dodsworth, Frederick	Newcastle.
Dodsworth, W. V.	Newcastle.
Donkin, A. S., M.D.	Sunderland.
Douglas, James	Winlaton.
Douglas, John	Gateshead.
Downie, Henry	Newcastle.
Dunn, A. M.	Newcastle.
Draper, Robert	Seaham.
Drewitt, D. O.	Jarrow Hall.
Drizinger, L.	Newcastle.
Dunn, Henry	Newcastle.
Dunn, William	South Shields.
Dunn, William, jun.	Newcastle.
Dwarris, Rev. B. E.	Bywell.
Easten, William	Newcastle.
Ellis, Robert K. A.	Sunderland.
Elwin, Robert	Sunderland.
Embleton, Dennis, M.D.	Newcastle.
Emmerson, W. L., M.D.	North Shields.
Eno, James C.	Newcastle.
Falconar, J. B.	Newcastle.
Fawcus, John	North Shields.
Featherstonhaugh, Albany	Roker.
Featherstonhaugh, Rev. W., M.A.	Edmondbyers.
Featherstonehaugh, Edward	Roker.
Fell, Edmund	Biddick.
Fell, H. B.	Biddick.
Fenwick, J. W.	North Shields.
Fenwick, John	North Shields.
Fenwick, G. W.	Newcastle.
Fenwick, George	North Shields.
Finch, Rev. T.	Morpeth.
Forrest, William	Newcastle.
Forster, G. B.	Backworth.
Forster, James S.	Newcastle.
Forster, Douglas	Newcastle.
Forster, John	Winlaton.
Forster, Robert	Newcastle.
Fothergill, J. M.	Newcastle.
Forth, Robert	North Shields.
Fothergill, Thomas	Bishop Auckland.

Fox, Henry E.	London.
Frain, Joseph, M.D.	Sunderland.
Francis, Matthew, M.R.C S.	Sunderland.
Frazer, Donald	Newcastle.
Garrett, John	Newcastle.
Gibb, C. J., M.D.	Newcastle.
Gibson, Charles, M.D.	Newcastle.
Gibson, W. W.	Hexham.
Gibson, J. P.	Hexham.
Gillies, Alexander	Gateshead.
Glaholm, J. P.	Newcastle.
Glendinning, John	Newcastle.
Glover, John	Jesmond.
Goddard, D. H.	Newcastle.
Gooch, T. L.	Saltwell.
Gourlay, Rev. G. M.	Blanchland.
Gowland, G.	Sunderland.
Graham, John, jun.	Sunderland.
Greaves, John	Newcastle.
Greener, Martin	Sunderland.
Green, Edward	Newcastle.
Green, Rev. T. R., M.A.	Newcastle.
Green, R. Y.	Newcastle.
Green, William, jun.	Blaydon-on-Tyne.
Green, C. H.	South Shields.
Greenwell, Robert A.	Newcastle.
Gregory, J. M.	Newcastle.
Grey, C. J.	Dilston.
Grey, Edward Bacon	Newcastle.
Haggie, R. H.	Newcastle.
Hall, Frederick	Newcastle.
Hall, George	Kent.
Hall, Rev. G. R.	Birtley, near Wark.
Hall, James	Newcastle.
Hall, John	Newcastle.
Hall, Thomas	Winlaton.
Halton, John	Carlisle.
Hancock, Albany	Newcastle.
Hancock, John	Newcastle.
Hare, John	Newcastle.
Hardy, H. G.	Byers Green.

Harris, Charles	Newcastle.
Harrison, J. A.	Killingworth House.
Haswell, F., R.N.	North Shields.
Havelock, Michael	Newcastle.
Headlam, Right Hon. T. E., M.P.	London.
Heald, Joseph	Newcastle.
Hedley, T. F.	Sunderland.
Henderson, M.	Newcastle.
Henderson, Robert	Newcastle.
Henderson, William	Durham.
Henzell, W. M.	Newcastle.
Heslop, R. Oliver	Newcastle.
Hicks, J. M.	Newcastle.
Hill, H.	North Shields.
Hills, James	Sunderland.
Hinde, Rev. J. S.	Cramlington.
Hobkirk, William	Cramlington Colliery.
Hodge, George	Seaham Harbour.
Hodgkin, Thomas	Newcastle.
Hodgson, James	Newcastle.
Hodgson, William	Darlington.
Hogg, James	Newcastle.
Holmes, W. H.	Newcastle.
Hooppell, Rev. R. E., M.A.	South Shields.
Hope, John	Newcastle.
Hope, William	Sunderland.
Houen, A. C.	Newcastle.
Howse, Richard	Newcastle.
Howarth, Thomas L.	Sunderland.
Hudson, R. M.	Sunderland.
Hughes, T. W.	Newcastle.
Humble, Thomas, M.D.	Newcastle.
Hunt, A. H.	Birtley.
Hunter, Christopher	North Shields.
Huntley, D. P.	Sunderland.
Hutchinson, Cuthbert	Whitburn.
Hutchinson, Joseph	Durham.
Hutchinson, William	Newcastle.
Iliff, Arthur	Roker.
Iliff, Rev. G.	Sunderland.
Ingham, Robert, Esq.	Westoe.
Irving, George	Newcastle.

Jackson, Daniel, M.D.	Hexham.
Jackson, Thomas	North Shields.
Jackson, Thomas, jun.	North Shields.
Jenkins, Rev. Edward	North Shields.
Jones, Rev. John	Dunston.
Johnson, Alfred	Gateshead.
Johnston, R. J.	Newcastle.
Jordon, Joseph	Newcastle.
Kaye, William	Newcastle.
Kell, John	Newcastle.
Kelman, William	Sunderland.
Kennedy, J. F.	Newcastle.
Kewney, George	North Shields.
Kidson, John	Sunderland.
Kirkby, J. W.	Pirnie Colliery.
Kirwood, Rev. R.	Chester-le-Street.
Knothe, Rudolph	Newcastle.
Kyle, Gibson	Newcastle.
Laidler, G. G.	Newcastle.
Lawson, Alexander, Professor	Oxford.
Lawson, Rev. E.	Longhurst Hall.
Lawson, George S.	Sunderland.
Lawson, John Nicholas	Ryhope.
Leathart, James	Newcastle.
Legge, Alfred	Newcastle.
Legge, John	Houghton-le-Spring.
Legge, L. C.	Houghton-le-Spring.
Leife, Rev. J. E.	Cresswell.
Leitch, T. C.	North Shields.
Lincoln, Thomas	South Shields.
Lister, Clement	Newcastle.
Lowrey, E.	Newcastle.
Lowrey, Richard	Newcastle.
Luckley, George	Newcastle.
Luke, Thomas	Sunderland.
Lyall, George	South Shields.
Macdonald, J. M.	Newcastle.
Mack, Robert	Newcastle.
Maling, E. A.	Sunderland.
Maling, C. T.	Ouseburn.
Maling, William	Newcastle.

Marreco, A. F.	Newcastle.
Marshall, F. C.	Jarrow.
Marsters, John	Sunderland.
Mather, Edward	Newcastle.
Matthew, G., jun.	Sunderland.
McAllum, C. O.	Newcastle.
McDonald, A. E.	Newcastle.
McLean, Hugh, M.D.	Corbridge.
Meggett, Archibald	Winlaton.
Mein, John	Newcastle.
Messent, Philip C. E.	Tynemouth.
Meynall, E. J.	Durham.
Milling, John	Newcastle.
Modlin, Robert, M.R.C.S.	Sunderland.
Moffatt, William	North Shields.
Mole, John W.	Newcastle.
Moody, Rev. C.	Newcastle.
Moor, W. T.	Newcastle.
Moore, A. J.	Sunderland.
Moore, John	Sunderland.
Moore, J. M.	South Shields.
Moore, John	Durham.
Moore, William	Sunderland.
Moore, William	Newcastle.
Morgan, G. B.	Bishopwearmouth.
Morland, John	Gateshead.
Morland, Thomas	Gateshead.
Morison, D. P.	Bulman's Village.
Morrison, H. M.	Newcastle.
Morton, Rev. Henry	South Shields.
Mounsey, Edward	Denham.
Murray, William, M.D.	Newcastle.
Muschamp, W.	Gateshead.
Neville, Samuel	Newcastle.
Nesham, T. C.	Newcastle.
Newall, R. S., F.R.A.S.	Ferndene, Gateshead.
Newton, Rev. J. H., B.A.	Cambo.
Nicholson, William	Winlaton.
Noble, Capt. A.	Elswick.
Norman, Rev. A. M.	Burnmoor Rectory.
O'Brien, W., M.D.	South Shields.

Oglivie, Joseph	North Shields.
Oliver, John T.	Newcastle.
Oliver, W. A.	Sunderland.
Park, A. D.	Newcastle.
Pattinson, J.	Newcastle.
Pattinson, Joseph	Newcastle.
Pattison, Rev. T. H.	Newcastle.
Pearson, W. H., jun.	Sunderland.
Pearson, William	Newcastle.
Peart, S., M.D.	South Shields.
Peacock, Reginald	Sunderland.
Peacock, Septimus	Sunderland.
Pecket, G. C.	Sunderland.
Peele, Richardson	Durham.
Pemberton, R. L.	Sunderland.
Philipson, G. H., M.D.	Newcastle.
Philipson, John	Newcastle.
Philipson, J. A.	Newcastle.
Philipson, L. W.	Newcastle.
Pilkington, Edward	Sunderland.
Popplewell, John	North Shields.
Porrett, J. C.	Sunderland.
Potter, Addison	Heaton Hall.
Potts, R. H.	Sunderland.
Price, John	Sunderland.
Proctor, B. S.	Newcastle.
Proctor, Matthew	Elswick.
Proctor, N. H.	Ouseburn.
Proctor, W. W.	Newcastle.
Prodham, Herbert	Hexham.
Prosser, Thomas	Newcastle.
Pruddah, Edward	Hexham.
Punshon, N.	Newcastle.
Ranson, Thomas W.	Sunderland.
Reay, John	Sunderland.
Redmayne, J. M.	Newcastle.
Redmayne, R. R.	Gateshead Fell.
Reed, Edward	Newcastle.
Reed, J. R.	Sunderland.
Reid, David	Newcastle.
Reid, James	Newcastle.

Reid, John C., M.D.	Newbiggen-by-the-Sea.
Reid, W. B.	Newcastle.
Richardson, Edward	Newcastle.
Richardson, John George	Monkton.
Ridley, Andrew	Newcastle.
Ridley, Samuel	Newcastle.
Ridley, W. B.	Newcastle.
Ritson, Thomas F.	Sunderland.
Robb, William David	Newcastle.
Robertson, David, F.G.S.	Glasgow.
Robertson, W. L.	Durham.
Robinson, W. S.	Sunderland.
Robson, Arthur	Sunderland.
Robson, E. C.	Sunderland.
Robson, Frederick	Newcastle.
Robson, J. B.	Newcastle.
Robson, Ralph	Hexham.
Robson, R. N.	Durham.
Robson, S. S.	Sunderland.
Robson, W. C.	Newcastle.
Rolf, A. G., M.R.C.S.	Gateshead.
Rowell, George	Newcastle.
Ryder, Martin	Sunderland.
Ryder, William	Newcastle.
Sample, Thomas	Morpeth.
Sansom, Thomas	Newcastle.
Scholefield, Henry	Newcastle.
Scott, Henry	Newcastle.
Scott, Stephen	Newcastle.
Shaw, Frederick	South Shields.
Shiel, George	Sunderland.
Shield, G. R.	Newcastle.
Shield, John, jun.	Newcastle.
Shields, John	Durham.
Shields, Rev. W. T.	Hexham.
Shooter, Rev. John	North Shields.
Short, John	North Shields.
Shotton, Edward	North Shields.
Simey, Ralph	Sunderland.
Simpson, J. B.	Ryton.
Smart, Colin	Sunderland.
Smiles, Henry	Newcastle.

Smith, Dr. R. A.	Sunderland.
Smithson, William	Newcastle.
Snowball, James	Gateshead.
Sopwith, T., F.R.S., F.G.S.	London.
Spence, C. J.	North Shields.
Spence, J. F.	North Shields.
Spence, J. F., jun.	North Shields.
Spence, Joseph	North Shields.
Spence, Robert	North Shields.
Spence, Thomas	North Shields.
Spencer, Michael	Newburn.
Spencer, Thomas	Ryton.
Stanger, J.	Newcastle.
Steel, Thomas	Sunderland.
Stephens, Thomas, M.D.	North Shields.
Stephens, Thomas, jun.	North Shields.
Stephenson, Robert	Middlesbro'.
Stephenson, Thomas	Newcastle.
Stevenson, A. S.	Tynemouth
Stevenson, Archibald	South Shields.
Stevenson, J. A.	Newcastle.
Stokoe, George, M.D.	South Shields.
Stokoe, Thomas	Newcastle.
Stout, G.	South Shields.
Straker, John	Tynemouth.
Straker, Joseph Henry	Tynemouth.
Street, Rev. J. C.	Newcastle.
Sutherland, B. J.	Newcastle.
Sutherland, Robert	North Shields.
Swallow, John	South Shields.
Swallow, John, jun.	South Shields.
Swan, Joseph	Newcastle.
Swan, J. W.	Newcastle.
Swan, Robert	London.
Swanston, William	Newcastle.
Swithinbank, G. E.	Newcastle.
Tate, George, F.G.S.	Alnwick.
Tate, R. M.	North Shields.
Taylor, Rev. Hugh	Wark Rectory.
Taylor, Hugh	Chipchase Castle.
Taylor, John	Newcastle.
Taylor, William N.	Ryhope.

Temperley, W. A.	Hexham.
Temperley, Nicholas	Newcastle.
Temple, William	Newcastle.
Tennant, Henry	Newcastle.
Thackray, William, jun.	Bishopwearmouth.
Thiedeman, Rudolph	Newcastle.
Thompson, George	Winlaton.
Thompson, C., jun.	Winlaton.
Thompson, J. T.	Newcastle.
Thompson, James	Sunderland.
Thompson, Thomas	Newcastle.
Thompson, Thomas	Sunderland.
Tidswell, William	Newcastle.
Todd, Thomas	Jarrow.
Tone, J. C.	Sunderland.
Tone, William	Sunderland.
Tone, William, jun.	Sunderland.
Trevelyan, Sir W. C., Bart.	Morpeth.
Tristram, Rev. H. B., M.A., F.L.S.	Greatham.
Turnbull, Edward	West Hartlepool.
Tweddell, G. M.	Stokesley.
Twizell, J. F.	North Shields.
Vermehren, H. W. M.	Newcastle.
Vint, Robert	Sunderland.
Waid, James	Richmond.
Wake, W. M.	Sunderland.
Wailes, George	Newcastle.
Wailes, W. S.	Newcastle.
Wait, James, jun.	South Shields.
Wait, John, jun.	North Shields.
Wallis, Robert, M.R.C.S	Stocksfield.
Warwick, John	Newcastle.
Watson, Henry	Milfield House.
Watson, J. W.	Bensham Grove.
Watson, J. C.	Heworth Lodge.
Watson, Joseph, jun.	Gateshead.
Watson, Mason	Newcastle.
Watson, R. S.	Newcastle.
Watson, Robert	Newcastle.
Watson, T. C.	Newcastle.
Watson, T. E.	Newcastle.

Waugh, J. G.	London.
Wayman, J. W.	Sunderland.
Welford, George, M.R.C.S	Sunderland.
West, Tuffen	Frensham.
Westmacott, Percy	Benwell Villa.
Wheeler, Rev. R. F.	Whitley.
Wheldon, John	London.
Wilcox, W. E.	Whitburn.
Wiener, Martin	Sunderland.
Williamson, John	South Shields.
Williamson, Sir Hedworth, Bart., M.P.	Whitburn Hall.
Wilson, Charles	Sunderland.
Wilson, E. J.	Liverpool.
Wilson, Henry V.	Newcastle.
Wilson, Henry	South Shields.
Wilson, John	North Shields.
Wilson, Joseph	Cleadon.
Wilson, Joseph	Newcastle.
Wilson, R. H., M.D	Gateshead.
Wilson, Thomas	Newcastle.
Wood, Lindsay	Hetton.
Wright, J., jun.	South Shields.
Youll, John G.	Newcastle.
Young, C. H.	Newcastle.
Young, Emmanuel	North Shields.
Young, Oliver	Newcastle.
Young, Thomas	South Shields.

HONORARY MEMBERS.

Airey, G. B., F.R.S.	Greenwich Observatory.
Baker, J. G.	Kew Gardens.
Bate, C. Spence	Plymouth.
Glaisher, James, F.R.S.	Lewisham.
Jones, T. Rupert, F.G.S.	Sandhurst.
Mennell, H. T., F.L.S.	London.
Oliver, Prof. D.	Kew Gardens.
Perkins, N. R.	Wooton-under-Edge.
Sedgwick, Prof. A., F.R.S.	Cambridge.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE.

REPORT READ AT THE ANNIVERSARY MEETING MAY 10TH, 1870,

ISAAC LOWTHIAN BELL, ESQ., V.P., IN THE CHAIR.

YOUR Committee have again to chronicle a season of comparative prosperity in the affairs of the Society, unmarked by any very special event.

The Treasurer's statement herewith presented shows a satisfactory balance in hand, notwithstanding a number of important improvements involving outlay which have been effected during the past year.

The Museum still continues to be largely frequented by the public, notwithstanding the charge for admission, thirteen thousand six hundred and forty persons having paid at the doors, in addition to members of the Society and their friends, who are admitted gratuitously. It is fairly open to question however whether this number would not be still further increased were the doors opened free on certain days as in some Museums. The average income from this source since 1863, when the charge was first fixed at its present amount, has been about £120, an important item in the Society's annual balance-sheet, but one with which a very moderate share of a Museum rate would enable it to dispense, at any rate, in part.

The Winter Evening Meetings have been continued during the past season, and have been fairly attended by members and their friends as heretofore; but the difficulty, which increases every year, of obtaining the services of suitable lecturers, has necessitated the omission of one meeting, and your Committee anticipate that some change in the arrangements will be required at no distant date.

The most important among the recent donations to the Museum have been the late Mr. Loftus' collections of fossils, presented by Sir W. G. Armstrong;—a skeleton of Bottle-nose Whale, from Messrs. Rogerson and Plumpton;—skeleton of Great Northern Rorqual, Mr. S. Langdale;—cast of Skull of *Physeter bidens*, from Sir W. C. Trevelyan, Bart.;—fasciculus of British Willows, from the Rev. J. E. Leefe;—a series of Specimens of *Eozöon Canadense*, Mr. H. B. Brady.

Your Committee would here impress upon members and the public the valuable aid which may still be given in respect to the increase of the collections. To take a single instance; many varieties of common British birds are still unrepresented in the Museum, though one often hears of their being obtained in our more or less immediate neighbourhood. Assistance in obtaining desiderata occurring in this way, either by presentation or purchase, is much required.

Through the kind assistance of Joseph Duff, Esq., of Etherley, a very valuable collection of fossils has been acquired from Midderidge Quarry, at the almost nominal cost of £10. Among the specimens, some of which are unique, are—Reptiles: *Protosaurus spineri*, new to England; and *Protosaurus Huxleyi*, a new species. Amphibians: *Lepidotosaurus Duffii*, the representative of a new genus from the Magnesian Limestone. Fishes: *Janassa bituminosa*, Schloth.; and *Acrolepis exsculptus*, Gumar, the latter new to the Marl-Slate of England; numerous specimens of the genera *Pygopterus*, *Palæoniscus*, *Platysomus*, *Cœlacanthus*, and many interesting plant remains. No other very important acquisitions have been made by purchase.

In the Vertebrate collections the British Mammals have been arranged in the south gallery, by Mr. John Hancock. Several species and varieties are wanting, which your Committee hope may be soon supplied. Mr. Hancock has also brought together, as a classical collection, the British Birds figured by Bewick, with the exception of the Red-breasted Goose and the Little

Bittern, of which the Society does not possess duplicates, and which are therefore for the present retained in the general collection.

In the Invertebrata Mr. D. P. Morison is now occupied in arranging the entomological collections in a series of drawers, which have been specially constructed for them.

Your Committee have under consideration certain changes which they trust will still further increase the value and usefulness of the Museum.

A small printing-press and type have been purchased, for labelling purposes, and it is hoped that before long considerable improvement will be effected in this important particular.

It is proposed to take down a large number of the foreign birds and deposit them in the drawers set at liberty by the removal of the insects to their new position. The space thus gained may, it is thought, be utilized for a zoological type-collection of an elementary character, to be provided with clear and full descriptive labels. It is also proposed to arrange, in one or more of the mineral cases, a student's collection of the commoner minerals, with a view of obviating the confusion often occasioned in the minds of students by numerous duplicates and varieties.

Having regard to the labour which these improvements will entail, your Committee are of opinion that the time has arrived when a porter may with advantage be engaged, so as to set the present keeper of the Museum at liberty for more responsible duties.

Lastly, your Committee have under consideration the possibility of publishing a short descriptive catalogue of the Museum, for the assistance of members and visitors in the examination of its contents.

Your Committee cannot close this report without expressing their regret at the loss of Mr. George Hodge's services as Honorary Secretary, which has been entailed by his removal to a distance. They trust, however, that this will not prevent his lending valuable assistance in the arrangement and supervision of the collections of Radiata.

JOSEPH BLACKLOCK, ESQ., TREASURER, IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY.

CURRENT ACCOUNT, 9TH JULY, 1868, TO 31ST DECEMBER, 1868.

1868.	Dr.	£	s.	d.
July 9.	To Balance in Lambton & Co.'s, to credit of the late Treasurer at this date	102	5	10
	,, Subscriptions from Members,	45	3	0
	,, Ditto from Associates	6	0	0
	,, Amount received for Admissions	53	15	11
	,, Dividend from the Liquidators of the Northumberland and Durham Banking Co. ...	0	19	8
	,, Ditto for Balance in Bank ...	1	10	6
	,, Institute of Mining Engineers,	20	0	0
	,, Fine Arts Society (arrears of rent)	34	12	0
	,, Lit. & Phil. Society	40	0	0
	,, Rents for Sign Boards affixed to the Museum buildings ...	7	0	0
	,, Overpaid to Bank	0	0	1
		£311	7	0

1868.	Cr.	£	s.	d.
	By Keeper's Salary from July (Jos. Wright)	37	10	0
	,, Sundries, per Jos. Wright ...	20	8	11
	,, Tradesmen's Accounts	24	11	1
	,, Fire Insurance	8	2	3
	,, Skin of Chimpanzee...........	1	15	0
	,, One Year's Rent of Exhibition of Boards at Stations.........	3	0	0
	,, Glass for the Alder Collection, per Mr. Brady	5	9	6
	,, D. P. Morison, Esq., grant towards Collection of Lepidoptera	5	0	0
	,, Rev. Mr. Kirwood's Collection of Beetles	10	10	0
	,, John Clayton, Esq., Half-year's Interest	39	0	0
Dec. 31.	,, Balance in Bank	156	0	3
		£311	7	0

JOSEPH BLACKLOCK, ESQ., TREASURER, IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY.

CURRENT ACCOUNT, 1st JANUARY, 1869, TO 31st DECEMBER, 1869.

1869.	Dr.	£	s.	d.
	To Balance brought forward......	156	0	3
	,, Subscriptions from Members,	175	19	0
	,, Ditto from Associates	16	0	0
	,. Amount received for Admissions	118	3	6
	,, Fine Arts Society (arrears of rent)	34	12	0
	,, Lit. & Phil. Society	40	0	0
	,, Institute of Mining Engineers	20	0	0
		£560	14	9

1869.	Cr.	£	s.	d.
	By Keeper's Salary (Jos. Wright)	75	0	0
	,, Sundries, per Jos. Wright ...	34	17	3
	,, Tradesmen's Accounts.........	114	19	0
	,, Fire Insurance	9	0	0
	,, J. Duff, Esq., for Fossils......	10	0	0
	,, D. P. Morison, Esq., for the Entomological Collection ...	3	10	0
	,, Specimen of Spiny Shark......	5	0	0
	,, Share of Cost of printing "Transactions"	26	19	6
	,, One Year's Rent of Advertising Boards	3	0	0
	,, John Clayton, Esq., One Year's Interest	78	3	4
Dec. 31.	,, Balance in Bank	200	5	8
		£560	14	9

JOSEPH BLACKLOCK, ESQ., TREASURER, IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY.

CURRENT ACCOUNT, 1st JANUARY, 1870, TO 10th MAY, 1870.

1870.	Dr.	£	s.	d.
	To Balance brought forward......	200	5	8
	,, Subscriptions from Members	59	17	0
	,, Amount received for Admissions	35	12	3
		£295	14	11
1870. May 10.	To Balance brought forward......	103	19	1

1870.	Cr.	£	s.	d.
	By Keeper's Salary (Jos. Wright)	25	0	0
	,, Sundries, per Jos. Wright ...	12	12	7
	,, Tradesmen's Accounts.........	87	10	10
	,, Fire Insurance	15	0	0
	,, J. Tait for Balleen of Whale	4	0	0
	,, Printing Press (Mr. Heyer)...	4	10	0
	,, D. P. Morison, Esq., for British Lepidoptera	3	19	1
	,, John Clayton, Esq., Half-year's Interest	39	3	4
May 10.	,, Balance in Bank	103	19	1
		£295	14	11

LIST OF

DONATIONS TO THE LIBRARY AND MUSEUM

OF THE

NATURAL HISTORY SOCIETY,

FROM MAY, 1868, TO APRIL, 1870.

Proceedings of the American Philosophical Society, Nos. 76, 77, 78, 79, Vol. X. *The Society.*

Proceedings of Zoological Society of London, Part 3, 1867; Parts 1, 2, 3, 1868; Part 1, 1869. *The Society.*

Transactions of the Academy of Science, St. Louis, U.S.A., 1861–68. *The Academy.*

Quarterly Journal of Microscopical Science, 1868. *The Royal Microscopical Society of London.*

Proceedings of the Academy of Natural Sciences, Philadelphia, U.S.A., Nos. 1, 2, 3, 4, and 77, Vol. X. *The Academy.*

Reports of the Smithsonian Institute, 1867-8. *The Institute.*

Land and Freshwater Shells of North America, by Binney and Bland, Part 1. *The Smithsonian Institute.*

Scudder's Orthoptera of North America. *The Smithsonian Institute.*

Annals of the Lyceum of Natural History, New York, U.S.A., Nos. 1–4, Vol. IX. *The Lyceum.*

History of the United States Sanitary Commission, 6 Vols. *The Secretary of the Commission.*

Proceedings of the Academy of Arts and Sciences, Boston, U.S.A., Vols. I., II., III., IV., and part of Vol. VII. *The Society.*

Memoirs of the Boston Natural History Society, Vol. I., Parts 1, 2, 3, 4; Proceedings, Vol. II.; and Harris's Entomological Correspondence. *The Society.*

Annual Report of the Trustees of the Museum of Comparative Anatomy, Harvard College, Cambridge, U.S.A., 1866. *The Trustees.*

A set of Transactions and other Publications of the Royal Swedish Academy, Stockholm. *The Academy.*

A parcel of Transactions, &c., of the Royal Norwegian University, Christiania. *The University.*

Report of the Leeds Literary and Philosophical Society, 1867-8. *The Society.*

Proceedings of the Literary and Philosophical Society of Liverpool, Nos. 20 and 21. *The Society.*

Annual Report of the Plymouth Institution and Devon and Cornwall Natural History Society, Part 1, Vol. III., 1867-8. *The Institution.*

Transactions of the Newcastle Chemical Society, Part 1, 1869. *The Society.*

Proceedings of the Natural History Society of Glasgow, Part 1, Vol. I. *The Society.*

Transactions of the Geological Society of Glasgow, Parts 1 and 2, Vol. III. *The Society.*

On the Palæozoic Bivalve Entomostraca, by Prof. T. Rupert Jones, F.G.S. *The Author.*

On the Nomenclature of the Foraminifera, by Prof. T. Rupert Jones, F.G.S., W. K. Parker, F.R.S., and J. W. Kirkby. *The Authors.*

Memoirs on the Cetacea, Greene's Protozoa, and several other Works, belonging to the late Mr. Alder. *Miss Alder.*

On the Chemistry of the Blast Furnace. *I. Lowthian Bell, Esq.*

Cast of the Skull of a Whale (*Physeter bidens*) in the Museum at Oxford. *Sir W. C. Trevelyan, Bart.*

Skeleton of the Bottle-nosed Whale (*Hyperoodon Butzkopf*), captured at Tynemouth. *W. Rogerson, Esq., and Thos. Plumpton, Esq.*

Skeleton of the Great Northern Rorqual (*Balænoptera Boops*), taken at Newbiggen. *S. Langdale, Esq.*

A pale variety of the Common Mouse (*Mus musculus*). *J. H. Richardson, Esq.*

A Specimen of the Lerot or Greater Dormouse (*Myoxus nitella*), shot in Brittany. *Major Craster, per R. Y. Green, Esq.*

Skull of the Great Anteater (*Myrmecophaga jubata*). *R. S. Newall, Esq.*

Skull of *Stylonoceros Reevesii*, from Chusan. *Rev. J. F. Bigge.*

A Specimen of the Common Fox (deposited). *A. Freire-Marreco.*

A Fœtal Leopard (*Felis leopardus*). *Miss Walker.*

Two Specimens of the Bank Vole (*Arvicola pratensis*). *W. Backhouse, Esq.*

Two Specimens of the Stoat (*Mustela erminea*). *Mr. James Stephenson.*

A Specimen of the Spotted Crake (*Gallinula porzana*) and the Jack Snipe (*Scolopax gallinula*). *J. H. Richardson, Esq.*

Specimens of the Penguin (*Spheniscus demersus*) and Gannet (*Sula Bassana?*) from Ichaboe. *A. De Pass, Esq.*

Penguin's Eggs, from Ichaboe. *Captain John Whitta.*

Specimens of the Lesser Black-backed Gull (*Larus fuscus*) and one of the Water Rail (*Rallus aquaticus*). *Mr. Thomas Thompson.*

Specimen of Jack Snipe (*Scolopax gallinula*).
Cuthbert Thompson, jun., Esq.

Specimen of Surf Scoter (*Anas perspicillata*), from British Columbia.
F. H. Donnison, Esq.

Nest and Eggs of Land Rail (*Gallinula crex*).
Rev. W. Featherstonehaugh.

Eggs of Common Swan (*Cygnus olor*). *Mr. John Thompson.*

Nests of Sociable Bunting (*Emberiza* ——?) *John Hancock, Esq.*

Specimen of the Lesser Spotted Dogfish (*Squalus canicula*), caught at Newbiggen. *Mr. J. T. Sharpe.*

Specimen of Lamprey (*Petromyzon fluviatilis*), from the Aln.
Miss Thompson.

Ditto *ditto* from the North Tyne.
Edward Charlton, M.D.

Mounted Specimens of Mackerel (*Scomber scombrus*), Pilot-fish (*Naucrates ductor*), and Plaice (*Platessa vulgaris*). *J. H. Richardson, Esq.*

Skeleton of Thornback Ray (*Raia clavatus*). *Ditto.*

Specimen of Great Greenland Shark (*Squalus borealis*).
J. H. Richardson, Esq., and G. C. Gilchrist, Esq.

A Specimen of the Brown Lizard (*Zootica vivipara*). *Mr. David Pringle.*

Carapace of Turtle. *Cornewall Collinson, Esq.*

A Specimen of the Gecko (*Gecko guttatus?*), from India. *Captain Buckler.*

Two Specimens of the Bull Frog, from Antigua. *Mrs. T. B. H. Abrahall.*

Various Snakes from Gibraltar. *Mr. James Mills.*

Specimens of Axolotl (*Gyrinus edulis*), from Mexico. *M. V. de Mean.*

A number of Indian Snakes. *Mr. William Lyall.*

Specimen of Northern Stone Crab (*Lithodes Maia*). *Miss Taylor.*

Mounted Specimens of Lobster (*Homarus vulgaris*), Prawn (*Palæmon serratus*), and Common Crab (*Cancer pagurus*).
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