TRANSACTIONS

OF THE

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM,

AND

NEWCASTLE-UPON-TYNE.

(New Series.)

VOL. IV.

LONDON:

WILLIAMS AND NORGATE,

14, HENRIETTA STREET, COVENT GARDEN.

1909-1913.

Yes

Not according to parts cover.

Is this correct?

1914-1916 seems more likely

NO

1916 - 1916 v.14 Part 1 1914

CONTENTS OF VOLUME IV.

(New Series).

Arthropoda Arthropoda Arthropoda Diplopoda Crustacea Copepoda Part 2 1916 Agnatha Osteolepida

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LIST OF PLATES, Vol. IV. (New Series).

LIST OF OTHER ILLUSTRATIONS.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE

REPORT OF THE COUNCIL

FOR 1909–1910

THE past year of the Society presents certain satisfactory features, and others which are somewhat disquieting. Much of the Society's work, especially in connexion with the maintenance of the Museum, has been greatly helped by the Crawhall bequest. Without this timely aid, indeed, the position at the present moment would be serious, and it is this fact—that it is difficult to see how some such exceptional source of income could have been dispensed with—which makes it clear that in some respects the Society is not so flourishing as the Council would wish to see it. In the very essential matter of the membership there is a further decline to record. Ten members have been lost by death and twenty-one by resignation, and as only thirteen new members have been elected, there is a nett loss of eighteen. The membership has now once more fallen below 400: the actual figure at the end of the year is 395.

The bequest of £6,000, received under the will of the late Mr. Geo. E. Crawhall, has been invested in satisfactory trust securities, and will yield an annual income of about £200. Particulars of the investments will be found in the Treasurer's report. A further sum of £1,000, on account of the share of residuary estate bequeathed unconditionally to the Society, has also been paid to the Treasurer during the year, and a small further sum may yet be received from this source. After careful consideration, it was decided that the share of residue should be set aside as a quasi-capital fund, to be available, under the order of the Council, to meet extraordinary expenditures that may from time to time be found necessary. Certain disbursements from it have already been sanctioned, including the cost of a new heating-boiler and some alterations to the hot-water system, the purchase of a new typewriting machine, of a cabinet for a large collection of local beetles, and of about £10-worth of selected specimens of marine invertebrates from the zoological stations at Naples and Plymouth. Some of these items of expenditure call for a word of explanation. The new boiler was required to replace an old one which had been in use since the Museum was built, and which finally became unusable early in the winter. The alterations in the hot-water system were designed to secure a better distribution of heat in the front of the building, where (especially in the vestibule and library) the circulation had never been satisfactory. A new arrangement of the connexions was made, and a new return-pipe laid from the front of the building back to the boilers. As the work was carried out in the spring, after artificial heating had ceased, its success has not yet been fully proved, but preliminary tests give every reason to expect a perfectly satisfactory result.

The collection of local beetles for which a cabinet has been bought is that which was described in the last report. It is being formed from a combination of three remarkably good private collections, namely those of the late T. J. Bold, and of Mr. Jno. Gardner, of Hartlepool, and Mr. R. S. Bagnall. The two latter gentlemen have kindly given their collections for this special purpose, conditionally upon suitable cases being provided, and the final combined collection will probably be the most complete of its kind in this country. At the time of the last report no means of providing cabinet space for this valuable collection were in sight, and the Council considered it a very suitable object for which to draw upon the special fund. The typewriter which has been purchased is a Hammond machine. It is well adapted for museum work, especially in its device for changing the type, and already it has proved very useful in both correspondence and label-writing.

The Council also decided, on the recommendation of the House Committee, to devote a portion of this fund to the much-needed repair and re-decoration of the Museum building, the interior of which has not been decorated since it was done originally. The repairs needed were chiefly to the ridge-tiles on the roof, to the roof-lights, and to the pointing of some of the masonry. Drip-mouldings have also been fixed on many of the windows to prevent rain from being blown through, and the roof of the boiler house has been put in repair. The railings and outside woodwork are being repainted and the interior re-decorated throughout. The work, or at least the greater part of it, would have been done long ago had funds been available, and the apparent impossibility of finding the means for it has been a source of increasing anxiety to the Council.

A considerable improvement has been brought about in the grounds on the west side of the building. The pond, which was leaking badly, has been cleaned out and re-cemented. Beds have been made along the west wall; the rockery and the other ground near it have been cleaned, a number of shrubs and small trees planted, and the paths put into good order for the first time.

An issue of the Transactions (New Series, vol. iii., part 2) was published during the year, and the concluding part of the same volume is now almost complete. The Council are pleased to find that the high standard of the papers is still fully maintained. Many of them, naturally, are of interest mainly to specialists, but this is inevitably the case with original work, the only work that a scientific society is justified in publishing. The best thanks of the Society are due to the President, who generously came forward to enable a valuable paper on local geology to be published, which was otherwise too long to have been accepted for printing at present. A suggestion to which the Council gave their approval some years ago—that a general index of the last series of Transactions should be prepared—is now, they are glad to see, being carried into effect. A number of members have kindly given their help, and the entries for most of the individual volumes are now in hand.

The usual series of winter lectures and "talks" and of summer field meetings have been arranged and held. A list of the lectures and "talks" appears in an appendix, and the field meetings will be reported upon by the chairman of the field section. The average attendance at the evening lectures was 85; at the children's lectures 164; at the curator's "talks" 53. To the gentlemen who gave their services as lecturers the Council accord their best thanks. They are especially indebted to Prof. Meek, who, almost at a moment's notice, took the place of a lecturer who was prevented from keeping his appointment.

The Hancock Prize Competition for 1909 was notable for the fact that in addition to the usual prize there were second and third prizes offered, and also a junior prize for competitors under sixteen years of age. The money for these prizes was given by the late Mr. Crawhall shortly before his death. Prof. G. S. Brady and Prof. A. Meek kindly acted as examiners, and they were advised in the case of the geological essays by Prof. G. A. Lebour. The awards were as follows:—First prize, Mr. Chas. Robson (Birtley); second prize, Mr. H. Jeffreys (Birtley); third prize, Mr. J. M. Taylor (Blackhill); junior prize, Clifford Rowell (Newcastle). Eighteen essays were sent in for the competition proper, and thirteen in the junior section.

On the death of King Edward VII. an address of condolence and loyalty was sent on behalf of the Society to the new King, George V., and this has been graciously acknowledged. Reference was made in it to the fact that it was the late King himself, as Prince of Wales, who opened the Museum twenty-six years ago.

The Society has been represented by delegates at several important gatherings of scientific men; for example, at the Darwin Commemoration at Cambridge, the Entomological Congress at Brussels, the Geological and Zoological Congresses at Stockholm and Gratz respectively, and at the meetings of the British Association and Museums Association. An address was presented by the Society's delegate at the Darwin Commemoration.

Last year the loss by death of three of the oldest of the vice-presidents had to be recorded, and during the year under review another vice-president, who was long associated with them, has been lost in Mr. D. O. Drewett. Mr. Drewett was almost the oldest member of the Society. He was formerly an active member of the committee, and took great interest in the work of the brothers Hancock and the other distinguished local naturalists of the 'sixties and 'seventies. The late Isaac Clark, of Blaydon, who has also died during the year, was a very old member of the Field Club. He was well known to an earlier generation, and to a few of the present members, as a keen ornithologist and egg-collector; no one had a better knowledge of the nesting places and habits of local birds.

The Council wish to express their thanks to the donors of the museum specimens of which a list appears in a later portion of the report; to Messrs. J. L. Gracie and J. G. Bell for their contributions towards eliminating last year's deficit; to Mr. J. Alaric Richardson for the fine ash used in making the paths; and to Messrs. Ernest Scott and Wilfred Hall for the time and trouble they expended in examining and reporting on the heating and lighting systems in the Museum. The Council also acknowledge their appreciation of the excellent work done by the curator, Mr. Gill, his assistant Mr. Fletcher, and staff, during the year under review.

CURATOR'S REPORT ON MUSEUM WORK.

1909-1910.

The most important piece of museum work described in last year's report was the overhauling of the collection of fishes. This has been continued in the present year, and is now practically completed. The few remaining fishes have been coloured, a large number of labels have been drawn up and printed, and a chart prepared showing the classification adopted in the cases. Fresh specimens are still needed to replace some unsatisfactory ones that are doing duty at present, and with a view to supplying this want we are making casts of certain fishes (monkfish, chub, char, etc.), and procuring some other casts (salmon and sea-trout) from a well-known specialist in their manufacture. The reptile and amphibian section, which adjoins that of the fishes, has not yet been thoroughly dealt with. We began work upon the snakes this year, but were stopped for the time being by the difficulty of identifying the specimens. One most welcome addition has been made to the reptile collection during the year, namely a skeleton of the green turtle. It was presented by Dr. F. C. Pybus, and has been very well mounted by Mr. Fletcher. A few other pieces of work done in the zoology room deserve mention. Some finishing-up has been done in the general shell collection, and a number of fresh shells, selected from the store cupboards by Miss Lebour, were worked in at the same time. The reproduction of a rock pool has been provided with a new key-chart and description; a large number of beautifully preserved marine invertebrates from the Zoological Station at Naples have been mounted in glass jars; and a little has been done towards preparing a fresh exhibited series of insects. With most of the orders of insects the difficulty is the obtaining of new material. Of the beetles, however, we have a fairly representative series, and a selected set of these has been identified for us by Miss Bowdler Sharpe at the Natural History Museum, South

Kensington. A cabinet has been purchased for the large combined local collection of beetles, and in preparation for installing it Miss Welford is re-carding the beetles in the late T. J. Bold's collection. We have made a set of corked trays fitting the desk cases, and these will be used for the exhibited collections of insects: they will bring up the insects so as to lie parallel with the glass and close under it.

The largest single specimen added to the collections during the year is the skeleton of a white whale or beluga. The animal was captured seven years ago at the mouth of the Tyne, and its occurrence there constituted a southerly record for the species in the North Sea. The skeleton has been mounted very successfully by Mr. Fletcher. Since it was finished we have made a hollow half-model of the whale itself (on the same principle as is adopted in the well-known whale room at South Kensington) and fixed it up round one side of the skeleton. From that side what is seen is a life-sized model of the entire animal; from the other, the skeleton enclosed by the animal's outline. The construction of the hollow model was altogether an experiment as far as we were concerned, and we are gratified to have succeeded with it. Another cetacean, again caught at the mouth of the Tyne, has also been occupying a good deal of our time lately. This is a white-beaked dolphin *(Lagenorhynchus albirostris)* which we bought in a fresh condition from a fishmonger. We secured a good cast of it, from which a paper model is now being made; we then dissected it, keeping some of the more interesting organs, and Mr. Fletcher is making a preparation of the skeleton.

We have mounted eight birds during the year, all of them good additions to the collection. Some foreign game birds have been removed from old cases in the storeroom, and the best of them identified and arranged in cases on the bird-room gallery. In the fossil room the chief addition that has been worked in is a set of American fossils acquired by exchange with the New York Museum of Natural History.

Another striking addition to the geological section is a large model of a metal-mine, made and presented by Mr. Richard Daniell of Shankhouse Colliery, Cramlington. This model has been fitted up in the north-west corner-room on the gallery floor, where it is well seen and is protected by rails and wire. We have numbered all the parts and put up framed descriptions, which enable the work of the mine to be followed through in proper sequence from beginning to end. In the ethnology section a number of additions have been incorporated, necessitating a good deal of re-arrangement, and a large number of new labels have been printed and placed in the cases.

Some special work has been done during the year in connexion with the library. Prof. Meek is forming a combined card-index of the zoological literature available for reference in the various libraries in Newcastle, and cards relating to the Museum library have been made out for this purpose by Miss Welford. The serial literature, of which we had not an exact catalogue previously, has been sorted out and catalogued by Mr. Fletcher.

Some of the donations of the year have been alluded to already, and a complete list of them will be found further on. We have been particularly indebted for fishes and other marine specimens to Mr. S. T. King, master of a Hartlepool trawler, Mr. L. Steel, a fish dealer in Newcastle, and Mr. G. E. Bullen of the St. Albans Museum. Mr. Alex. Girdwood has sent us some very good beetles, butterflies, centipedes, etc., from the West African Gold Coast. From Sir Arthur Middleton we have received fine growths of the rare coral-root orchid found this year at Belsay. The fossils received from the New York Museum were a valuable addition to our palæontological collections, and with them we received an excellent model of the remarkable Permian reptile *Naosaurus*. Mr. Stanley Smith has presented certain of the specimens figured in his paper on the local Bernician beds, and Mr. P. Walther has given us some interesting minerals from the Eifel and elsewhere. In the ethnology section the most striking addition is a dandy-horse made about 1810 for the first Earl of Durham and presented by Messrs. Atkinson and Philipson. The long series of the Linnean Society's Journals, which Mr. H. T. Mennell has presented, forms an important accession to the library.

I attended the annual conference of the Museums Association held at York in July. The proceedings struck me as being of unusual interest, and some of the papers contained suggestions that will be of considerable service in work that we have in view.

E. LEONARD GILL.

MUSEUM STAFF

CURATOR.......................................E. LEONARD GILL, M.SC.
ASSISTANT ....HERBERT FLETCHER.
HONORARY KEEPER...... ....JOSEPH WRIGHT.
LADY ASSISTANT AND SECRETARY.....MISS E. WELFORD.
ATTENDANT...................................WILLIAM VOUTT.
GARDENER ....ALBERT SPENCER.

NEW MEMBERS ELECTED

FROM JULY, 1909, TO JUNE, 1910.

Dr. Robert Anderson, 4, Gladstone Terrace, Gateshead.
J. Dowson, 3, Victoria Crescent, Cullercoats.
John I. Graham, Thirlwall Office, Gilsland.
Principal W. H. Hadow, M.A., Mus. Doc., Armstrong College, Newcastle.
Jas. McD. Manson, Hillcroft North, Low Fell.
Arthur Moule Oliver, 1, Fenham Terrace, Newcastle.
Robert Plumpton, 6, Hawthorn Terrace, Newcastle.
Miss Rose Roberts, Stella House, Blaydon-on-Tyne.
Edward Rutter, 203, Westoe Road, South Shields.
Dr. Robt. Hy. Smallwood, M.A., B.S., &c., 11, Wentworth Place, Newcastle.
C. F. Swan, Prudhoe Hall, Northumberland.

ASSOCIATE MEMBERS

George W. Finch, West Moor, near Newcastle-on-Tyne.
H. S. Wallace, 17, Kingsley Place, Heaton.

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 23rd, 1909

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Ridley.
Lord Barnard.
Lord Ravensworth.
The Bishop of Durham.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Andrew Noble, Bart., F.R.S.
Sir G. H. Philipson, M.D., D.C.L.
Sir John Swinburne, Bart.
Sir Lindsay Wood, Bart.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Col. C. W. Napier-Clavering.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
E. J. J. Browell.
R. Coltman Clephan, F.S.A.
Clive Cookson.
W. D. Cruddas.
D. O. Drewett.
Samuel Graham.
H. N. Middleton.
John Pattinson, F.I.C.
Prof. M. C. Potter, M.A., Sc.D.

COUNCIL

Hugh P. Angus.
W. E. Beck.
Rev. W. McLean Brown.
John L. Gracie.
Wilfred Hall.
T. E. Hodgkin, M.A.
Hon. J. Arthur Joicey.
Prof. Alex. Meek, M.Sc., F.Z.S.
J. Alaric Richardson.
Ernest Scott.
George Sisson.
J. D. Walker, J.P.

HON. SECRETARIES

N. H. Martin, F.R.S.E.
C. E. Robson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITOR

Samuel Graham.

EVENING MEETINGS HELD DURING THE WINTER SESSION, 1909–1910.

Oct. 13.—Mr. Geo. W. Temperley : "The Sea-Birds of our Coast, and how to identify them" ; chair taken by Col. C. H. E. Adamson, C.I.E.

Nov. 10.—Prof. A. Meek, M.Sc., F.Z.S. :—"The Segments of the Head" ; chair taken by Mr. R. Coltman Clephan, F.S.A.

Dec. 8.—Mr. Geo. Hurrell, B.A. : "Shore Life" ; chair taken by Mr. Richard Adamson.

Jan. 19.—Mr. H. J. Chapman, F.R.H.S. : "A Talk about Orchids" ; chair taken by Mr. C. E. Robson.

Feb. 9.—Dr. R. Gordon Bell : "Starch : Nature's First Organic Product" ; chair taken by Mr. J. Alaric Richardson.

Mar. 9.—Mr. W. H. Young, F.L.S., F.Z.S. : "Mendelism" ; chair taken by Mr. Jos. G. Angus.

Mar. 23.—Private Evening Meeting of the Society : Report on Field Meetings of 1909, by Mr. C. E. Robson, Chairman of the Field Meetings Committee. Reading of extracts from the four prize essays in the Hancock Competition (see page 4).

AFTERNOON LECTURES TO CHILDREN.

Dec. 30.—Dr. A. Holmested Hobbs : "Tierra del Fuego : its People, its Birds and its Animals" ; chair taken by the Rev. W. McLean Brown.

Jan. 6.—Prof. G. A. Lebour, M.A., D.Sc. : "Hillocks, Hills and Mountains" ; chair taken by Sir Geo. Hare Philipson, D.C.L., F.R.C.P.

CURATOR'S "MUSEUM TALKS."

Oct. 27.—The Winter Migrants.
Nov. 24.—Early Life on the Earth.
Dec. 15.—Animal Locomotion.
Jan. 26.—The Age of Reptiles.
Feb. 23.—Young Birds.
Mar. 30.—Animal Weapons and Defences.
Apr. 27.—The Wild Rose and its Family Relations (by Mr. Richard Adamson).

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM 1st JULY, 1909, TO 30th JUNE, 1910

RECEIPTS.	£	s.	d.	PAYMENTS.	£	s.	d.
Members' Subscriptions	344	12	0	Balance due Treasurer	85	17	4
Museum Admission Fees	146	16	1	Salaries	577	6	6
Sale of Guide Books, &c	6	16	5	Advertising	5	13	4
Interest on Investments	278	15	0	Fuel, Lighting, and Water	51	3	2
Special Donations toward 1908–9 Deficit	10	0	0	Insurance	26	15	4
Sundries	0	14	7	Materials and Fittings	12	18	7
Transfer from Deposit Account	150	0	0	Postage and Carriage	15	10	2
				Printing	23	7	0
				Property Tax	10	11	2
				Building Repair Fund	40	0	0
				Stationery	0	19	6
				Sundries	69	17	8
				Balance in hand	17	14	4
	£937	14	1		£937	14	1

The outstanding liabilities on 30th June amounted to £49 10 0.

BUILDING REPAIR FUND

	£	s.	d.		£	s.	d.
Balance, 30th June, 1909	16	13	1	Dinning & Cooke—New boiler	82	14	11
Transfer from General Fund	40	0	0	Walter Lacey—Laying out museum grounds	13	16	10
Deficit	43	3	8	Sundries	3	5	0
	£99	16	9		£99	16	9

SAML. GRAHAM, Hon. Auditor. A. H. DICKINSON, Hon. Treasurer.

DEPOSIT ACCOUNT.

	£	s.	d.		£	s.	d.
Legacy from the late G. E. Crawhall	1,000	0	0	Transfer to Current Account	150	0	0
Interest	6	9	3	Bryant and Son—Entomological Cabinet	33	6	0
				Hammond Typewriter Co.—Typewriter and Accessories	17	3	5
				Balance in Bank, 30th June, 1910	805	19	10
	£1,006	9	3		£1,006	9	3

SPECIAL PUBLICATION ACCOUNT

	£	s.	d.		£	s.	d.
Balance in Bank, 30th June, 1909	60	5	2	*Printing and Lithographing	61	0	10
Members' Subscriptions	41	6	0	Postage and Carriage	5	2	4
Sale of Society's Transactions	1	16	6	Balance in Bank, 30th June, 1910	37	6	9
Interest on Account	0	2	3				
	£103	9	11		£103	9	11

* In addition to this there is an outstanding liability for printing for £97 9s. 9d.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1910:—

£	s.	d.			Taken at cost. £	s.	d.
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock (Coppin Bequest)		2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt		500	0	0
2,000	0	0	Tyne Commissioners' Consolidated Fund at 4 per cent.		2,000	0	0
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock	Crawhall Bequest	6,000	0	0
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock				
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock.				
					£10,500	0	0

SAML. GRAHAM, Hon. Auditor. A. H. DICKINSON, Hon. Treasurer.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1910.

AMERICAN MUSEUM OF NATURAL HISTORY, New York (per Prof. Bashford Dean, by exchange).—Fossil fish remains from the Devonian, Cretaceous and Eocene of North America and the Cretaceous of Mount Lebanon. Plaster restoration of the reptile *Naosaurus claviger*, Cope, from the Permian of Texas.

B. AMSDEN, B.A., B.Sc., LL.B.—Flowering specimens of the "Isle of Man Cabbage," *Brassica monensis*.

MESSRS. ATKINSON AND PHILIPSON.—A dandy-horse (hobby-horse) made about 1810 for the first Earl of Durham; in excellent preservation.

RICHD. S. BAGNALL, F.E.S., F.L.S.—Examples of two rare spiders, *Tmeticus (Oreonetides) firmus* and *abnormis*, from the Derwent Valley.

GEO. E. BULLEN.—Examples of small and mostly scarce gobies collected by the donor from the sea near Plymouth: *Gobius 4-maculatus*, *G. minutus*, *G. pictus*, *G. ruthensparri*, *Crystallagobius nilsonni*, *Lepadogaster gouanii*, *L. bimaculatus*.

JAS. CAYGILL.—Fossils from the Coal Measures of Consett: good pieces of *Lepidodendron*, *Sigillaria*, and *Calamites*, and shells ot *Anthracosia*. Also a curiously slickensided block of shale, and a horse-shoe found in some old workings, rusted into a large nodular mass.

ALEXR. CHEAL.—A pair of bullfinches from Sussex.

ISAAC CLARK.—A hen crossbill from the Tyne Valley.

MRS. ALFRED COCHRANE.—Two eggs of Pallas's sand grouse from Turkestan.

KENNETH COOKSON (per T. E. Hodgkin).—A male sparrowhawk in very good plumage, from near Stocksfield.

GEO. E. CRAWHALL, by bequest of the late.—Eight cases of birds, containing well mounted specimens of tawny owl, peregrine, hen harrier, magpie, blackbird (pied variety), shelduck, tufted duck, golden-eye, pochard, shoveler, wigeon, teal. Three stoats in more or less complete ermine dress. Mounted heads of red deer hind, fallow deer stag, and fox. A case of exotic butterflies.

GEO. E. CRAWHALL, Executors of the late.—A pair of goat's horns. Coloured cast of a great auk's egg. Pair of moccasins and hoof of moose, ornamented with Indian bead-work.

RICHARD DANIELL (Shankhouse Colliery, Cramlington).—Large wooden model of a metal-mine, made by the donor. Showing underground workings, shaft machinery, and a great variety of machinery for dressing the ore.

MR. DICKINSON (gamekeeper, Prestwick Car).—Pair of partridges in case, one with a large horny tumour on the head.

DOVE MARINE LABORATORY, Cullercoats.—A rare Goniasterine starfish (not yet identified), brought into Shields by a trawler.

W. P. GRACE.—A large hymenopterous insect, *Cimbex sylvarum* ♀, and examples of the mite *Trombidium holosericeum*: all from Whickham.

SAML. GRAHAM.—Two cases of stuffed birds, containing a red-necked phalarope, a green woodpecker, and two kingfishers.

DR. A. HOLMESTED HOBBS.—Specimens from northern Tierra del Fuego: a collection of 54 of the most striking flowering plants; two primitive native knives; a piece of iron pyrites used by the natives for making fire.

REV. J. E. HULL, M.A.—Eighteen further species of spiders to add to the local reference collection given previously by the same donor.

CYRIL W. HURST.—Twenty-two moths to add to the Raine Collection: including *Noctua C-nigrum*, *Heliophobus popularis*, *Leucania putrescens*, *Miselia Oxyacanthæ* (dark variety).

R. W. KENNEDY.—A living example of *Zoropsis maculosus*, Cb., a large Canary Island spider, found in a shop in the Bigg Market.

S. T. KING (Hartlepool).—Animals brought up by the trawl in the North Sea: a Greenland bullhead, *Cottus grœnlandicus*; *Psolus phantapus*, a holothurian, alive; *Funiculina quadrangularis*, a sea-pen.

EDWD. MERRICK.—Clay containing crystals of selenite, from Walker.

SIR ARTHUR E. MIDDLETON, BART.—Fine, growing clumps of the coral-root orchid, *Corallorhiza innata*, from the donor's estate at Belsay.

J. G. ORMOND.—A living emperor moth, *Saturnia carpini*.

J. J. OXLEY.—Minerals from Newfoundland: galena crystals in clay, Bay St. George; sample of a deposit of asbestos re-sorted by glacial action, Mount Cormick.

DR. F. C. PYBUS.—The skeleton of a green turtle, *Chelone mydas*.

E. O. REID.—A brambling from Woolsington. The furcula of a knot shot at Hebburn.

W. H. RYOTT.—A specimen of the longicorn beetle *Astynomus ædilis* captured in Norway.

FRED SCOTT (per T. E. Hodgkin).—A living female of the giant saw-fly, *Sirex gigas*, from Stocksfield.

JOS. P. SLEIGH.—A number of natural history specimens from the Loyalty Islands, including a group of strikingly plumaged small birds, some shells, and a large number of insects, spiders, etc. Also, on loan, a number (about 20) of ethnological objects, including ornaments, articles of dress and utensils, from the Loyalty Islands, Samoa, New Guinea, and Ceylon.

STANLEY SMITH, M.Sc., F.G.S.—Four specimens figured in the donor's paper on the Upper Bernician limestones: two *Producti*, *Girvanella*, *Saccamina*.

MRS. STANLEY (London).—An eighteenth-century brocade silk quilt with curious gimp trimming.

L. STEEL.—A good example of the monkfish, *Rhina squatina*.

C. T. TRECHMANN.—Some excellently preserved crustacea and other natural history specimens (about 36), chiefly from South Carolina; including a perfect *Limulus*.

ARTHUR TROBRIDGE.—Fine sample of a deposit of trona (sesquicarbonate of soda) from a lake in Central Africa.

WM. VOUTT.—Two tortoise's eggs, laid by a tortoise kept in Newcastle.

P. WALTHER.—Many mineral and rock specimens, including augite crystals, volcanic ash and bombs from the Eifel; a plate of lepidolite from Quebec; four metal models of tantalum crystals; fresh, differently coloured samples of potash minerals—kainite, carnallite, sylvite—from Stassfurt; manganese concretions from deep sea off South America; garnierite, worked as an ore of nickel, from New Caledonia; some small Cambridge Greensand fossils. Other specimens by exchange, including a fine section of an agate from the Eifel; two very fine pieces of atacamite from Chile; a piece of a meteorite from Texas; native nickel-iron from the Yukon, Canada; native tantalum, a sample of the first and only known find of the mineral, from the Urals.

J. HENRY WATSON (Manchester).—Eggs (for rearing) of the Japanese silk-moth, *Antheræa yama-mai*, the Bengalese (Arrindi) silk-moth, *Philosamia ricini*, and the emperor moth, *Saturnia carpini*.

C. W. WHITE.—Minerals collected near Blanchland: transparent and smoky quartz; galena; fluorspar.

A Synopsis of the British Symphyla, with descriptions of New Species.

By Richard S. Bagnall, F.E.S., F.L.S.

(With Plate I.).

In a recent paper published in these Transactions (iii., pp. 646–653, pl. xix., figs. 1–10, 1910) I dealt with four species of Symphyla, three of which were for the first time recorded from the British Isles. I did not then anticipate following up the study, but in my spare time collecting throughout the spring of this year I met with numerous examples of the order from various localities in the North of England, and many of these proved of exceptional interest on microscopic examination. In July I was able to add to this collection examples taken from two localities on the West Coast of Scotland. The material thus brought together mainly forms the subject of the present contribution.

Briefly, five species of *Scutigerella* are recognized, of which three are new to science, whilst of the seven species of *Scolopendrella* three also are new. In some of these forms structural characters that were unknown in previously described species have been discovered, namely the peculiar flap-like processes on the posterior margin of the 13th scutum in *Scutigerella biscutata*, and the peculiar characteristic setæ in *S. hanseni.*

Up to a year ago but one species was recognized as British; in the present synopsis we deal with no less than twelve distinct forms and a variety, all of which, with the exception of *S. notacantha*, are recorded from the counties of Northumberland and Durham, and five of which we have also discovered in Scotland. *Scutigerella biscutata* sp. nov., *S. spinipes* sp. nov., *S. hanseni* sp. nov., *Scolopendrella subnuda* Hansen, *S. horrida* sp. nov., *S. delicatula* sp. nov., *S. isabellæ* Grassi, and its var. *dunelmensis* nov., and *S. minutissima* sp. nov., are for the first time recorded from the British Isles.

I must confess that I have experienced some considerable surprise at the richness of the Symphylous fauna of the North of England, and I find it difficult to explain, and still more difficult to estimate the probable number of species that may be found in the country. Up to this year eight (or nine) European species have been discovered, chiefly from Italy, Denmark, Austria, and Germany, and of these we have discovered six. Both *Scutigerella nivea* Scopoli, and *Scolopendrella microcolpa* Muhr. might confidently be expected to occur with us.

It is interesting to note that Prof. Verhoeff, whose great work "Die Diplopoden Deutschlands" is now being published, says (*in. litt.*) that the form I have named *S. biscutata* is known to him from South Germany.

I believe, with Prof. Hansen, that the Symphyla are found more commonly on limestone formations, and chiefly on this account have spent several hours gathering material from the coast near Hart, and on the Wear between Durham and Sunderland; districts on or in close proximity to the magnesian limestone formation. I am also led to believe that there is a more or less defined variation in the habitat of the different species. The two commonest forms, *Scut. immaculata* and *Scol. vulgaris*, are found under stones lying comparatively loosely on or in more or less loose, loamy soil, the latter species showing a tendency towards a riparian habitat; *Scut. biscutata* and *S. spinipes* seem to prefer a heavier soil, and are as a rule found under more deeply embedded stones. *Scol. notacantha* was found on a river estuary where the soil would be more or less saline, but only two examples (the identification of one being uncertain) were taken. *S. subnuda*, *S. delicatula*, and perhaps *S. horrida* are found under stones, usually small ones, well sunk in a damp clayey ground, whilst my numerous examples of *Scol. isabellæ* var. *dunelmensis* (which may ultimately prove to be a distinct species) were found under stones, such as cobble stones, deeply embedded in hard, much-trodden earth of a clayey nature, no other species being found with them.

I find particular pleasure in dedicating one of the new forms to the well-known zoologist Prof. H. J. Hansen of Copenhagen, who has in recent years monographed the Order Symphyla.

ORDER SYMPHYLA.

I. Species generally larger and more robust, with the first pair of legs always well-developed and more than half the length of the following pair ; the exopods well-developed and conspicuous.

Posterior margins of all the dorsal scuta but the last one slightly rounded or emarginate, angles generally broadly rounded.

Dorsal surface of the hind pair of legs furnished with numerous setæ. Cerci without striped terminal area or transverse lines at tips. Genus **Scutigerella,** Ryder.

II. Species smaller and more slender, with the first pair of legs rarely more than one-half the length of the following pair (*S. notacantha* is the only exception), and more usually rudimentary ; none of the exopods well-developed.

Posterior margins of all the dorsal scuta but the last one produced into a pair of triangular plates.

Dorsal surface of the hind pair of legs furnished with very few setæ. Cerci usually with a striped terminal area, and often in addition with raised transverse lines on the most distal part outside the area. Genus **Scolopendrella,** Gervais.

TABLES OF THE SPECIES.

GENUS SCUTIGERELLA, Ryder.

I. Last dorsal scutum with a very deep and somewhat large cavity, overlapped anteriorly and situated in the middle of the posterior margin.

1. Posterior lobes of the thirteenth dorsal scutum without a pair of processes ; surface of all scuta and the cerci rather closely and minutely setose. Cerci from three to five times as long as broad at base. Tactile hairs on the last segment short and very fine.

a. Size larger (4·5–8·0 mm.). Setæ on cercus about one-fifth as long as the depth ot cercus, more numerous. Setæ on legs more numerous and less conspicuous.
immaculata (Newp.)

b. Size smaller (about 3·0 mm.) ; setæ on cercus about two-fifths as long as the depth of cercus, fewer ; setæ on legs long and conspicuous, less numerous.
spinipes, Bagnall.

2. Posterior lobes of the thirteenth dorsal scutum each furnished with a process longer than broad and overlapping the fourteenth scutum; surface of the fourteenth scutum without setæ, excepting a conspicuous series protecting the cavity. Other setæ larger and less closely placed, especially on the cerci. Cerci about two and one-half to three times as long as broad at base. Tactile setæ on the last segment longer than the cerci; rather strong. **biscutata,** Bagnall.

II. Last dorsal scutum without such median cavity, but sometimes with a simple depression in its place.

1. All setæ on dorsal scuta (excepting an antero-lateral pair on the first scutum) backwardly directed, rather short and fusiform, *i.e.*, blunt and broadest at about middle. Antennæ long and slender, composed of thirty-eight or more joints. Setæ on surface of cerci rather long and closely set. **hanseni,** Bagnall.

2. All setæ normal; second scutum with a pair of forwardly directed antero-lateral setæ, at least twice as long as any of the other lateral setæ, which are backwardly directed. Antennæ shorter, composed of thirty joints or less.

a. Setæ on surface of cerci numerous, closely set, and the distal ones shorter than one-half the depth of the cercus. Second dorsal scutum with the posterior margin slightly convex; first, third, fifth, sixth, and eighth scuta each with a pair of rather long forwardly directed antero-lateral setæ, and two pairs of lateral setæ (longer than the other lateral setæ) as in the second scutum. Penultimate scutum posteriorly conspicuously emarginate with broadly rounded lobes. Antennal joints varying from twenty-three to twenty-eight. **caldaria**, Hansen.

b. Setæ on surface of cerci few, widely set, and some of the distal ones longer than the depth of the cercus. Second dorsal scutum with the posterior margin straight or very faintly emarginate; first, third, fifth, sixth, eighth, ninth, eleventh, and twelfth scuta each with a pair of long outwardly directed setæ about as long as those on the second scutum. Penultimate scutum posteriorly very slightly emarginate, and with a pair of long backwardly directed postero-lateral setæ. Antennal joints varying, according to Latzel, from twenty to thirty. [**nivea** (Scopoli).]

Genus SCOLOPENDRELLA, Gervais.

I. First pair of legs well-developed, composed of three free and distinctly articulated joints, excluding the trochanter, and terminating in two conspicuous claws.

1. Length 3·0 to 3·4 mm. First pair of legs more than two-thirds the length of the following pair, of normal shape. Hind margin of each scutum with a distinct longitudinally striate belt between the pair of triangular processes. Cerci without the raised transverse lines at the most distal part. Central cephalic rod interrupted before the middle, and there branching shortly to either side. **notacantha,** Gervais.

2. Length 1·2 to 3·0 mm. First pair of legs at most not more than one-half the length of the following pair. Hind margin of the scuta simple, without striate belts. Cerci with raised transverse lines at the most distal part opposite to the terminal area. Central cephalic rod interrupted, but without the lateral branches before the middle.

   a. Nearly all the antennal setæ thickened and distinctly pubescent. Dorsal and marginal setæ and those on scuta short, but more numerous and closely set. Cerci a little more than four times as long as deep, and clothed with a larger number of setæ differing considerably in length; terminal area and apical setæ short. Size larger (av.: 2·5 mm.).

   [**microcolpa,** Muhr.]

   b. Antennal setæ naked, normal. Dorsal and marginal setæ on scuta few, very sparsely placed and minute. Cerci from three to four times as long as deep, and clothed with comparatively few rather long setæ unequal in length; terminal area and apical setæ both long. Size smaller (av.: 1·5 mm.).

   subnuda, Hansen.

II. First pair of legs obsolete, represented by a pair of rudimentary wart-like protuberances without even claws.

1. Size usually larger and slightly more robust. The last pair of legs with three long protruding dorsal setæ on the metatarsus, and four or, more usually, five similar setæ in the anterior dorsal row on the tarsus. The cerci rather large and densely clothed with both moderately long and short setæ.

a. 10 or 11 setæ on lateral margin of second scutum between the antero-lateral seta and the apical; including two prominent ones. **isabellæ,** Grassi.

b. Only 7 or 8 such setæ, including three prominent ones, the third coming next to the apical seta.
isabellæ, Grassi, var. **dunelmensis,** Bagnall.

2. Size usually smaller and more slender. The last pair of legs with two long protruding setæ on the metatarsus, and only two or three in the anterior dorsal row on the tarsus. Cerci not so long and less closely furnished with setæ.

a. Lateral margins of 2nd scutum angulate at about the anterior third; inner margin of process with one or two setæ between the apical seta and the one at the basal angle.

aa. Cerci without long outstanding setæ on either the upper or lower margin. Setæ on scuta exceptionally long, as long or almost as long as the length of processes; five on the lateral margin of the second scutum between the antero-lateral and apical setæ, and one on the inner margin of process. More slender.
horrida, Bagnall.

bb. Cerci with a few long outstanding setæ on lower margin only. Setæ, excluding the antero-lateral pairs, on scuta small; second scutum with about seven setæ on the lateral margin and two on the inner margin of process between the setæ above-named (*a* and *aa*). Three setæ on tarsus of hind leg. Less slender. **vulgaris,** Hansen.

b. Lateral margins of second scutum arcuate; inner margin of process without any setæ between those above-named (*a*).

aa. Size larger (2·5 mm.). Cerci with a few long outstanding setæ on both the upper and lower margins. Setæ on scuta, including the antero-lateral pairs, very weak and minute; only four on the lateral margin of the second scutum between the antero-lateral and apical setæ. Two setæ on tarsus of hind leg. Very slender. **delicatula,** Bagnall.

bb. Size smaller (1·5 mm.). Cerci with fewer and longer setæ and without the long outstanding setæ on either the upper or lower margin. Setæ on scuta well-developed; second scutum with three long and two short intermediate setæ between those above-named (*aa*). Three setæ on tarsus of hind leg. Very slender.
minutissima, Bagnall.

Genus SCUTIGERELLA Ryder

Group I. – Posterior margin of the last dorsal scutum with a deep anteriorly-overlapped median cavity.

A.—*Thirteenth scutum normal; surface of all the scuta rather closely and minutely setose; cerci longer and narrower, generally closely and minutely setose; tactile hairs on the last segment short and very fine.*

AA.—*Size larger, setæ on cercus more minute (about one-fifth the depth of cercus) and more numerous. Setæ on legs shorter, less conspicuous, and more numerous.*

Scutigerella immaculata Newp. (Pl. I., figs. 1–2.)

As it is probable that several of the British records of this species refer partly or wholly to other forms, the following are the data of several specimens I have myself examined.

Professor Hansen has recorded British examples submitted by Mr. Pocock, from Devonshire.

Fig. 1. *Scutigerella immaculata.*

A. Metatarsus and tarsus of last left leg × 60.
B. Tarsus of left front leg × 60.

ENGLAND. NORTHUMBERLAND. — Wylam-on-Tyne, one; Nunnykirk, Longwitton Dene, and Hartburn, one example from each locality, June 1st, 1911.

DURHAM.—Axwell Park and Gibside in the Derwent Valley, not uncommon; common in woods on the banks of the Wear between Leamside and Durham, and more rarely in a Dene at Fencehouses, with *S. biscutata*; on railway near Penshaw, and on the river banks between Hylton and Lambton; on the sea banks at Horden; several on the Durham side of the Tees at Barnard Castle, June 6th, 1911.

YORKSHIRE.—A few under a stone by hedge side near the moors at Ravenscar.

CHESHIRE.—Numerous examples taken by Dr. Randell Jackson in Delamere Forest.

SCOTLAND.—I have seen an immature example collected by Mr. Wm. Evans on the Isle of May, and have taken it with *S. vulgaris* in a field near Rothsay, on the Isle of Bute.

IRELAND.—The following are the data attached to specimens submitted by Prof. Carpenter:—1, Leenane, Co. Galway, April, 1897; 1, Galway, July, 1895; 1, Ballycorns, Co. Dublin, Feb. 5th, 1909; 1, Manor Hamilton, Co. Leitrim, March 11th, 1908; 2, Lambay, Jan., 1906; 1, Whitehead, Belfast, October 20th, 1897 (R.W.); 1, Clonbrock, Co. Galway, September, 1897; 1, Tallaght, Co. Dublin, April, 1895 (J.A.H.); and 1, Bray, Co. Wicklow, July, 1895.

BB.—*Size smaller, setæ on cercus fewer and less minute, about two-fifths as long as the depth of cercus. Dorsal setæ on tarsi longer than the claws, and a conspicuous series of setæ on the inner margin of tarsus of the last pair.*

Scutigerella spinipes sp. nov.

Material, one adult, two 11-legged and one 8-legged specimen. Length of the largest specimen 3·0 mm. The species, apart from its small size, so closely resembles *immaculata* as to make it unnecessary to describe it in detail.

The number of antennal joints in the larger specimen is 20; the scuta are shaped almost as in *immaculata*, but are distinctly more sparingly clothed with setæ which are comparitively longer, whilst the setæ on the cerci are fewer and distinctly longer, quite twice as long as we have seen in any specimen of *immaculata*, being at least two-fifths the length of the greatest depth of the cercus, those on *immaculata* never being more than one-fifth the depth of the cercus.

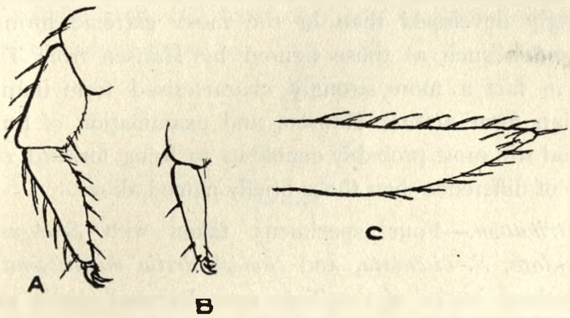


Fig. 2. *Scutigerella spinipes.*

A. Metatarsus and tarsus of last left leg × 120.

B. Tarsus of left front leg × 120.

C. Lateral view of cercus × 120.

The chief feature of the animal lies in the chætotaxy of the legs. In *immaculata* the hind legs are clothed rather closely with short setæ, those on the dorsal surface of the tarsus of the hind leg in the specimens I have seen never being longer than the claws, whilst those on the inside margin of the tarsus are inconspicuous. In *spinipes* all the legs are armed with a few conspicuously long setæ, those on the dorsal row of the tarsus of any leg being longer than the claw of that leg. The leg of the hind pair in my larger specimen has one, three and either four or five long dorsal bristles on the tibia, meta-tarsus and tarsus respectively, the shortest of these being distinctly longer than the longer claw; whilst there is a row of four or five on the inner margin of the tarsus, each being about as long as the longer claw, and a single longer bristle on the inner distal angle of the meta-tarsus, the latter being in itself a good character, as *immaculata* has a series of short bristles on the inside margin of the meta-tarsus (see text-figures.) The bristles on the inner margins of the other legs are fewer and less conspicuous, whilst the legs of the first pair have only two dorsal bristles on the tarsus, one at about the middle and one near the apex.

I think there is every justification for separating this form from *immaculata*, the setæ of the cerci and legs being more strikingly developed than in the most extreme forms of *immaculata* such as those figured by Hansen from Texas. It is in fact a more strongly characterised form than the Algerian form *armata* Hansen, and examination of further material will most probably enable us to bring forward other points of difference than those briefly named above.

Distribution.—Four specimens taken with *Scutigerella immaculata*, *S. biscutata*, and *Scolopendrella minutissima* on the Durham banks of the Tees near Barnard Castle in the early spring of this year (1911.) I should here express my gratitude to Mr. Wm. Hall of Fatfield, who actively participated in the capture of the above-named species, and has helped me on other occasions when in quest of Symphyla.

B.—*Posterior lobes of the 13th scutum each furnished with a process longer than broad; surface of all scuta excepting the 14th covered moderately closely with moderate-sized setæ; 14th scutum without dorsal setæ; cerci shorter and broader, and only sparsely clothed with a comparatively few rather long setæ; tactile hairs on the last segment long and rather strong.*

Scutigerella biscutata sp. nov. (Pl. I., figs. 3–6.)

Material—Numerous specimens from several localities.

Length 3·0 mm. to 3·5 mm.

This species is closely related to the previous form, but is easily separated by the presence of the two flap-like processes of the 13th scutum. The setæ of the scuta are comparatively longer than in *spinipes*, but the dorsal surface of the 14th scutum is devoid of setæ. In *spinipes* the dorsal setæ of the 14th scutum are minute and sparsely set, representing a condition intermediate between *immaculata* (in which this scutum is well clothed with setæ) and the present form *biscutata*. The cerci are shorter and deeper than in *spinipes*, and the tactile setæ are longer and stronger. The setæ of the legs are not so long and conspicuous as in *spinipes*, and are fewer than in *immaculata*, whilst the hind legs (if not all the legs) are more than usually stout, and have only two or three setæ on the dorsal row of the tarsus.

Fig. 3. *Scutigerella biscutata*.
Metatarsus and tarsus of last left leg × 120.

I hope to obtain further material and make a special study of both *spinipes* and *biscutata* before the promised Ray Society Monograph of the British Myriapoda is published. They are highly interesting forms, and whilst both are well characterised they belong to what I consider to be the most difficult group we have in the Symphyla, difficult chiefly on account of the lack of useful characters in the shape and chætotaxy of the intermediate scuta, which make the second group of the genus a much easier one to work.

Distribution.—I first recognised this distinct species from examples taken in a dene at Fencehouses, together with the Diplopod *Titanosoma jurassicum* Verhoeff, in the early spring of this year (1911), and on searching for further specimens of these arthropods I also found another interesting Scolopendrellid in the same dene, namely, *Scolopendrella delicatula* sp. n., and another Diplopod, *Napoiulus* sp., new to this country. In my old collection I detected single examples of *S. biscutata* taken on the Clyde near Bishopton, and on the sea banks at Hart, Co. Durham.

During the year I have seen several specimens from an old quarry and other suitable localities near Penshaw, and with Mr. William Hall of Fatfield, have taken it plentifully on the Durham banks of the Tees at Barnard Castle, June 4th, 1911.

Group II.—Posterior margin of last dorsal scutum without such cavity, but sometimes with simple depression in its place.

A.—*All setæ on dorsal scuta (excepting the antero-lateral pair on the first scutum) backwardly directed, rather short and fusiform. Antennæ with 38 joints.*

Scutigerella hanseni sp. nov. (Pl. I., figs. 7–9.)

Material.—One adult specimen.

Length.—The specimen is distinctly contracted, and measures 4·65 mm. Rather robust.

Head somewhat ovate, about seven-eighths as long as broad, with a sharp lateral angle at the base of the mandible;

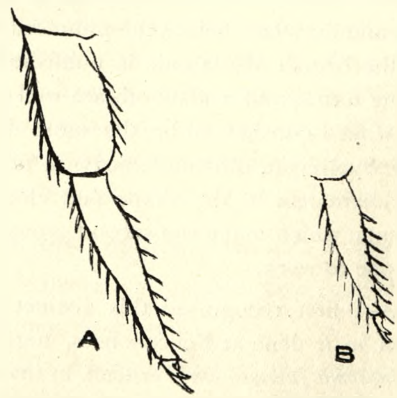


Fig. 4. *Scutigerella hanseni.*
A. Metatarsus and tarsus of last left leg × 90.
B. Tarsus of left front leg × 90.

the longest seta in front of this angle being shorter than the breadth of the basal antennal joint. The posterior angles are broadly rounded and closely set with numerous short, blunt, fusiform setæ up to the angle at anterior third; other setæ moderately long, slender, and acuminate.

Antennæ long and slender, measuring one-half the length of the body, and composed of thirty-eight joints. The setæ on the inner side of the antennæ are not longer than those on the outer side. The secondary whorl does not appear to commence until about the tenth joint, and is well-developed from the 19th joint to apex.

Scuta.—With the exception of a single pair of rather long and pointed antero-lateral setæ on the first scutum, all the setæ on the scuta are of a peculiar and distinctive type. They are moderately closely set, short, blunt at tip, and broadest about the middle, or in other words, more or less roughly fusiform; none are exceptionally long, a pair at the posterior angles of at least the second and third scuta being about one-half as long again as the others. The second scutum is widest posteriorly with the hind angles broadly rounded; the posterior margin is almost straight. The penultimate scutum is somewhat similar in shape, but is less strongly narrowed anteriorly, and has the hind angles less broadly rounded.

Legs.—The legs of the last pair are similar to those in *S. caldaria*, the setæ on the outside margin of the tibia and some of those on the meta-tarsus are short and rather blunt, somewhat similar to those on the scuta, whilst there are at least ten spines in the outer dorsal row of the tarsus and about as many in the same row on the meta-tarsus. The tarsus is slightly longer compared to its depth than in *caldaria*.

Cerci.—At least four or four and one-half times as long as broad; clothed with a moderate number of long stiff setæ, most of which are at least half as long as the depth of the cercus. The terminal setæ are broken off in our single specimen, and the creature itself is in most parts too opaque to describe with satisfaction.

Distribution. – I have only seen one example of this very striking and distinct form; it was taken with *S. immaculata* in a quarry in Axwell Park, Co. Durham.

B.—*All setæ on dorsal scuta normal; a pair of long antero-lateral setæ on scuta 1, 3, 5, 6 and 8. Antennæ with 23 to 25 joints.*

Scutigerella caldaria Hansen.

This is purely a hothouse species. I have recently taken further examples from the Kew Gardens, London, and the Botanical Gardens, Glasgow, and in addition have discovered it in a propagating house in the Victoria Park, Sunderland. It is thus now known from London and Glasgow, and from the counties of Northumberland and Durham. Abroad it is recorded from Denmark and France, and I have taken a specimen from a hothouse in the Brussels Botanical Gardens, Belgium.

Genus SCOLOPENDRELLA Gervais

Group I.—First pair of legs well developed, more than two-thirds the length of the second pair; central cephalic rod interrupted and branched before the middle; hind margin of each scutum with a longitudinally striate belt between the processes, and cerci without the raised transverse lines near terminal area.

Scolopendrella notacantha Gervais.

I am unable to record any further examples of this interesting form. Dr. Randell Jackson has searched for it again on the banks of the Dee at Queensferry, but without success.

Group II.—First pair of legs less than one-half the length of the second pair; central cephalic rod interrupted, but not branched before the middle; posterior margin of scuta simple, and cerci with raised transverse lines near terminal area.

Scolopendrella subnuda Hansen. (Pl. I., figs 10–13.)

Hansen, Quarterly Journal of Microscopical Science, xlvii., pp. 70–72, pl. 6, figs. 2a–2g, 1903.

This is the first British representative of Hansen's second division of the genus, characterised by having the hind margins of the scuta simple, instead of with longitudinally striate belts as in *notocantha*, the only representative of the first division; but like that species those of group II. possess twelve pairs of well-developed legs, the first pair containing three free and distinct joints, excluding the trochanter, and the tarsus terminating with two conspicuous claws.

Group II. is composed of three species, *microcolpa* Muhr. sharply separated from the other two by having the antennal setæ thickened and distinctly pubescent, *subnuda* Hansen, and *silvestrii* Hansen.

Subnuda is a minute species rarely longer than 1.5 mm., and is easily recognised by the very few setæ at the margins of the scuta, the form of the cerci, which are also sparsely spinose, and by the form of the legs. The legs of the last pair have but a single prominent dorsal seta on both the tibia and meta-tarsus, whilst the tarsus has one protruding dorsal seta at the middle, and a shorter sub-apical one. The first pair of legs are half as long as the second, and the anterior claw is well-developed, much-curved, and nearly twice the length of the inferior claw.

Distribution.—In February, 1911, I found a single specimen of this minute form under a stone on the sea-banks, at Hart, near West Hartlepool, and on May 20th had the good fortune to discover another example which occurred under a deeply embedded stone in a large wood on the banks of the Wear between Leamside and Durham. I have a third example taken near Hylton with *S. vulgaris*, and have more recently obtained a specimen from under a stone near Brodick on the Isle of Arran, Scotland, and several specimens from a quarry, Penshaw, 1911.* Hansen described the species from six

* Several on banks of the Wear near Washington, Oct., 1911.

European examples, four collected by himself, together with *S. microcolpa*, at Palmi, Calabria, one taken Mr. C. Börner either at Catania or Palmi, and another example by Mr. Börner from Marburg, Germany.

Group III.—As in Group II., but first pair of legs obsolete.

A.—*Size larger and more robust; last pair of legs with three long protruding dorsal setæ on the meta-tarsus, and five or sometimes four on the tarsus. Setæ on margins of scuta more numerous.*

Scolopendrella isabellæ Grassi. (Pl. I., figs. 14 and 15).

GRASSI, Mem. d. Reale. Accad. d. Sci. di Torino, ser. 2, xxxvii., pp. 594–5, 1886; HANSEN, Quarterly Journal of Microscopical Science, xlvii., pp. 74–77, pl. 6, figs. 4a–4h, 1903.

This form is larger than *S. vulgaris*, to which species it is somewhat closely allied. It may be readily separated by the longer cerci, these being four and one-half times as long as deep, by the shape of the cercus and by the more numerous setæ (including both moderately long and short ones intermingled) which are more closely placed. The leg of the last pair presents a good characteristic in the disposal of the dorsal setæ, the tibia possessing two and the metatarsus three rather long ones, whilst the tarsus has a series of five (or in some specimens only four) setæ, which are shorter than those on the tibia and metatarsus. In *S. vulgaris* the dorsal outstanding bristles of the hind-leg are all rather long, and comprise two on both tibia and metatarsus, and only three on the tarsus. There are minor but important differences in the shape and chætotaxy of the scuta.

I have only seen one British specimen (from Penshaw) that quite agrees with Hansen's diagnoses, but numerous examples from Gibside must be regarded as a variety, for which I propose the name *dunelmensis*.

VAR. dunelmensis nov. (Pl. I., figs. 16 and 17).

This variety differs mainly in the chætotaxy of the second and third scutum. In the typical form there are at least ten or eleven lateral setæ on the second scutum between the antero-lateral seta and the apical one, two of which are distinctly longer than the others ; in all the Gibside specimens there are only seven or eight such setæ, including three more conspicuous or longer ones, namely, one short one, one longer, one, or sometimes two short ones, one longer, two short and one longer, and then the apical seta. The second of these lateral setæ in the third scutum is distinctly longer than in the type form, whilst the setæ of the cerci appear to be more regular in length. In the typical form, so far as I understand, the metatarsus possesses in addition to the three long dorsal bristles a very minute dorso-lateral seta near its most distal extremity; in var. *dunelmensis* this minute seta is replaced by a bristle almost as long as those on the fore-margin, and in one specimen there are four instead of three dorsal setæ on this joint.

Distribution.—Forma principalis. A single specimen taken with *S. vulgaris* on the Wear near Penshaw, Co. of Durham, April, 1911.

Var. dunelmensis mihi. Numerous examples from Gibside, Co. Durham, June, 1911. These were taken under small stones very firmly embedded in much trodden earth, a situation that would appear quite unlikely to harbour such delicate creatures. No examples of *vulgaris* or any other species of *Scolopendrella* occurred with this form.

Grassi in describing *S. isabellæ* records specimens from near Como, near Capua, near Lecco, and at Catania, but Hansen considers that some of his specimens would be really referable to *vulgaris*, a species not then described. Hansen has taken *isabellæ* at Scilla and Aspromonte in Calabria, whilst Börner has taken it at either Palmi in Calabria or Catania in Sicily. Apparently not uncommon in Southern Italy.

B.—*Size smaller and more slender; last pair of legs with two protruding dorsal setæ on the meta-tarsus and two or three on the tarsus. Setæ on margins of scuta fewer.*

AA.—*Setæ on scuta exceptionally long; second scutum with five on the lateral margin and one on the inner margin of process between the antero-lateral and apical setæ and inner basal and apical setæ respectively. Cerci without outstanding setæ on upper or lower margins.*

Scolopendrella horrida sp. nov. (Pl. I., figs. 21 and 22).

Allied to *S. isabellæ* and *S. vulgaris*; about 2·0 mm. in length; slender.

Head as in above-named species, but marginal setæ comparatively longer.

Antennæ in type specimen with fifteen joints, so strongly contracted that up to now I have been unable satisfactorily to determine the secondary whorl.

Scuta.—The second and third scuta (fig. 21) are shaped almost as in *vulgaris;* the processes of the second about as long as broad, and of the third slightly shorter than broad. The distance between the processes of the former scutum is a little more than the length of the process, and of the latter more than twice as long as the length of the process. The setæ are much longer than usual; there are five on the lateral margin of the second, and three on that of the third scutum between the long antero-lateral seta and the apical one, and two on the inner margin of the processes, including one at the angle. The antero-lateral setæ are about one-third longer and the other lateral setæ are either quite as long as or only a little shorter than the processes.

Legs.—The last leg is moderately or rather long, with the tarsus at least four times as long as deep. The type specimen has the hind legs tucked in under the body, with the fore margins of the tarsi touching; I have therefore been unable to determine exactly the nature of the chætotaxy and claws. There are two outstanding setæ on both the tibia and metatarsus, and I think, but am uncertain, that there are three on the tarsus; these setæ are about as long as the depth of the latter joint.

Cerci.—The cercus is considerably shorter than the last leg, and about the same relative length and depth as in *delicatula*. The setæ are not very closely set, and there are no conspicuous outstanding ones on either margin; the setæ are comparatively short, about one-third as long as the depth of the cercus, and several are slightly but by no means conspicuously longer than the others. The apical seta is longer than the upper margin of the terminal area.

Habitat.—One ten-legged specimen found under a small stone embedded in clayey soil on the sea banks near Hart, Co. Durham, with *S. subnuda* and the small wood-louse *Haplophthalmus mengi*. *S. horrida* is most closely related to *vulgaris*, but is easily recognised by its distinctive chætotaxy. The setæ of the scuta are fewer and comparatively speaking exceptionally long, whilst the outstanding hairs on the underside of the cercus are not present. No other described species possesses the exceptionally long setæ seen on the scuta of *horrida*, this character suggesting its specific name.

BB.—*Setæ on scuta normal; second scutum with about seven on the lateral margin and two on the inner margin of process between the setæ before specified. Cerci with a few long outstanding setæ on lower margin only. Three dorsal setæ on tarsus of hind leg.*

Scolopendrella vulgaris Hansen. (Pl. I., figs. 18–20.)

Northumberland.—Wylam, Newcastle.

Durham.—Not uncommon in the Derwent Valley, at Gibside, Winlaton Mill, Winlaton, and Axwell Park; Sunderland. Common on the Wear at Hylton, Penshaw, in Lambton Park, and at Leamside; in a dene at Fencehouses; a few on the banks of the Tees at Barnard Castle, and not uncommon on the Durham side of the Tees at Piercebridge.

Yorkshire.—Common under stones by the river side below Aysgarth Falls and near Redmire, in Wensleydale, June 3rd, 1911.

SCOTLAND.—One specimen, Bishopton, on the Clyde, and several from under stones in a field near Rothbury on the Island of Bute.

CC.—*All setæ on scuta minute and weak; second scutum with only four on the lateral margin and none on the inner margin of process between the setæ before specified. Cerci with a few long outstanding setæ on both the upper and lower margins. Two dorsal setæ on tarsus of hind leg.*

Scolopendrella delicatula sp. nov. (Pl. I., figs. 23–24).

Material.—Several specimens.

Allied to *S. vulgaris.* Slightly more slender and about 2·5 mm. long.

Head almost as in *S. isabellæ* and *S. vulgaris*, but broader, being scarcely longer than broad.

Antennæ with only 17 joints in two specimens and only 14 in another. The secondary whorl at the middle of the antennæ (viz., on the eighth joint) and the antennal setæ are longer than would be expected from the minute and weak setæ of the scuta.

Scuta.—The processes of the second scutum are as long as, or slightly longer than broad, whilst those of the third scutum, which are rather blunt apically, are much shorter than broad. The distance between the former pair of processes is longer than the length, and of the latter about twice the length, of the process. The setæ are very minute and weak, and remind one of the vestigial condition seen in *subnuda*; antero-lateral setæ only about two-thirds the length of the processes. Second scutum with four, and third with three weak lateral setæ between the antero-lateral and apical ones, and the inner margins of processes without setæ, excluding the apical one and one at basal angle.

Legs.—The legs of the last pair are rather short and robust, the tibia, meta-tarsus, and the tarsus each with two outstanding dorsal setæ, which are almost as long as the depth of the tarsus. The tarsus is somewhat stout and not quite three times as long as deep. The claws are rather long and somewhat slender, the inferior claw being shorter, more slender and more strongly curved than the other.

Cerci.—Rather small, roughly about two-thirds the length of the last leg and about three and two-thirds as long as deep. Set with a moderate number of setæ, of which three or four on both the lower and upper margins are long and outstanding, the others being rather short and somewhat depressed. The terminal area is more than one-half as long as the depth of the cercus, and as in *vulgaris*, the apical seta being slightly longer than the length of the area.

Distribution.—Two examples from Fencehouses, Co. Durham, June, 1911; one (with fourteen antennal joints) from Alwinton in Northumberland, July, 1911, and one from a quarry (with *subnuda*) near Penshaw, August, 1911. I also have a second Penshaw example taken by Mr. W. Hall on the Wear banks at South Biddick, June, 1911, which is larger than the others, has the head comparatively longer and the antennæ with twenty-one joints.

This species somewhat resembles *subnuda* superficially on account of the naked appearance of the scuta. It is, however, most nearly related to *vulgaris*, and is easily separated from that species by its shorter, broader head, the form of the scuta and the sparse and minute nature of their setæ. The cercus has the long outstanding setæ on the upper as well as the lower margin, as in *simplex* Hansen, whilst the tarsus of the hind leg is more robust and has only two outstanding setæ on the dorsal row. *S. delicatula* is abundantly distinct from all other described species.

DD.—*Size smaller; setæ of scuta long; second scutum with three long and two small setæ on the lateral margin between the antero-lateral and the apical setæ, and none on the inner margin of process. Cerci sparsely furnished with a few long bristles, and without the long outstanding setæ on the upper and lower margins. Three dorsal setæ on tarsus of hind leg.*

Scolopendrella minutissima sp. nov. (Pl. I., figs. 25–27).

Material.—One specimen with 8 and one with 9 pairs of legs, excluding the vestigial pair.

Size.—The larger specimen is 1·5 mm. long; both are exerted. Very slender.

Head almost as in *S. vulgaris*. The antennæ of the type specimens are not only all broken but too contracted to describe; the largest number of joints we have counted is fifteen, but this is not the full complement.

Scuta.—The second scutum is comparatively speaking exceptionally long. The processes are distinctly longer than broad, whilst those of the third scutum are just as long as broad. The distance between the former pair of processes is very little, if any, longer than the length, and of the latter quite twice the length of the process. The antero-lateral seta is not strongly pronounced, and on the lateral margin of the second scutum there are three long setæ between the antero-lateral seta and the apical one, with two small intermediate setæ as shewn in the figure. The larger setæ are about one-half as long as the process. The antero-lateral setæ of the third scutum are longer than the others, being about as long as the process, whilst there are only two long setæ and no minor ones between the antero-lateral and apical setæ. As in *delicatula* the inner margins of the processes are without setæ.

Legs.—I have not yet made a satisfactory study of the first or vestigial pair, but there is in one specimen a distinct rudimentary leg comprising a single joint twice as long as broad, and surmounted by what would probably be a vestigial claw (fig. 27). The legs of the last pair are long and rather stout, the tibia, metatarsus, and tarsus having one, two, and three long outstanding bristles respectively, these being almost as long as the depth of the tarsus, which is rather stout and about three times as long as deep.

Cerci.—Small, only a little more than half the length of the legs of the last pair, and about three times as long as deep.

The setæ are few in number, sparsely set and comparatively long, being about two-thirds as long as the depth of the cercus. There are no long outstanding setæ on the upper and lower margins. The terminal area is two-thirds as long as the depth of the cercus, and the apical seta is as long as the dorsal length of the area.

Distribution.—Two specimens taken under stones on the Durham banks of the Tees near Barnard Castle in the early spring of this year (1911.) It is a minute form and may easily be overlooked.

S. minutissima is the smallest species of the *S. vulgaris* group, and in form of the scuta is most closely allied to *S. delicatula.* Apart from its minute size it may be readily separated by the distinctive chætotaxy of the scuta, by the fewer, longer and more sparsely set setæ on the cerci and the absence of the long outstanding hairs on their upper and lower margins, and by the number of the outstanding dorsal setæ on the tibia, meta-tarsus, and tarsus of the hind leg. Compared to the size of the creature the scuta are more than usually large.

The following is a list of the species we now recognise as British, with notes on their British distribution :—

1. *Scutigerella immaculata* (Newp.). Widely distributed.

2. ,, *spinipes* Bagnall. A few examples from Barnard Castle, Co. Durham.

3. ,, *biscutata* Bagnall. Probably widely distributed; recorded from several localities in Weardale and Teesdale, Co. Durham, and also from Scotland.

4. ,, *hanseni* Bagnall. One example from Axwell Park, Co. Durham.

5. ,, *caldaria* Hansen. Probably not uncommon; found only in hot-houses; London, Wylam, Sunderland, and Glasgow.

6. *Scolopendrella notacantha* Gervais. Two examples (identification of one uncertain) from Queensferry, Cheshire.

7. ,, *subnuda* Hansen. Rare, but probably of wide distribution; known from several localities in Durham and from Scotland.

8. ,, *isabellæ* Grassi. One example from Penshaw, Co. Durham.

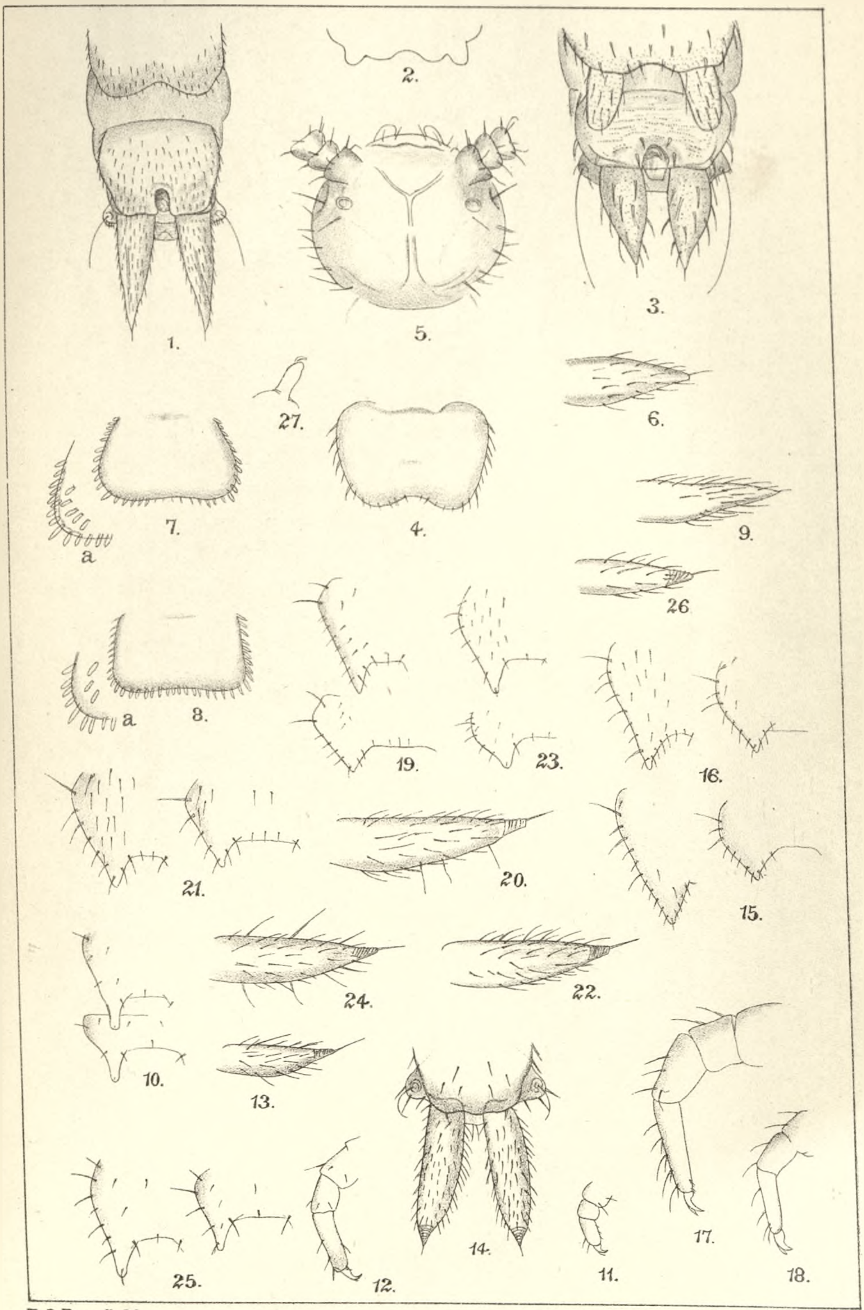
8v. ,, *isabellæ* var. *dunelmensis* Bagnall. Several examples from one locality in Gibside, Co. Durham.

9. ,, *horrida* Bagnall. One example from Hart, Co. Durham.

10. ,, *vulgaris* Hansen. Probably common and widely distributed; known from many localities in Northumberland, Durham, and Yorkshire, and from Scotland.

11. ,, *delicatula* Bagnall. Rare, a few examples from three localities in Durham and from one locality in Northumberland.

12. ,, *minutissima* Bagnall. Two examples from the Durham banks of the Tees at Barnard Castle.



R. S. Bagnall, del.
W. West, lith.

E. Wilson, Cambridge.

BRITISH SYMPHYLA.

EXPLANATION OF PLATE I.

1. *Scutigerella immaculata* (Newport). Dorsal view of end of abdomen showing cerci, 14th and part of 13th scuta × 30.
2. ,, ,, Outline of posterior margin of 13th or penultimate scutum of another specimen × 38.
3. ,, *biscutata* Bagnall. Dorsal view of end of abdomen showing cerci, 14th and part of 13th scuta × 60.
4. ,, ,, 2nd dorsal scutum × 45.
5. ,, ,, Dorsal view of head × 60.
6. ,, ,, Lateral view of cercus × 60.
7. ,, *hanseni* Bagnall. Outline of 2nd scutum × 45. *a* showing character of setæ.
8. ,, ,, Outline of 13th scutum × 45. *a* showing character of setæ.
9. ,, ,, Lateral view of cercus × 60.
10. *Scolopendrella subnuda* Hansen. Left margin of 2nd and 3rd scuta × 150.
11. ,, ,, ,, Left leg of the 1st pair × 150.
12. ,, ,, ,, Left leg of the 12th pair × 150.
13. ,, ,, ,, Lateral view of cercus × 150.
14. ,, *isabellæ* Grassi. End of abdomen showing dorsal view of cerci × 60.
15. ,, ,, ,, Left margin of 2nd and 3rd scuta × 75
16. ,, ,, var. *dunelmensis* Bagnall. Left margin of 2nd and 3rd scuta × 75.
17. ,, ,, ,, Last leg of the 12th pair × 90.
18. ,, *vulgaris* Hansen. Last leg of the 12th pair × 90.
19. ,, ,, ,, Left margin of 2nd and 3rd scuta × 90.
20. ,, ,, ,, Lateral view of cercus × 120.
21. ,, *horrida* Bagnall. Left margin of the 2nd and 3rd scuta × 90.
22. ,, ,, ,, Lateral view of cercus × 120.
23. ,, *delicatula* Bagnall. Left margin of the 2nd and 3rd scuta × 90.
24. ,, ,, ,, Lateral view of cercus × 150.
25. ,, *minutissima* Bagnall. Left margin of the 2nd and 3rd scuta × 120.
26. ,, ,, ,, Lateral view of cercus × 120.
27. ,, ,, ,, Vestigial leg of the 1st pair × 300.

New and Rare British Spiders.

By the Rev. J. E. Hull, M.A.

(With Plate II.)

The notes now given cover my systematic collecting in West Allendale from May, 1910, to November, 1911, together with the more noteworthy results of four days' collecting at Forres, N.B., in August, 1910; a day at Ullswater in June, 1910; eight days in the neighbourhood of Beal, Northumberland, in May and June, 1911. A few notes refer to specimens submitted to me by correspondents.

The new spiders noted below are *Hilaira nubigena* ♂ ♀; *Agyneta mystica* Cb. ♂; *Scleroschema reginaldi* ♀; *Cnephalocotes ambiguus* Cb. ♀; and *Cnephalocotes incurvatus* Cb. ♀. *Lycosa agricola* Bl., var. *maritima* is a known variety which seemed to require a varietal name, here supplied. *Prosthesima apricorum* L. K., *Tarentula barbipes* Sund., and *Hilaira frigida* Thor., are names which I think should be substituted for others current in British lists, for reasons given below. It seems necessary also that a new status should be ascribed to *Caledonia evansii* Cb., to indicate its substantial identity with *C. aliena* Kulcz., a Kamtschatkan spider.

The list includes thirteen new records for Northumberland (marked with an asterisk)—ten species and three well-known varieties.

Prosthesima apricorum L. K.—*P. petiverii* Scop.: Cb. Brit. and Irish List, 1900.—An adult male, Staward Peel, June; adult females, Glenridding, Westmoreland. These were submitted to Dr. Kulczynski, who pronounced them identical with the spider called by him *P. apricorum* L. K. Following Simon (Arachn. de France, iv., p. 63) we have dropped *atra* Latr. in favour of *latreillei* Sim. To be consistent we must also abandon *petiverii* Scop., which is no more authentic than *atra* Latr. If retained, it belongs rightfully to *P. subterranea* C. L. K., which is very nearly allied to *apricorum* L. K., and of longer standing. Dr.

Kulczynski's allocation of these two names is now well established; and as the original types are apparently not available, it is inevitable that we should conform with Continental usage.

Zora nemoralis Bl. Both sexes occurred plentifully among heather in a birch wood on the southern margin of the Culbin sands, Forres. So far as I know this is the most northern record of this species.

Scotina gracilipes Bl. An adult female was taken at the same time and place as the preceding.

Clubiona neglecta Cb. Adult females, Culbin sands, August; Warkworth, September.

Clubiona grisea L. K. Adult females, Culbin sands; with *neglecta*—probably the most northerly record for Britain of both species.

Xysticus sabulosus Hahn. A single adult female on the seaward side of the Culbin sands.

Tibellus oblongus Walck. Very abundant on the sandhills of the Northumbrian coast, but apparently much less so in the same situation in Elginshire. Dr. Kulczynski has recently pointed out that under this name two species — the true *T. oblongus* Walck. and *T. maritimus* Menge—have been confounded by British arachnologists and others. All the examples I have seen from the northern coast sandhills appear to be *T. oblongus* Walck.

Attus caricis Westr. An adult pair was taken in June at Newton Moss, Penrith, where it was first taken by Mr. F. O. Pickard-Cambridge and recorded under the name of *Dendryphantes hastatus*. This mistake, I understand, is being rectified by the Rev. O. Pickard-Cambridge in a forthcoming paper. I know of no British figures of this species and therefore take this opportunity of supplying them.

***Heliophanus cupreus** Walck. A female was taken at Staward in June—the first record for Northumberland. It is singular that Dr. Jackson did not find this spider at Hexham. It ought to be found in most parts of the county, as it is not rare in Cumberland and the south of Scotland.

Euophrys erratica Bl. Both sexes, Kyloe Crags, May.

Hahnia nava Bl. Goswick links, June.

Trochosa cinerea Fabr. During the past summer I have had from time to time fine specimens of this spider from the workmen engaged in carting stones from the bed of the West Allen at Ninebanks. No doubt it is to be found throughout Northumberland and Durham in similar places. A female was sent to me recently by Mr. W. L. Turner from the neighbourhood of Blanchland. It was, however, taken on the Northumberland side of the Derwent.

Tarentula barbipes Sund.—*T. andrenivora* Walck. of British authors.—As far as I know, the typical male of *Tarentula andrenivora* Walck. has never occurred in Britain, all the records, as I understand, referring to *T. barbipes*—which if not a true species, is at any rate so constant and distinct a form that it ought to be recorded under this name. I have had it recently from Kyloe (Northumberland), Cleveland, and Elginshire. The Cleveland example was named for me by Dr. Kulczynski.

Lycosa postuma Cb.—*Trochosa postuma* Cb., Proc. Dorset Field Club.—August is a bad month for *Lycosæ*, so that I was very fortunate in obtaining a fine adult female of this spider on the Culbin sands. Mr. Pickard-Cambridge confirms my identification. This is the second occurrence, the type specimen, also a female, having been taken near Balmoral many years ago. As this was in bad condition I have handed over the Culbin specimen to Mr. Pickard-Cambridge, who will give a supplementary description in a forthcoming paper. Here I need only add that it is undoubtedly a *Lycosa*, nearly allied to *L. amentata* Sund.

*Lycosa purbeckensis F. Cb. Both sexes, abundant among the grass just above high water mark at Fenham. Like other northern examples of this species they were all of the var. *minor*.

*Lycosa agricola Bl., nov. var. maritima. Very plentiful on the shingle at high watermark near Ross links. These were all of the maritime form, which, so far as I can make out at present, differs from the inland form in colour only. The general hue is reddish brown instead of hoary grey, and the median band of the thorax is usually without the characteristic constriction. This spider, which I have met with before in Galloway and on the Moray Firth and mistook for *L. arenicola* Cb., should I think receive the varietal name of *maritima*.

Dictyna arenicola Cb. A single immature female which may certainly be referred to this species occurred on the links at Findhorn.

Meta menardi Latr. A numerous colony was recently discovered by Mr. J. Walton Lee in a cellar under Dilston Castle. Several examples of both sexes, taken in the Isle of Wight, have also been submitted to me by Mr. H. W. White of Harrow.

*Ero cambridgii Kulcz. I have had the female of this species (lately separated from *furcata* Vill. by Prof. Kulczynski) under observation for three years but failed to get a recognisable male. I have females from Ross links, North Sunderland, Cresswell, Newbiggin, and Ninebanks.

Asagena phalerata Panz. Adult females, under stones, Ninebanks.

Robertus neglectus Cb. Adult females (with eggs) Glenridding, June; Kyloe Crags, June.

Robertus arundineti Cb. Adult male, Culbin sands. Both sexes, Glenridding.

*Agyneta mystica Cb. Adult male and three females, Ninebanks, May and June; an adult female, Findhorn links. Previously the type specimen, a female from Balmoral, had long remained unique. The male, therefore, is new, and will be described by Mr. Pickard-Cambridge.

Agyneta passiva Cb. Both sexes, Fenham, May.

Agyneta cauta Cb. A single adult female, Culbin sands. Second record from Scotland.

Agyneta—Micryphantes—Microneta—Syedra. In a previous paper I ventured to propose the new genus *Agyneta*, giving a brief diagnosis, with the intention of going through the four above-named genera more carefully in a subsequent paper. Dr. Jackson has, however, undertaken the very necessary task. At present, therefore, I must content myself with rectifying my statements concerning the genus *Agyneta* in two particulars. First, it was a mistake, as Dr. Jackson has since pointed out to me, to say that fang-teeth were totally absent: there is a single central outer tooth, and perhaps another, exceedingly small, at the extremity of the fang-groove. Secondly, *conigera* Cb. was inadvertently omitted from the list of species.

Porrhomma microphthalmum Cb. An adult male at 2,000 feet on Killhope Law. An adult female at Ninebanks at about 1,100 feet.

Pœciloneta variegata Bl. Findhorn links and Altyre woods, Forres. These individuals were very dark coloured, the abdomen being almost entirely black. This species, commonly associated with *Bathyphantes*, has very little in common with that genus, from which it differs in the armature of the legs, in the dentition of the falces, and most significantly in the genitalia. Its nearest ally seems to be *Drapetisca*.

Bolyphantes expunctus Cb. Three years ago I recorded this species from the neighbourhood of Forres, where it was taken by Mr. J. W. H. Harrison, but the exact habitat was not known. To re-discover it and learn something of its life-history was the main reason why he and I visited that district in August, 1910. We succeeded in locating it in the Altyre pinewoods (famous among lepidopterists as a breeding place of *Eupithecia togata*, and with botanists as one of the few habitats of *Goodyera repens*) where it swarmed on the lichen-covered conifers. On the clean conifers comparatively few were found, and on other trees only stray examples. As far as I could discover it makes no snare of any kind and evidently subsists chiefly on the pine aphis. It comes to maturity about the middle of August, a good many examples being still immature on the 17th. Very nearly 300 adult specimens were taken in a very few minutes. Since then I have learnt from Mr. W. Evans of Edinburgh that he has taken it plentifully on juniper at Aviemore, where it was associated with *Dictyna arenicola* Cb.

Oreonetides adipatus C. L. K. Adult female, Killhope Law, August, 1911.

Oreonetides firmus Cb. A single adult female occurred in the birch wood on the southern border of Culbin sands. First record for Scotland.

Hilaira frigida Thor.—*H. montigena* L. K. of British authors. By the kindness of Dr. de Lessert of Geneva, I have a pair of Swiss examples of *H. montigena* L. K., which is quite different from our British spider. After some correspondence with Dr. Kulczynski and Mr. Cambridge I have come to the conclusion that our British spider should be called *H. frigida* Thor. A single adult female was taken at Lochan Dorb, Inverness-shire, in August.

*__Hilaira nubigena__ sp. n. Killhope Law. Description, etc., below.

Sintula cornigera Bl. An adult female was captured on the bank of the Findhorn River near Forres.

Phaulothrix Bertkau. So long as *huthwaitii* Cb. and *hardii* Bl. are regarded as congeneric, their common generic name should be *Phaulothrix* Bertk. not *Leptorhoptrum* Kulcz. as given in my last paper—that is, assuming that *Leptothrix* Menge is really preoccupied, as Simon says it is; but the only previous use I can trace is for a botanical genus.

Phaulothrix hardii Bl. Abundant on the Culbin sands in August on the part nearest the sea. Also on the Findhorn sandhills. All the examples taken were immature, lacking their final moult.

*Coryphæus simplex F. Cb. Adult female from Cresswell sandhills, sent to me by Mr. W. Flowers.

*Erigone atra Bl.—var. lantosquensis Sim. According to Dr. Kulczynski, the form of *E. atra* Bl. with a rudimentary denticule on the lower face of the palpal tibia of the male is *E. lantosquensis* Sim. I do not remember ever taking it along with the typical form (which is sometimes very abundant on wire fences on the Allendale moors up to 1,800 feet or thereabouts), and all the specimens I at present possess are from maritime localities. During 1910 I took it at Findhorn Bay (August) and Warkworth (September).

*Erigone arctica White—var. maritima Kulcz. Dr. Jackson has pointed out to me that this particular form of *arctica* White has not been definitely recorded for Northumberland. Nevertheless, it is fairly plentiful on the Northumberland coast, though not in my experience so abundant as the typical form.

Lophomma herbigradum Bl. A fine gynandrous example of this common species was taken by me at Ninebanks in the spring of 1910. For the most part this specimen exhibits the usual phenomena of bisexuality; that is, one side is male and the other female, with no atrophy or distortion of parts except where mutual accommodation is necessary on the median line. Naturally this disturbance of structure shows itself chiefly in the sexual region of the epigaster. In the present instance the female side of the external genitalia suffers less modification than the male side (pl. ii., figs. 8, 9). In one particular, however, this individual differs from all other bisexual spiders I have ever seen or heard of; for while the right side of the cephalothorax is male and the left female, in the case of the abdomen the sexes are reversed—the right side being female and the left male.

Lophomma subæquale Westr. An adult female, Goswick links, June.

Entelecara thorellii. Both sexes plentiful, Fenham and Ross links, May and June.

Entelecara trifrons Cb. Both sexes, Fenham, May.

*Entelecara omissa Cb. An adult female was taken at Ninebanks, in November, at a depth of five or six feet in a "dead-heap"—that is, a heap of limestone boulders, the refuse of an old lead mine.

Notioscopus sarcinatus Cb. Mr. Harrison has again procured this species pretty freely at the original spot on Eston Moor, Cleveland, but as far as I know it has failed to turn up elsewhere. Simon (Hist. Nat. d. Araignées, 2nd ed., i., 667) rightly recognises the relationship between this genus and *Oedothorax* Bertk., from which it may be distinguished by the recurved line of the front eyes and the five inner fang-teeth.

Caledonia aliena Kulcz.—sub-sp. evansii Cb. *Caledonia evansii* Cb. of British authors.

Dr. Kulczynski's excellent figures and description of his *Erigone aliena* (Aran. in Camtsh. Coll., 1885) long ago suggested to me that this spider was identical with the species known in Britain as *Caledonia evansii* Cb. During the past summer I submitted British examples to him for comparison with his type specimen. Having compared the two, he says that they are identical save for a slight difference in the copulatory organs, such as frequently appears in spiders of the same species widely separated geographically. He is therefore inclined to regard *evansii* Cb. as a sub-species of *aliena* Kulcz., and perhaps that is the simplest method of recognizing both the agreement and the difference. The difference in this case is solely in the position of a minute spine on the middle coil of the central spiral vessel of the copulatory apparatus of the male. It is on the anterior face in British examples, on the posterior in the Kamschatkan type (pl. ii., figs. 14, 15). It may be observed that this genus also has affinities with the *Oedothorax* group, but in a systematic arrangement it ought probably to stand nearer to *Dicymbium* and *Tiso*.

Troxochrus scabriculus Westr. Mr. F. P. Smith suggested to me some time ago that a new genus was required for this species. That, as it happens, is impossible; for Simon makes it the *typus* of *Troxochrus*. Nevertheless it is true that it ought not to be considered congeneric with *hiemalis* Bl. and *ignobilis* Cb. On the other hand it appears to me to agree in all essential generic characters with *Tapinocyba*, differing in nothing but what is incidental to its somewhat larger size. In fact the agreement is so absolute that I see no valid reason for maintaining two separate genera for these spiders. An appeal to the dentition of the fang-groove confirms this view. In the alliance to which these spiders belong, the number of inner teeth may be 3, 4 or 5, and the number 4 occurs only in the spiders now under consideration. I am therefore of the opinion that *Tapinocyba* should be dropped as a synonym of *Troxochrus*. As a new genus must be established for *hiemalis* Bl. and *ignobilis* Cb. I propose the name *Scleroschema* and append a brief diagnosis.

Scleroschema gen. nov.

General form of *Aræoncus* (with which it also agrees in type of genitalia) but the legs of both sexes are normal in form and clothing, with the tarsi as long or nearly as long as the metatarsi; the cuticle is more coriaceous; the curvature of the front line of eyes is much less. From *Troxochrus* it differs in the narrow caput, which is without postocular furrows in the male, and in the genitalia, which are of quite a different type. From all its nearer allies it differs in having only three teeth on the inner margin of the fang-groove.

British species: *hiemale* Bl. (type); *ignobile* Cb.

Troxochrus scabriculus Westr., with which these spiders have been associated, is a summer spider, while these two species mature much later in the year.

*Scleroschema reginaldi n. sp. An adult female, Fenham, Northumberland. Description and figures below.

Troxochrus exilis Bl.—*Tapinocyba pallens* Cb. Auctt.

Blackwall's description (Spiders G. B. & I., p. 305) of his *Walckenaera exilis* and of its habitat fit *pallens* Cb. so exactly, to the exclusion of every other species known to me, that comparison of types could hardly make the synonymy more certain; therefore, though the types of *exilis* Bl. are lost, I have no hesitation in applying Blackwall's name to the spider commonly called *Tapinocyba pallens* Cb.

This species occurred in the pine woods of Altyre, near Forres, among pine needles, along with *Oonops pulcher* Templ. and other commoner species.

Troxochrus præcox Cb. Both sexes, Fenham, May.

Gongylidiellum vivum Cb. An adult female, Culbin sands. First record for Scotland.

Diplocephalus castaneipes Sim. An adult female, Lochan Dorb, Inverness. This is the first record for

Scotland, but no doubt it occurs commonly on the mountains. The present specimen occurred at about 1,800 feet.

*Cnephalocotes curtus Sim. An adult female, Findhorn links. Both sexes on the coast at Fenham, Northumberland.

Cnephalocotes ambiguus Cb. Plentiful on the mud-flats on the southern shore of Findhorn Bay. The only previous record is of the type specimen (a male) which was taken in the Isle of Arran by Mr. W. Evans. The female is therefore new. Mr. Pickard-Cambridge has undertaken to describe and figure it.

Cnephalocotes incurvatus Cb. Northumbrian coast, near Cresswell; Findhorn links: an adult female in each place. This sex was previously unknown (see description below, and plate ii., fig. 20).

*Cnephalocotes interjectus Cb. Northumbrian coast, Beadnell; plentiful.

Lophocarenum parallelum Bl. Both sexes, Ross links, June.

Hilairȧ nubigena n. sp.

Plate II., figs. 1, 4, 5, 6, 7, 13.

Male.—Cephalothorax 2·10 mm. long, greatest width 1·52 mm. Frons flattened, nearly horizontal, sparsely sprinkled with bristles, the longest of them being in the median line. Occipital tuber dome-shaped, sloping more steeply in front than behind, traversed by a median line of longish bristles.

Eyes comparatively small. Upper row strongly procurved; the middle interval about two-thirds of the lateral, slightly concave. Lateral eyes on prominent tubercles, the anterior occupying the summit and its fellow the posterior slope, the former being the longest of the eight. Clypeus vertical, rather higher than the ocular quadrangle is long.

FALCES normal; outer teeth 5, inner 3 (the distal two small and obtuse, the third larger and acute).

PALPI.—Femur ·65 mm. long; patella ·16 mm. long, ·21 mm. wide, convex above, concave below (viewed laterally); tibia only ·17 mm. long below but very convex above and produced to a length of ·65 mm., its greatest width being ·44 mm. The upper surface is uniformly convex on the outer side, but the anterior part of the inner side is very dark coloured and slightly concave, so that there is a median ridge terminating at the middle projecting point of the fore margin, which point is obtuse and a little curved downward. On either side of it the margin forms a fairly deep sinus, the outer longer than the inner and divided almost equally by a broad rounded point which projects forward. On the under surface of the main central projection there is a dark transverse ridge which does not reach either margin. Tarsus ·78 mm. long. The copulatory organs follow the normal plan of the group to which this species belongs, nevertheless the terminal lobe is very distinctive in structure. When the tarsus is viewed from below the lobe occupies the outer half of the distal end, and presents a quadrate membranous surface encircled by a narrow chitinous rim. This rim is sinuous, and at the outer side (where it is turned up sharply almost at right angles to its normal plane) it is faced by a dark rounded projection hollowed on the inner side. Behind this terminal lobe the spathulate tip of the embolus is just visible. Basal part of the paracymbium comparatively small, flat, with a tuft of bristles; the free recurved half very strongly carinate, the ridge rising sharply from the middle of the limb and continuing nearly parallel to the outer edge.

LEGS comparatively short and slender. Patellar and tibial spines normal; trichobothrium of metatarsus iv. exactly at the middle of the distal half. Metatarsus i. bowed at the base, with the basal half of the remainder fusiform, the distal half nearly cylindrical and slender. Above and on either side of the swollen part are grouped a score of stout black spines of various sizes. Four of these approach the median line of the upper side, three in front and one behind; below these eight on either side. Beyond these are two more on the front side.

Female.—Cephalothorax 2·10 mm. long, 1·50 mm. wide at the broadest part, 1 mm. wide at the clypeus. Caput convex, perceptibly raised behind the eyes. All the thoracic furrows strongly marked.

Eyes pretty closely grouped, covering a space ·70 mm. wide. Upper medians and fore laterals equal in size, the diameter being one-third longer than that of the fore medians. The latter are nearly in contact. Middle interval of the upper row considerably less than the lateral.

Falces normal, except that the inner teeth seem to be rather larger than usual in *Hilaira*, though not so strong as in *Phaulothrix*.

Legs.—Tibiæ i. and ii. cylindrical, their diameter 2½ times that of the metatarsi. Tibia iv. subclavate; diameter at the distal end ·27 mm., at the base ·19 mm. Spines normal but comparatively weak, especially the distal spine of tibia iv. Hairs coarse and bristly. Lengths of joints of first pair—tibia 1·22 mm., metatarsus 1·00 mm., tarsus ·55 mm.; of the fourth—tibia 1·20 mm., metatarsus 1·22 mm., tarsus ·77 mm.

Epigyne unusually large, its width being ·64 mm. It is raised into a transverse ridge some ·37 mm. above the level of the epigaster at its highest point. The backward slope is very steep and almost wholely occupied by the vulvar fovea. The sculpture of the vulva is more elaborate than in any of the allied species, and will be best understood by a reference to the figures.

Coloration normal of the genus, with the thorax darker than usual and the furrows more strongly marked. In the case of the male the contrast between the dark thorax and the pallid dome of the cephalic tuber is heightened by the difference in the surface of the cuticle, the thorax being thickly pitted with minute impressions. Generally the two sexes agree in colour, but some males have the thorax nearly dead black.

Killhope Law, July, 1910, 1 female; October 5th, 1910, several females; July, 1911, half-a-dozen females; August 15th, 1911, 1 male, 1 female; September 7th, 1911, 11 males and about 40 females. All these were taken in the same swampy patch just above the old mines on the western side of the watershed between East and West Allen, and nearly all of them within a very restricted area on the western edge of this swamp. On the last date named, the rushes on this very spot had been mown and lay in two heaps. One of these yielded a male and a female. After trying all over the swamps (unusually dry after the long drought) and obtaining four females only, I returned to this spot, and in half an hour obtained the total number recorded above. The male would seem to attain maturity about the middle of August, so that its adult period probably coincides with that of *H. excisa* Cb. The present species, however, belongs to the Arctic group, distinguished by the peculiar metatarsus of the first pair of legs (in the male), which includes *glacialis* Thor., *incondita* L. K., *consimilis* Cb., and *mirabilis* C. L. K., all of which it considerably exceeds in size. In this respect the two sexes are about equal, the total length ranging from 4 mm. to 4·4 mm.

Scleroschema reginaldi n. sp.

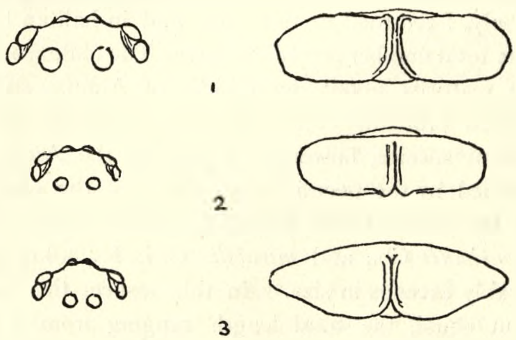
Adult female. Total length 1·6 mm.

On the strength of the following generic characters I assign this spider to the genus *Scleroschema* :—

Sternum broad, with a wide termination behind; cuticle of the abdomen coriaceous; inner teeth three; hairs of the legs long and tibial setæ pretty strong, longer than the diameter of the joint; tarsi and metatarsi of the first pair of legs equal; the spiracular fold just reaching the margin of the mamillary cavity; front line of eyes recurved; epigyne more than twice as broad as its median length.

SPECIFIC CHARACTERS. — Cephalothorax comparatively broad, its width along the line of the upper eyes ·35 mm. Its cuticle is quite smooth. Eyes comparatively large, but their position normal of the genus: clypeus vertical, not in the least protuberant. Sternum nearly smooth, without wrinkles or pits.

Abdomen rather broad. Epigyne three times as wide as long; front and back margins parallel. The epigynal plate, the surface of which is wrinkled all over, is cleft along the median line. The margins of the two valves are raised into a rim along the borders of this cleft, and are nearly in contact in front but divergent in the posterior half, so as to expose a paler triangular piece below.



1. *Scleroschema reginaldi* sp. n. 2. *S. hiemale* Bl.
3. *S. ignobile* Cb.
[Eyes from above; epigyne from below].

Cephalothorax brown with a dusky indefinite patch in the middle and a dark margin; all its appendages clear yellow, but there are very narrow rings of clear black at the extremities of coxæ, trochanters, femora and tibiæ, and at the base of the femora. Sternum (and also the epigynal plate) rich dark brown. Abdomen wholly black.

The smooth and glossy cephalothorax and sternum, without rugosity or impressions of any kind, will distinguish it from either of its congeners.

A single adult female was taken by my son, Mark Reginald, at Fenham, Northumberland, in May, 1911.

Cnephalocotes incurvatus Cb. (?)

Plate II., fig. 10.

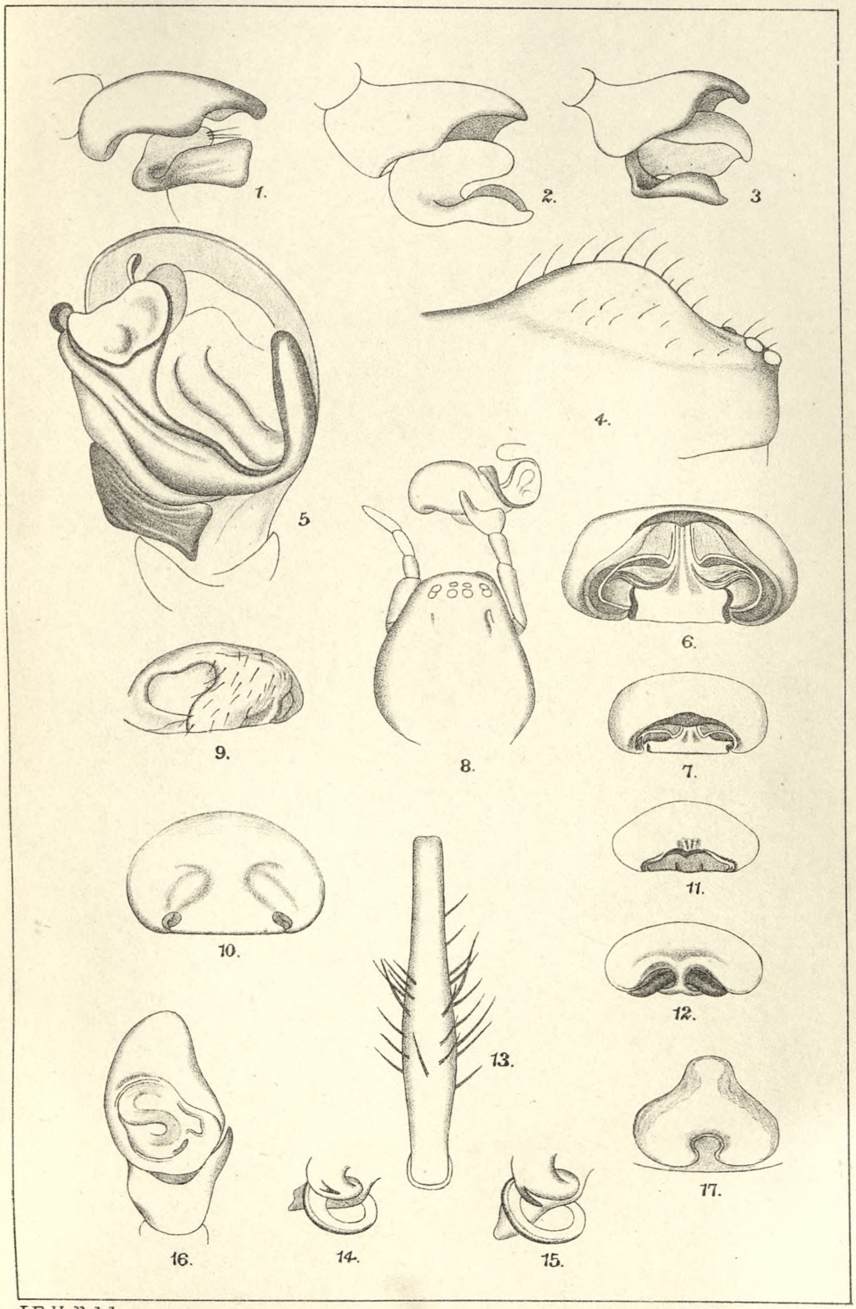
Female.—Total length, 1·86 mm. Abdomen greenish black, broad oval, with the usual four impressed reddish spots on the anterior half. Underside a trifle paler, with two parallel longitudinal rows of pale spots. The rust-coloured indurations are present only in front of the spinners and on either side of the genitalia. The general characters are those of *Cnephalocotes*, and the only tangible specific character is the structure of the epigyne. In this it approaches most nearly to *C. pusillus*, and the general form—as will be seen from the figure—is suggestive of *Lophocarenum* rather than of *Cnephalocotes*. The most distinctive features are a pair of tiny reniform openings towards the posterior margin and very wide apart.

This spider is identified with *C. incurvatus* only conjecturally. It corresponds with the male sufficiently well and seems to occupy the same geographical area. Two specimens were taken in 1910—one by Mr. W. Flowers on the coast sandhills near Cresswell, Northumberland, in June; the other by myself on the sandhills at Findhorn in August. The latter is now in the possession of the Rev. O. Pickard-Cambridge, who agrees with me in thinking that it is probably the missing female of *C. incurvatus* Cb.

REFERENCES TO PLATE II.

(All the figures are drawn from specimens immersed in spirit).

1. *Hilaira nubigena* ♂ : tibia and paracymbium of right palpus, outside.
2. ,, *montigena* L. K. ♂ : ,, ,, ,,
3. ,, *frigida* Thor. ♂ : ,, ,, ,,
4. ,, *nubigena* ♂ : caput viewed laterally.
5. ,, ,, ♂ : tarsus of right palpus from below and a little in front.
6. ,, ,, ♀ : epigyne from behind.
7. ,, ,, ♀ : epigyne from below.
8. *Lophomma herbigradum* Bl. (gynandrous) ; cephalothorax and palpi.
9. ,, ,, genital region of epigaster.
10. *Cnephalocotes incurvatus* Cb. (?) ♀ : epigyne.
11. *Hilaira frigida* Thor. Epigyne, from below.
12. ,, *montigena* L. K. Epigyne, from below.
13. ,, *nubigena* sp. n. ♂. Metatarsus of first pair, from above.
14. *Caledonia aliena* Kulcz. ♂ : apical part of copulatory organ.
15. ,, *evansii* Cb. ♂ : ,, ,, ,,
16. *Attus caricis* Westr. ♂ : Tibia and tarsus of left palpus from below.
17. ,, ,, ,, ♀ : epigyne.



J. E. Hull, del.
W. West, lith.

E. Wilson, Cambridge.

NEW AND RARE BRITISH SPIDERS.

Notes on Pauropoda, with a brief description of a New Species of Brachypauropus.

By Richard S. Bagnall, F.E.S., F.L.S.

Since the publication of my short paper on British Pauropoda (present Trans., n.s. iii., pp. 654–659, pl. xix., figs. 11–25) I have examined some more local material, and am able to give further localities for some of the species and to record a new species belonging to the family Brachypauropodidæ—the least known of the three Pauropod families. Unfortunately my best preparation of this latter animal was accidentally destroyed after examination, and the figure of the anal segment is from a rough sketch then made; the figure of the antenna is from a second example.

I find particular pleasure in naming the species after Lord Avebury—the discoverer of the Order Pauropoda.

Family PAUROPODIDÆ Lubbock.

I have now obtained Prof. Silvestri's valuable work on Pauropoda. He goes wonderfully fully into the anatomy of the animal, and describes several species that may reasonably be expected to occur in this country. Our species *gracilis* Hansen, *vulgaris* Hansen, and *danicus* Hansen, are referable to the genus *Allopauropus* Silv.

Genus PAUROPUS Lubbock.

Pauropus huxleyi Lubbock.

From under a log of wood in a quarry near Penshaw.

Genus ALLOPAUROPUS Silvestri.

Allopauropus gracilis (Hansen).

Common in the Penshaw district; on the Durham banks of the Tees at Barnard Castle; Harbottle and Hartley, Northumberland.

A. gracilis, as well as *vulgaris* and *danicus*, occur in Italy.

Allopauropus danicus (Hansen).

Since recording this species from Sunderland I have taken an example on the edge of a wood on the river Wear between Durham and Leamside.

Family BRACHYPAUROPODIDÆ Cook.

Genus BRACHYPAUROPUS Latzel.

Only two species, *hamiger* Latzel and *superbus* Hansen, are known, the latter described from a single male. Our knowledge of the family, as Hansen says, is scanty, and knowing exactly where my species was taken, I hope to obtain further material and so perhaps add a little to our knowledge of an intensely interesting creature. In the meantime I give the following brief description.

Brachypauropus lubbocki sp. nov.

Length about 0·5 mm. This species is sharply separated from *hamiger* and *superbus*—the only characterised forms—by the form of the antennæ and of the anal plate and styli.

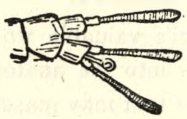


Fig. 1. *Brachypauropus lubbocki.* Part of right antenna × about 300 diameters.

Fig. 2. *Brachypauropus lubbocki.* Processes of anal plate and styli *(s)* from above × about 500 diameters.

The branches of the antenna are short, scarcely longer than broad, whilst the flagella are short and stout, about three times as long as the length of the globulus and stalk.

I was unable to make out the whole of the anal plate, only the processes, which from above are leaf-like, whilst each of the very characteristic styli resembles a short inverted T.

Habitat.—Two specimens from a quarry near Penshaw, Aug., 1911, together with three examples of a minute apterous and primitive insect belonging to the recently diagnosed Order Protura—representatives of which have not been previously recorded as British. My friend Mr. H. S. Wallace was with me on the occasion of these interesting captures.

A Section of the Cliffs near Newbiggin-by-the-Sea, in which is exposed a Gravel Bed containing Chalk Flints.

By R. G. A. Bullerwell, M.Sc.

In the cliffs to the south of Newbiggin-by-the-Sea, and about 450 yards from the mouth of the river Wansbeck, is exposed an accumulation of coarse gravel occupying a position between the Coal Measure sandstone and the Boulder Clay, and abutting against an ancient cliff running normal to the present sea front.

The gravel deposit is 480 feet long, diminishing in thickness as it is traced from north to south. At its northern extremity it constitutes nearly the entire section of the cliff, which is here 22 feet high, the visible gravel being 18 feet thick. Its base is hidden beneath the gravel and sand of the present beach, while it is covered above only by a few feet of boulder clay. Southward the gravel thins out, and is seen resting upon the dipping surface of the sandstone, and covered by a thicker deposit of boulder clay; until at a distance of 470 feet from the old cliff it is only one foot thick and 11 feet above the beach. No means exist for determining the extent of the gravel bed inland, no deposit of a precisely similar nature having been observed in the neighbourhood.

From Newbiggin Bay southward the rocks form hard precipitous cliffs in which two thin beds of coal are exposed. The sandstone has in places been quarried for building purposes. Below the point marked "Hawk's Cliff" on the ordnance map the rocks are softer, and consequently have been more readily affected by the abrasive action of the tide and atmosphere; so much so that in contact with the gravel bed the precise structure of the cliff can be noted only after a specially high tide, when the debris of crushed sandstone and broken shale has been cleared away. The rocks are gently folded and present a series of anticlines and synclines. The strata exposed show the following sequence:—

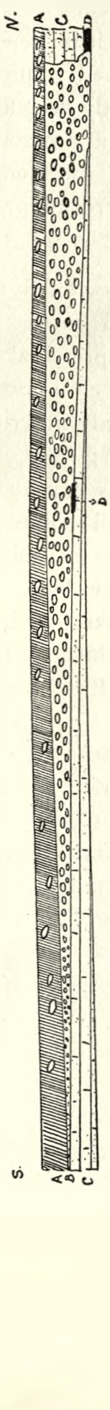
Boulder Clay: the characteristic stiff brown unstratified clay with boulders	2 feet.
Sandstone: very much crushed and broken ...	10 „
Blue Shale: a fissile blue shale, containing bands of ironstone and distorted remains of *Anthracosia*	8 „
Coal Seam	2 „
Underclay: this is not visible in the section immediately in contact with the gravel bed, but it is a few yards away. It exhibits the usual development and contains nodules of ironstone and the fossil *Stigmaria*.	
Sandstone forming the present sea-platform.	

In the section of the ancient sea-cliff the base recedes faster than the upper portion, the concavity being filled with gravel.

The elevated platform upon which the gravel deposit rests is of Coal Measure sandstone, sloping towards the cliff at an angle of 5°, irregularly eroded, much of it owing its preservation to the tenacity of the overlying deposit, which in many places is supported by columns and buttresses of sandstone, so that the base of the gravel-bed may be examined for a distance of three or four feet backward from the cliff-front. A portion of the soft underclay, which would originally entirely cover the sandstone, remains, forming a matrix in which are embedded small rounded and water-worn pebbles. A small fragment of the coal-seam has resisted denudation, and is shown in the section. The platform forms one-half of an anticlinal fold.

Where the deposit abuts against the cliff, the gravel bed is almost entirely arenaceous and formed of material for the greater part but little water-worn. Flat slabs of rock similar to the detritus at the base of "Hawk's Cliff," crushed and broken fragments of micaceous sandstone and coarse sand covered by well rounded boulders, constitute the greater part of this section of the deposit. Occasional quartz pebbles, very small and well rounded, appear.

Section of Cliff near Newbiggin.



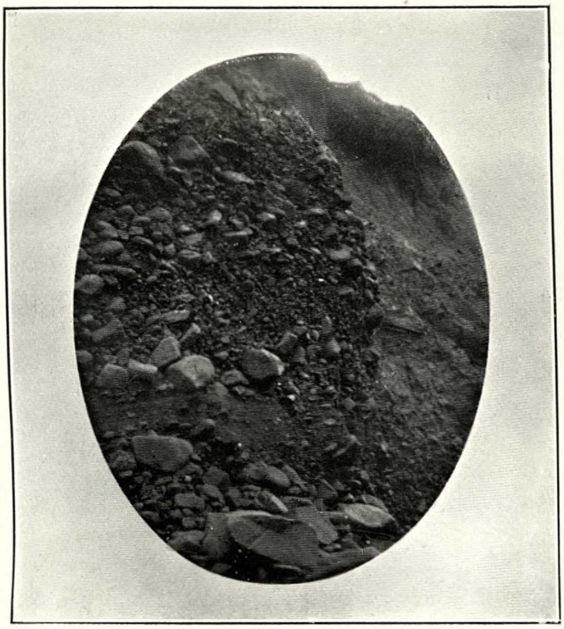
Scale, 1 inch=80 feet.

A. Boulder Clay. C. Coal Measure Sandstone.

B. Gravel D. Coal.

Midway between the extremities of the gravel-bed the best development is seen. Here it is composed of gravel varying in size from a hazel nut to well rounded boulders, the largest I have seen measuring slightly over five feet in girth. Patches of fine gravel and coarse sand are common. In this position also, pebbles consisting of fragments of arenaceous strata derived from the adjacent rocks predominate, but a larger quantity of foreign material is intermixed.

Fragments which have travelled a considerable distance are, of course, small, and often being much weathered, difficult to recognise. The principal of them are porphyrites (Cheviot), abundant and well preserved; granite with pink felspar, very much weathered and crumbling when removed; granite (probably Aberdeen); whin, always much weathered and derived from the dykes exposed on the coast; Carboniferous limestone, not at all common; small fragments of gneissic and schistose rocks occasional; flints. These last are old chalk flints, usually broken and angular in form, occasionally flaked as if broken by impact with other stones. Some are of a bright red colour, and all are hard and have lost their facile cleavage. Rarely, more complete specimens occur which have been but slightly affected by water action. These generally contain traces of organic remains, but the fossils are not sufficiently perfect to make them of much value. Their presence here seems to indicate the existence, somewhere in the bed of the North Sea, of Cretaceous deposits, probably derived from the chalk formation which at one time appears to have existed in the North of Scotland, of which the rounded water-worn flints of Aberdeen are remains. Flints occur in great abundance in parts of that county. In some places the ground is covered with them, *e.g.*, the Black Hills near Peterhead, where the cultivated land is white with bleached flints; the paths are paved with them, and heaps from the soil are everywhere abundant. No trace of the chalk from which they have been derived is to be seen. All along the shore, wherever the granite formation admits of a beach,



The Gravel.

General View of the Cliffs.

quantities of water-worn flints are found, mingled with the other pebbles evidently brought there by the tides.

From its nature the Newbiggin gravel-bed is not likely to yield many organic remains. A broken fragment of a shell *(Ostrea?)* is, so far, the only fossil I have seen.

Above the gravel-bed is the boulder clay, the included erratics being principally limestone characteristically striated. South of the deposit the sandstone slopes from the gravel-bed at an angle of 5°, and is covered with boulder clay. Sometimes a foot or more of crushed rock lies beneath the clay. About 200 feet from the gravel-bed the rock is glaciated, the striations pointing S.S.W.

From the point where the sandstone dips beneath the present beach nothing occurs but boulder clay covered with blown sand. Near the mouth of the river, and for a distance of some 200 feet, the clay is divided into two unequal portions by an almost uniformly straight line of erratics.

The gravel-bed at Newbiggin appears to be the sole surviving fragment of a pre-boulder-clay littoral deposit, but how far this may extend it is yet impossible to say. That similar deposits have not been found in the locality seems to point to a limited development inland.

Much of the original beach may have been removed by denudation during the subsequent Ice Age, the gravel in the cliff owing its preservation to the cliff over which, as indicated by the rock striations and the included erratics, the ice sheet flowed.

Looking towards Newbiggin from a point near the gravel deposit, one is struck by the series of promontories running parallel with each other, sheltering small bays and coves, and gradually becoming more prominent towards the north. In the foreground is the ancient cliff; behind and running further seaward is "Hawk's Cliff"; beyond is Spital Point, while in the distance, but most prominent of all, is Newbiggin Point.

In Pre-Glacial, or early Glacial times, the ancient cliff would be the northern boundary of a cove or bay in which fragments of local rocks were rolled and deposited; sea-worn material from distant places, carried by currents and hurled by the waves, added to the accumulation. A similar deposit is now being formed at the base of "Hawk's Cliff," where sub-angular material, together with rounded sea-worn boulders, is heaped up. A more extensive accumulation may be seen at the mouth of the Wansbeck, but there the material is invariably rounded and water-worn.

Notes on Neolithic Chipping-Sites in Northumberland and Durham.

By C. T. Trechmann, B.Sc.

(With Plates III.–VI.)

In the Natural History Transactions for 1880, vol. viii., part ii., is a notice by the Rev. W. Howchin, F.G.S., of prehistoric remains in Allendale, giving an account of, as he terms it, "a true surface find of flint implements of a very rich and interesting character, and under such circumstances as may lead by its suggestiveness to a more extended search among the fells of our northern district, which cannot fail to reward the patient worker with encouraging results."

I visited the site in question while staying at Allendale a few years ago, and in addition to seeing several of the implements still in possession of the local inhabitants, picked up on the site after long searching several specimens, some of which it seems desirable to record in completion of the list given by the Rev. W. Howchin in the above-mentioned paper now thirty years ago.

In one of the small runnels made by the rain on the wilderness of bare ground on the site (which is on the fell top about 2½ miles S.W. of Allendale Town) caused by the fumes from the chimney of the smelting mill, I found a perfect greenstone axe measuring 4½ inches in length by 2½ inches in greatest breadth, rather irregularly formed, but giving a fine regular almost semicircular cutting edge.

The side upon which it has lain for centuries is practically unweathered and shows the traces of grinding well, but the upper surface, which is more convex, is deeply pitted by the solvent action of rain and peaty water. The material of the specimen is a much decomposed igneous rock, possibly a porphyry, but whose true nature I have not been able to determine.

Most of the flints had been carried off the ground, but after some time I collected about twenty specimens, including two small arrowheads, two scapers, one of them calcined, four trimmed flakes, and about ten flakes or chippings. The two arrowheads deserve attention; the rest of the find comes under the general category of implements described in Mr. Howchin's paper.

The first specimen (Plate III., fig. 8) is a small barbed specimen (one barb missing) of brown translucent flint, quite unweathered and unbleached, and very sharp and fresh.

The second specimen (Plate III., fig. 7) is a small almost lozenge-shaped example measuring $\frac{5}{8}$ inches in length and breadth, and showing two periods of workmanship. The history of this specimen is somewhat interesting; it was originally a flake chipped from a nodule of transparent honey-coloured flint which had been flaked and left lying till the surface had become thoroughly bleached to a smooth porcellanous whiteness. At some long-subsequent period (possibly some centuries later) the second Neolithic man found it and fashioned it into an arrowhead, exposing once again the light yellow flint which has remained unweathered till the present day. The two periods of chipping are shown both on the upper and under surfaces; the under surface shows the convexity due to the bulb of percussion of the original flake. The phenomenon of double workmanship has been noticed both on Paleolithic and Neolithic implements, and is evidence of the great length of time which separates different stages of even the Neolithic period. This specimen suggests to me that the great quantity of newer stone age implements which are scattered over our fells is due rather to the length of time during which the district was occupied by flint-chipping tribes than to any density of population.

Neolithic Site at Blackton in Teesdale.

Extended search resulted in the discovery of several other localities for neolithic implements on the Durham and Northumberland fells. The most prolific locality is one which, though less rich than the find at Allendale, is an important site, and enables me to institute a comparison between the Neolithic remains found on chipping-sites on our fell districts and those found along the coast, which will be discussed later on.

The site in question, which I found in July, 1905, is situated on the southern boundary of the county of Durham, near the head of Blackton beck in Teesdale. The implementiferous ground occupies an elevation of 1000–1100 feet, and consists of an undulating tract with the slope to the south-west, on either side of the beck in a shallow depression sheltered on the north-west and south-east by two escarpments of millstone grit, the actual site lying somewhere on the junction of the millstone grit and carboniferous limestone series.

Blackton beck flows under the high road from Middleton to Barnard Castle at an elevation of 909 feet O.D.; a short distance above the bridge is the Blackton smelting mill, the flues of which are carried up about a mile, terminating in a tall chimney. Precisely as at Allendale the sulphurous fumes from the chimney in contact with atmospheric moisture change to sulphurous and sulphuric acid, and have destroyed the heather over many acres of land, while the subsequent wind action and rain-wash have cleared away the variable layer of peat, exposing the original land surface, which is a light dry sandy loam with angular pieces of shale and sandstone and fragments of quartz crystals.

On this surface, which includes several undulating knolls or hillocks, the worked flints may be picked up, most easily when the ground has been disturbed and washed by recent rains.

I can find no record of flints having been previously detected in this locality, and so believe that the greater part of the specimens have come into my possession. A fine leaf-shaped arrowhead was found by a gentleman living at Bishop Auckland, who heard about the locality from a friend of mine, but I have not seen the specimen.

Axes.—No axes have turned up on this site yet, the only polished implement being the hammer stone to be described later.

Arrowheads.—Three perfect and four or five fragmentary arrowheads have been found by me on this site.

1. A perfect, thick stemmed, double barbed specimen measuring $1\frac{3}{8}$-in., of grey translucent flint rather roughly worked, and showing the surface of the flake on the under side. Plate III., fig. 1.

2. A small double barbed and stemmed specimen of grey mottled flint, unweathered and very sharp and fresh, also rather unsymmetrical. Plate III., fig. 2.

3. A small, thick, subtriangular specimen in blackish flint. Plate III., fig. 4.

4. A large, finely worked lance or arrow head measuring 2-in. in length by $\frac{7}{8}$-in. across in grey flint, very thin and evenly flaked on both sides. This specimen was broken diagonally across about the centre in Neolithic times. I found the two pieces about twenty yards apart, and put the point into my ticket pocket for safety; when examining the rest of the flints in the train on the way home I found that it fitted the base which I had gathered up with other specimens some distance away. This specimen is worked to a fine point, and cannot have been long in use; it may have been broken in the making, and the two pieces flung away in different directions; they show a slightly different condition of surface. Plate III., fig. 5.

5. Stemmed and double-barbed arrowhead neatly worked out of carboniferous chert. Both barbs and point chipped off. Plate III., fig. 3.

6. Part of a lozenge-shaped specimen of grey flint. Plate III., fig. 9.

Saws.—Three very definite and characteristic flint saws were picked up on this site, formed of flakes of grey flint delicately notched along one or both edges. The first specimen (Plate III., fig. 13) shows about fifty notches over a length of one and a half inches; it is notched on both edges.

Another (Plate III., fig. 15) measures two inches in length, and has over thirty notches, while the last (Plate III., fig. 14) is a much less delicate specimen with only ten notches.

The specimen (Plate III., fig. 10) consisting of transparent yellow flint may also be a saw with the notches worn down.

These saws were doubtless used in the manufacture of arrow shafts and in fashioning small wooden and bone articles.

"*Pigmy*" *Implements* (Plate III., fig. 12).—One very characteristic specimen of this type was found, three-quarters of an inch long and scarcely more than one-eighth wide, formed out of a narrow flake of white translucent flint delicately worked along one edge only, the other edge being the sharp edge of the flake. Both ends are square and untouched. This is the only specimen found on this site. It is difficult to see what it can have been used for. The purpose of these implements is still problematical; various uses are suggested, such as surgical operations, trepanning, tattooing, etc., or they may in some cases have been simply borers.

Scrapers.—About forty scrapers have been found up to the present time, generally of small size, some of the minute so-called thumb scrapers being only half an inch in width. Plate IV., fig. 7, is a very small specimen. The largest measures $1\frac{5}{8}$-in. in width. They are generally formed of thick flakes, whose under surface has a concavity in the direction of its greatest length, and which would give a suitable scraping edge when trimmed to a semicircular form.

They are very variable in shape and material, nearly all the forms recorded from Britain occurring. I have photographed a few of the more characteristic specimens, Plate IV., figs. 1–9. Figs. 1–4 are described as semicircular or thumb-flints, fig. 6 is a flat circular specimen, figs. 8 and 9 as "duck-billed" or "kite-shaped" scrapers. They are better illustrated by photographs or sketches than by descriptions.

Flakes and Chippings.—These are by far the most numerous relics on this as on most other Neolithic sites, the largest measuring about three inches; many are very symmetrical, and show great skill in flaking; many of the larger specimens have been used as knives and scrapers without any further chipping, as shown by their blunted edges; some are more or less delicately flaked across the upper surface.

One specimen (Plate IV., fig. 12) measuring 1⅞-in. is formed of a single flake from the outside of a large rounded nodule of dark grey flint, and has had most of the crust or surface of the nodule carved away by a sort of parallel flaking. This specimen was picked up in a sheep track on an elevated knoll some distance from the chimney. A similar specimen is figured, Plate IV., fig. 13. Other flakes (Plate IV., figs. 17 and 18) are remarkable for their symmetry.

The flint of which the foregoing implements are formed is very variable in texture and description, ranging from white and light yellow translucent material through various shades of pink and grey, opaque and nearly transparent to almost black, though never so black as some of the freshly broken upper chalk flint of South England. The surface of the nodules is apparent in many cases, and shows that much of the flint has been taken from weathered or water-rolled masses.

Several dozens of symmetrical flakes occurred, while well over a thousand indefinite chippings and fragments were picked up. One very symmetrical flake of reddish banded chert of the kind found in the lower carboniferous (Yoredale) series in the vicinity (Plate IV., fig, 17) was picked up; in addition to this specimen other flakes and chips, together with many cores or nuclei of chert were gathered up.

The flint cores on the contrary were very scarce, not above six examples being found, while the unworked nodules were quite absent. This is a curious fact in presence of the very large proportion of flakes picked up, and suggests that the flint was brought to the locality in an already flaked condition by the wandering tribes from the south, who gathered up chert on the way from the various exposures of the Yoredale rocks where it occurs, as being the best substitute for flint which the locality affords.

The flint almost certainly came from the Yorkshire wolds, and greatly resembles that composing the implements left in such quantity by Neolithic man in that district. The rounded and weathered surface of the raw material tends to show that much of it was picked up on the sea coast.

Of implements other than of flint and chert the only specimen found was a fine hammer stone or crusher of a very dense quartzite, measuring three inches in length by one and a half across (Plate IV., fig. 19). It has been carefully smoothened over the entire surface, and shows some traces of polishing due to finger action, while both ends are slightly but quite perceptibly bruised, apparently more from pressure than from blows. It may have been used in secondary chipping on other implements.

The occurrence of a rich Neolithic site such as this strengthens the idea that many more such must be present on our northern fells, such as lie at a moderate elevation and afford a supply of water and some shelter from the prevailing winds. Unfortunately in nearly all such localities the surface of the soil is covered with a more or less thick covering of peat on which grows the present heather, and it is only in isolated cases, as in the neighbourhood of a smelting mill, that we have an opportunity of examining the old land surface, when we often find it rich in prehistoric remains.

The occupation of the country over an extended period by Neolithic flint chippers has caused a great accumulation of imperishable flint remains on our fells, and all bare ground or places where sods are being removed in connection with reservoir construction or shooting butts should be examined for flint flakes.*

* A single modern gunflint picked up on this site completes the list of flint implements. Dropped at a quite recent period amongst the heather, it found its way to the level of the Neolithic surface when the heather was destroyed.

The next site I wish to record is in Weardale, at a greater elevation than the last. It is situated at the chimney of Rookhope Smelting Mill on Redburn Common at an elevation of 1,829 feet O.D. The mill is situated on the roadside by Rookhope Burn, the flues being carried in a north-westerly direction a distance of nearly two miles to the fell top, the outlet being situated just on the escarpment of the millstone grit.

A tremendous area of ground has been denuded by the action of the fumes, and in consequence I hoped to find a quantity of implements, but in this was disappointed; after long search I picked up, as I anticipated, an arrowhead (Plate III., fig. 6) lying about half-a-mile from the chimney on the bare ground, in addition to a core of grey flint and five or six flakes of flint, chert, and quartz.

The spot is extremely desolate and very exposed, and no doubt seldom visited except by the workmen cleaning down the flues (the mill was still working in 1905). The desolation of the site and absence of water must have prevented its occupation by Neolithic man, and the implements picked up have been merely dropped by accident.

The arrowhead is a stemmed and double-barbed example with the tip of both barbs broken off. It is formed out of grey flint streaked with light grey and bleached and weathered to a bluish surface.

Some other sites which I have traced on the fells call for no special attention at present, as I have not yet collected sufficient of the material or anything sufficiently remarkable to justify my recording them.

A large tract of bare ground surrounding a smelting mill chimney which I examined near Reeth Moor in Arkengarthdale was curiously and to my surprise totally devoid of flakes, although it was situated on the edge of the Yoredale escarpment with exposures of chert.

Neolithic Remains on the Durham Coast.

Neolithic remains can be traced at various points along the Durham and Northumberland coast, and at several places there is evidence of the existence of well defined working sites.

These appear to be the remains of true kitchen-midden or coast finds, debris left by tribes of flint chippers attracted by the quantity of food to be found along the shore, and as such, can be present only on those parts of the coast which have been protected from denudation since Neolithic times. This is more particularly the case along the wide and open bay stretching from Hartlepool northwards to Seaham Harbour. North of this, where the magnesian limestone is very soft and friable and much coast erosion takes place, I have failed to find any working sites, and the flakes only occur very sparingly. The implements also differ in many aspects, as I shall show, from those described from the fells of the western parts of the county.

Several of the finds, together with figures of some of the implements, appeared in the "Naturalist" for 1904 and 1905, and I propose here to give a résumé and extension of my research in this district.

Between Seaton Carew and West Hartlepool a kitchen-midden of Romano-British times occurs which has yielded some flint fragments, in addition to remains such as a Roman fibula, Samian pottery, etc. I have to record a curious flake $1\frac{1}{2}$ inches in length worked round the edges to a somewhat crescent-shaped outline. The site of the kitchen-midden is now covered up.

On the promontory of Hartlepool, which seems to have undergone much denudation since historical times, I have failed to find any traces of flint remains.

Between Hartlepool and the mouth of Crimden beck, about three miles, the coast is covered with ballast and sandbanks, and it is hopeless to look for prehistoric remains.

Immediately to the north of Crimden beck is a mass of boulder clay protected from the sea by a heavy bank of sand. The surface of this boulder clay bank, which skirts the north side of Hesleden or Crimden Dene, is covered with a layer of sand, which, if removed, would doubtless reveal an extensive chipping site, as flakes are in evidence wherever the sand is removed along the edges of the bank by rain or wind. On a patch of ground denuded of sand I picked up several large flakes of pink and yellow flint and a fine scraper. The scraper is a triangular specimen of dark brown flint with a neatly worked edge, and part of the crust of the flint nodule from which it was formed remaining (Plate VI., fig. 2).

Flints may be traced sparingly for about two miles to the north as far as the Black Hall Rocks, in which place they are very abundant on the fields above the caves and a little to the north. The site seems to have been a favourable one for the flint chippers, water being supplied by a small stream running nearly parallel to the coast for some distance, and the ground being well sheltered and fertile. The implements are picked up on the ploughed fields, and are consequently more or less damaged. I have recorded from here :

Scrapers, 7 ; borer, 1 ; very small or pigmy implement, 1 cores, 12 : flakes and chips about 600 ; bruised quartzite pebbles about 12.

Between Black Hall Rocks and the site at Horden presently to be described are several large ravines cut out of the boulder clay and the underlying magnesian limestone. Flakes and cores are plentiful along the edges of these ravines ; in one spot where long slender flakes occur I have found two or three pigmy implements. On the top of a large bank of clay immediately to the north of the mouth of Castle Eden Dene the flakes found were remarkably large, sharp and unweathered.

Neolithic Coast Chipping Site near Horden.—In 1904 I first detected the existence of a well-defined coast chipping-site on the sea banks near Horden, about a mile to the north of Castle Eden Dene mouth, and immediately to the south of a beck called Blackhills Gill.

The site is a well chosen one, and consists of a large tract of clay and drift at an elevation of about 100 feet above the sea level. The coast outline has not apparently receded here since Neolithic times, and is protected by sand banks and a "storm beach" of large shingle. The ground slopes gently to the west, and has until quite recent times been covered with a layer of blown sand; much of this sand remained in 1904 as a protecting wall on the edge of the bank, but has since then been nearly all carted away in connection with the Horden Colliery workings, and given me an opportunity of examining more of the bare ground. As the surface is washed by the rain no doubt more implements will come to light.

The fact of the ground never having been ploughed up, together with the covering of sand alluded to, accounts for the preservation of the several delicate arrowheads found on this very restricted site. It thus represents an undisturbed Neolithic working site, the flakes and implements being all sharp and undamaged.

This site is the only locality on the Durham coast where I have succeeded in tracing arrowheads, the series including six perfect and two defective specimens.

The largest arrowhead (Plate V., fig. 1), measuring $1\frac{5}{8}$-in. in length, resembles almost exactly in form that figured in Evans' "Ancient Stone Implements," fig. 304. It is stemmed and double-barbed, chipped out of opaque grey flint, and is unweathered.

Plate V., fig. 2, is a very symmetrical specimen neatly chipped out of pink flint now bleached to a white porcellanous surface.

Plate V., fig. 3, is a less symmetrical specimen, now bleached to a white glossy surface.

Fig. 4 shows an arrowhead of unusual fineness chipped to an acute and almost needle-like point. The minute working at the point cannot be detected without a lens. It measures $\frac{15}{16}$-in. in length, and is chipped out of black translucent flint. There is nothing like it figured by Evans.

Fig. 5 is a roughly lozenge-shaped specimen; the material is black translucent flint, very similar to the last.

Fig. 6 is a leaf-shaped non-pointed specimen; a broken lozenge-shaped example (fig. 10), and a broken barbed specimen complete the series of arrowheads.

The scrapers found are characteristic of the district, and no very symmetrical examples occur. In several cases they are formed from a flake which has been struck off the outside of a flint pebble.

Plate V., fig. 11, shows a scraper of yellow flint slightly sand polished. Fig. 12 has been chipped out of a nodule of yellow flint, and shows part of the crust of a rounded pebble. Fig. 13 is apparently a scraper which has been broken across; it is of a dark pink flint characteristic of the district. Fig. 14 is a scraper or thumb-flint of light grey splintery flint. Fig. 15 is a scraper of so-called "duck-bill" form, of light flint which has been weathered white.

Between 500 and 600 flakes were picked up, nearly all of small size, and showing great variety in shape, size, and colour of material, ranging from minute splinters up to a length of $1\frac{1}{2}$ inches, rarely more. Plate V., fig. 16, shows a flake which has been trimmed along the edges forming a sort of knife. Fig. 17 is a symmetrical flake of grey translucent flint.

Plate V., figs. 7, 8, and 9, represent trimmed flakes. Fig. 9 may be a broken scraper.

The surface of the ground on this site was strewn with small rounded flint nodules washed apparently out of the local boulder clay, and no doubt carefully collected and kept in readiness to be worked up into flakes and implements. Some of the nodules are battered and bruised round the edges, but the favourite "hammer stones" seem to have been the rounded quartz pebbles, which are so plentiful on the shore. Several were picked up showing traces of extensive bruising. Cores or nuclei of the small flint nodules were also plentiful. Two so-called pigmy implements occurred, one of which is represented at Plate V., fig. 19.

Plate V., fig. 18, represents a "fabricator" of quartz, much worn and rounded at the end, possibly used for working out the barbs of arrowheads and similar purposes.

A few perforated pebbles of flint and limestone were found, possibly gathered up to be used as ornaments or net weights.

In addition to all these flint implements, about a hundred rough weathered chippings of greenstone were gathered up. They are pronounced by Canon Greenwell to be undoubtedly flaked by human hands. On examining the series it is evident that they have been roughly chipped to pointed or cutting forms. One piece, as pointed out by Mr. Sheppard, is undoubtedly a chipping from a polished greenstone axe (Plate V., fig. 20). So far I have only detected these greenstone chippings on this one site. Perhaps a weathered basalt was employed as a substitute for flint when the supply of that material ran out. A series of these chippings was illustrated in the "Naturalist" for November, 1905.

Several objects traceable to Roman and later times were found on the bare ground, some fragments of Roman mortaria, parts of the rim and pieces of the body of the vessel studded on the inside with hard grains; in the case of the Romano-British kitchen-midden at Seaton Carew this material was shown to be slightly fused ironstone. Several masses of very hard cinder-like substance occurred, apparently the material for breaking up and studding in the mortaria. The rest of the pottery, all in small fragments, are part of the rims of ordinary black ware, and fragments of a very rough hand-made pottery in which the clay has been mixed with quartz before burning. This latter is indistinguishable from some that I have found in the midden at Seaton Carew.

All the above-mentioned pottery is characteristic of the Romano-British period, left at a time long subsequent to the flint implements. Part of a bone knife handle, probably Roman, also occurred.

Further to the north, between Horden and the mouth of the Wear, and thence to the mouth of the Tyne, Neolithic remains occur only very sporadically. The coast is not protected by sand dunes and shingle banks, the limestone is softer, and the boulder clay less in evidence. More coast denudation seems to have taken place, and the Neolithic chipping sites are probably washed away. Many small ravines and gorges occur, but are for the most part devoid of chipped flints.

The following gives a summary of flints found up to the present on Durham coast sites:—

Seaton Carew: flint fragments found in kitchen-midden with Romano-British remains.

Mouth of Crimden Dene: scraper, 1; flakes, 8.

Edges of Crimden Dene, and near the coast: flakes, 30; cores, 3.

Crimden Dene, Black Halls, in ruts on old ploughed fields: scraper, 1; flakes, 50.

Black Halls, near the hotel: scrapers, 7; borer, 1; pigmy implement, 1; cores, 15; flakes and chips about 1,000; bruised quartzite pebbles about 12.

Black Halls, Deneholme: scraper, 1; flakes many.

Deneholme, Horden: flakes about 150; cores 8–9.

Horden: about 600 chipped flints on site of the old settlement.

Horden to Sunderland: scraper, 1; flakes sparingly found.

Near Westoe a well formed flake occurred on the top of a stack of limestone in Frenchman's Bay, entirely cut off from the rest of the coast line.

The study of these coast finds raises some interesting questions respecting the relative age of the coast settlements with those on the fells in the county of Durham.

There is a striking dissimilarity between the remains found on such a site as that described from Horden in this paper to that at Blackton in Teesdale, not only in the material used, but in the implements which occur. While I endeavoured to show that the fell implements were carried by migrating tribes from the south, bringing with them bundles of long and slender symmetrically formed flakes, and gathering up chert on the way; the coast implements were on the contrary all manufactured on the spot. This is proved by the much greater quantity of flakes, minute splinters, cores or nuclei, and unworked nodules, hammerstones and other debris of the flint workshop. On the Blackton Beck site only five or six cores occurred, and one hammerstone, while the unworked flint nodules were entirely absent.

The material used by the coast chippers consists of flint taken exclusively from the small rounded nodules out of the boulder clay which are sparingly found on the sea shore, and great skill is shown in working up the hard and often splintery material, especially in the case of the arrowheads. The coast series most resembles the Neolithic remains found on chipping sites in various parts of Scotland.

Whether the coast sites are older or newer than those on the fells I shall not attempt to say; they may be contemporary, but at any rate there was no intercourse or exchange of materials between the two.

Flint saws are found on the fells, but I have found no trace of them on the coast sites.

Neolithic Remains on the Northumberland Coast.

Chipped flints appear to be much more sparingly distributed along the Northumberland coast than in the southern part of the county of Durham. They are practically absent from that part stretching from the mouth of the Tyne northwards to Whitley Bay. Opposite St. Mary's Island traces were noticed, but the coast seems to have receded much in recent times. From here northwards we find a long stretch of blown sand comparable to that found between Hartlepool and Crimden Dene, which effectively conceals any chipping sites which may exist.

The only definite chipping site detected in this locality is situated about a mile north of Newbiggin, and nearly opposite the village of Woodhorn. As in other sites, the flints are found immediately above the coast line. They are exposed along the edges of an old sandstone quarry. In order to reach the sandstone it has been necessary to strip off about three feet of clay and rubble which covers the rock. This rubble, mixed with pieces of sandstone, is shot over the sea banks, where every high tide washes some of it away, exposing the flint flakes and other remains.

The series includes most of the usual objects found on such sites, but flint seems here to have been a scarcer commodity than on the Durham coast. Most of the flakes show traces of having been used as cutting and sawing tools. About four hundred implements, flakes and chippings were obtained on this site. All are remarkably small and meagre in appearance; the largest flake is only $1\frac{1}{2}$ inches long, most are much smaller, while splinters of flint are plentiful. Some of the scrapers are absurdly small.

One curious implement (Plate VI., fig. 17) in the form of a small sling stone occurred; it shows the crust of the pebble on one side, and was probably used as a scraping tool, since numerous fine fractures are seen on one edge only. The flints are all fresh and sharp, and generally highly bleached and mottled from exposure. About ten distinct scrapers were found, all abnormally small. One is represented at Plate VI., fig. 19. In addition to these a quartzite core with a few quartzite flakes occurred, and two or three much battered quartzite striking stones. Plate VI., fig. 16, represents a core from this locality of dark flint bleached white. No arrowheads nor any greenstone nor polished implements have occurred up to the present on this site.

The rest of the Northumberland coast, so far as I have examined it, seems to be unprolific in Neolithic remains. Plate VI., fig. 15, represents an arrowhead given to me by the Rev. M. Fletcher of Seahouses. It was found by a work-man at a considerable depth in some excavations made in 1905 immediately to the south of Bamburgh Castle. The excavations revealed the existence of extensive kitchen-middens of doubtful age on this site. Apparently it occurred at a lower level than the shells and bones of the midden, which is probably of mediæval age. The arrowhead appears to be formed out of a chert, and is deeply weathered and stained to a brownish yellow colour.

EXPLANATION OF PLATES.

Plate III.

Fig. 1. Arrowhead, double barbed and stemmed, grey flint. Blackton in Teesdale.

" 2. Arrowhead, double barbed and stemmed, mottled grey flint. Blackton.

" 3. Arrowhead, grey chert, barbs and point missing. Blackton.

" 4. Arrowhead, roughly triangular, black flint. Blackton.

" 5. Lance head, fractured in prehistoric times. Blackton.

" 6. Arrowhead, barbed and stemmed. Barbs chipped off. Rookhope, Weardale.

" 7. Arrowhead, lozenge-shaped, showing two periods of work. Allendale.

" 8. Arrowhead, dark brown flint, one barb missing. Allendale.

" 9. Arrowhead, end missing, light grey flint. Blackton.

" 10. Flake, light brown transparent flint, flaked to a straight cutting edge and notched. Blackton.

" 11. Flake, light grey flint, worked round the edges. Blackton.

" 12. Pigmy implement, white translucent flint, worked along one edge. Blackton.

" 13. Saw, grey flint, serrated along both edges. Blackton.

" 14. Saw, bluish opaque flint, rough serration on one side. Blackton.

" 15. Saw, dark flint, serrated on one edge. Blackton.

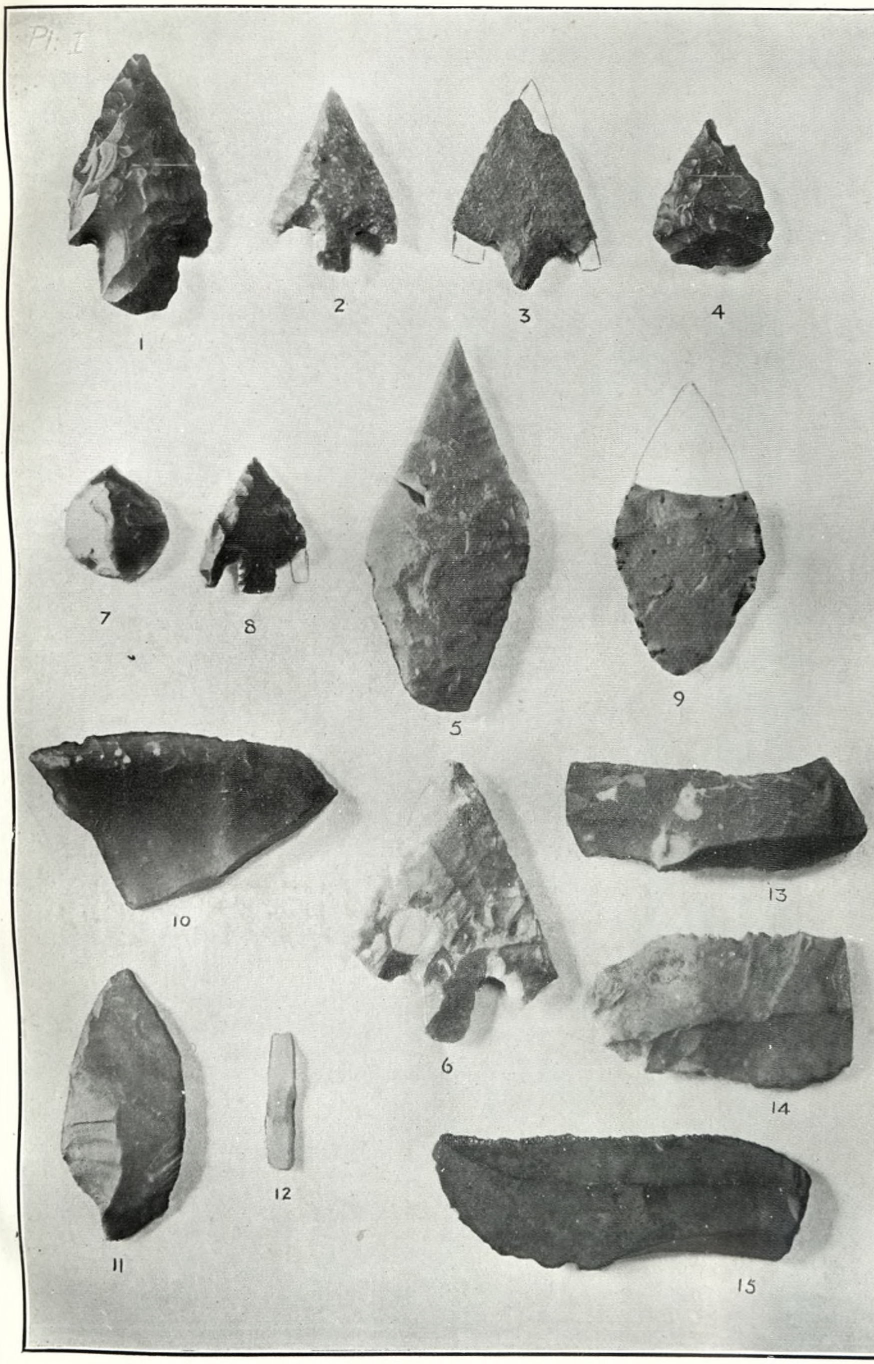
Plate IV.

Fig. 1. Scraper, dark flint. Semicircular form.
,, 2. Scraper or thumb flint, a characteristic specimen. Brown translucent flint.
,, 3. Scraper, bluish flint.
,, 4. Scraper, grey mottled flint. Worked to a semicircular edge.
,, 5. Scraper. Rough specimen in brown flint.
,, 6. Scraper. A flake taken from outside of a nodule of flint and worked to a semicircular edge.
,, 7. Scraper. A very small and delicately worked specimen. Grey flint.
,, 8. Scraper. "Duck bill" form, showing crust of pebble. Dark flint.
,, 9. Scraper, pink flint with crust of pebble.
,, 10. Flake, grey flint worked to a triangular almost arrowhead form.
,, 11. A similar specimen with less secondary chipping.
,, 12. Knife, dark translucent flint, flaked and notched.
,, 13. Flake, with both edges trimmed. Grey flint.
,, 14. Flake in white translucent flint.
,, 15. Borer, curved point, worked along one edge.
,, 16. Scraper-like implement, possibly a knife. Yellow opaque flint.
,, 17. A symmetrical flake of lower carboniferous chert.
,, 18. Hammerstone, quartzite, bruised at both ends.
,, 19. Flake, showing part of crust of flake nodule and scar of another flake.

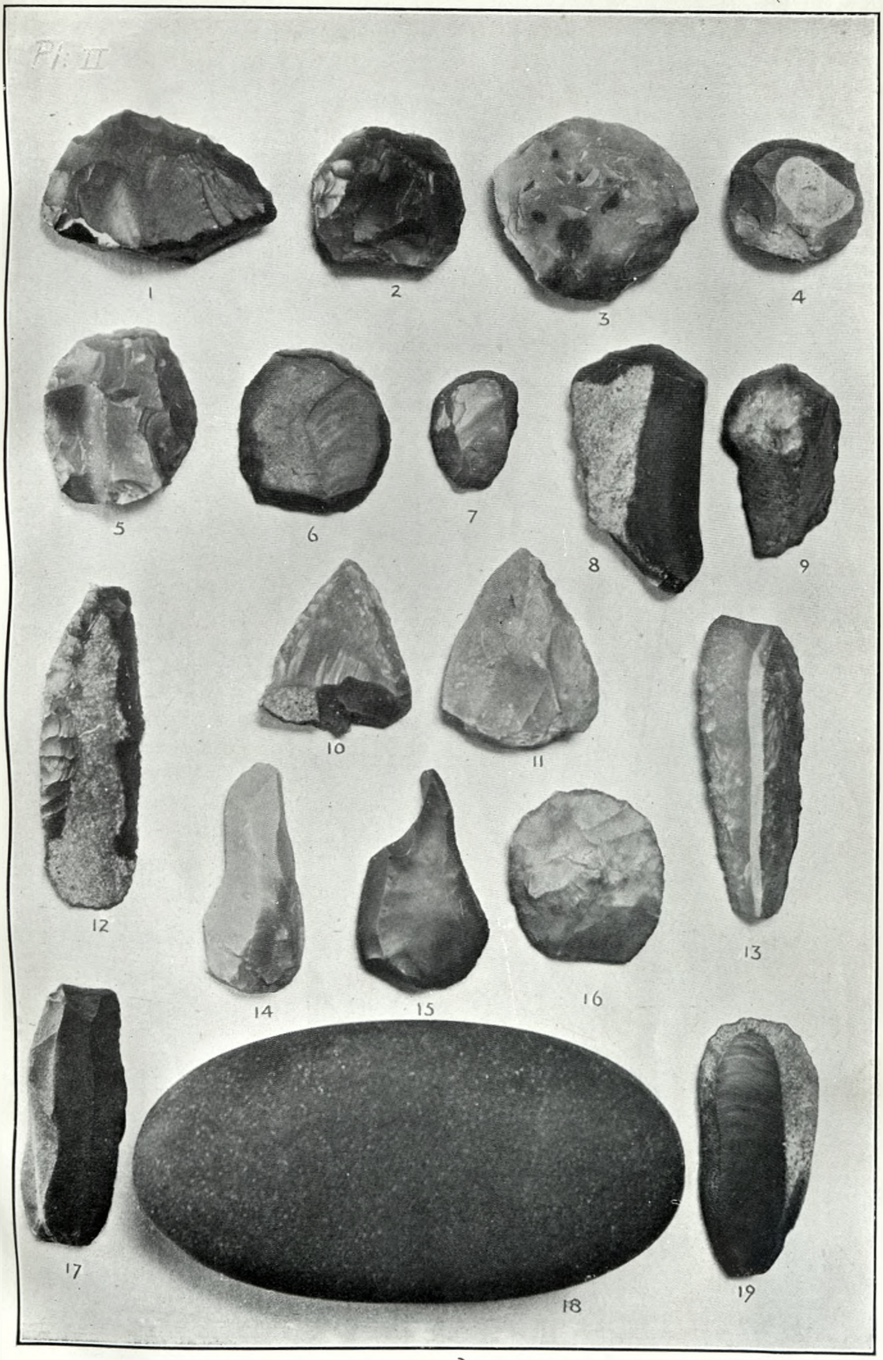
All the specimens figured on Plate IV. are from Blackton in Teesdale.

Plate V.

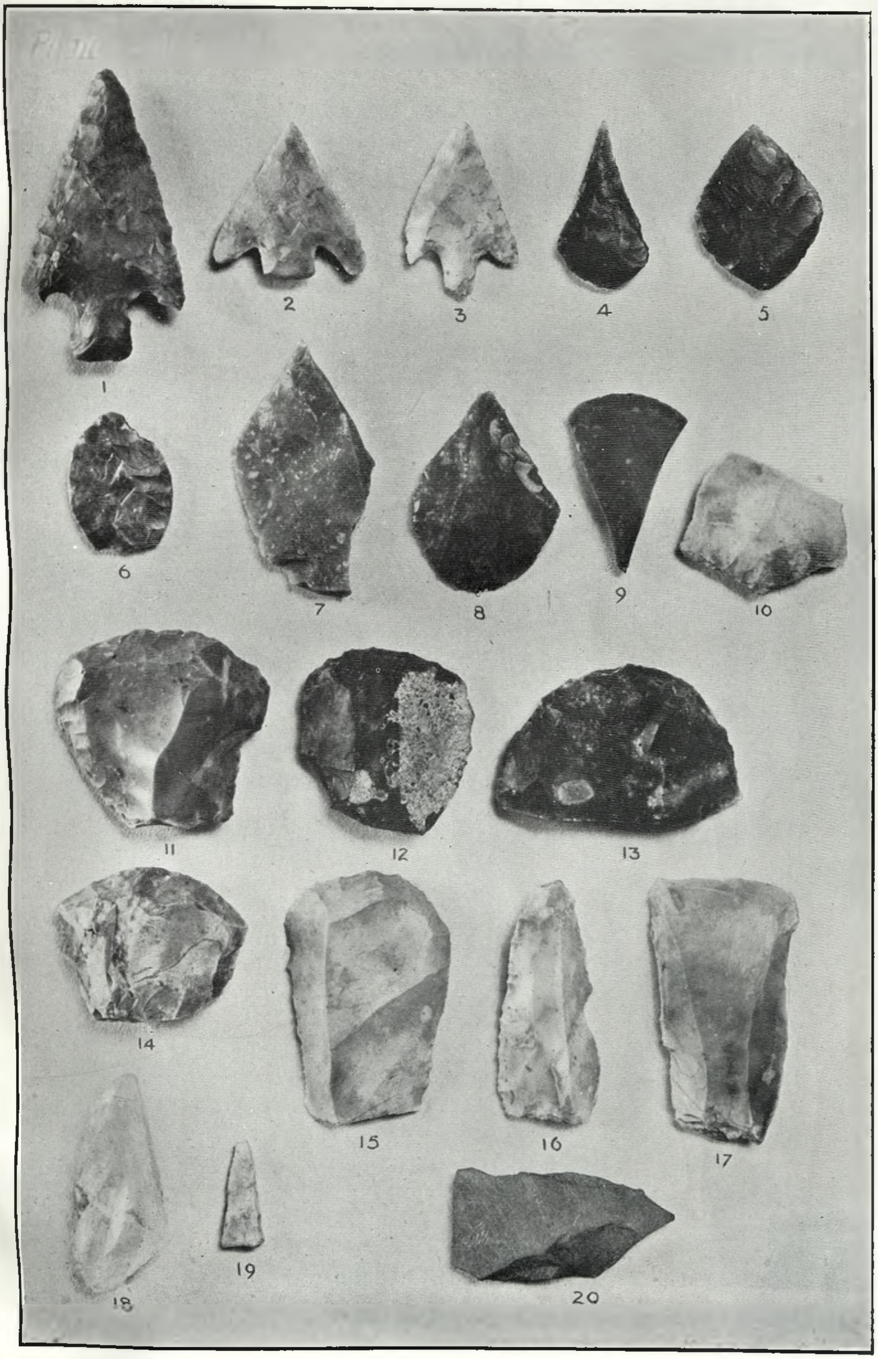
Fig. 1. Arrowhead. Opaque grey flint.
,, 2. Arrowhead. Pink flint, bleached white by exposure.
,, 3. Arrowhead. Bleached to a glossy white surface.
,, 4. Arrowhead of unusual fineness. Black translucent flint.
,, 5. Arrowhead. Black translucent flint.
,, 6. Arrowhead, leaf shape. Brown mottled flint.
,, 7. Flake or splinter. Yellow flint worked to a point.
,, 8. Flake worked to a point.
,, 9. Splinter of brown flint, worked to a curved cutting edge. Possibly a form of arrowhead.



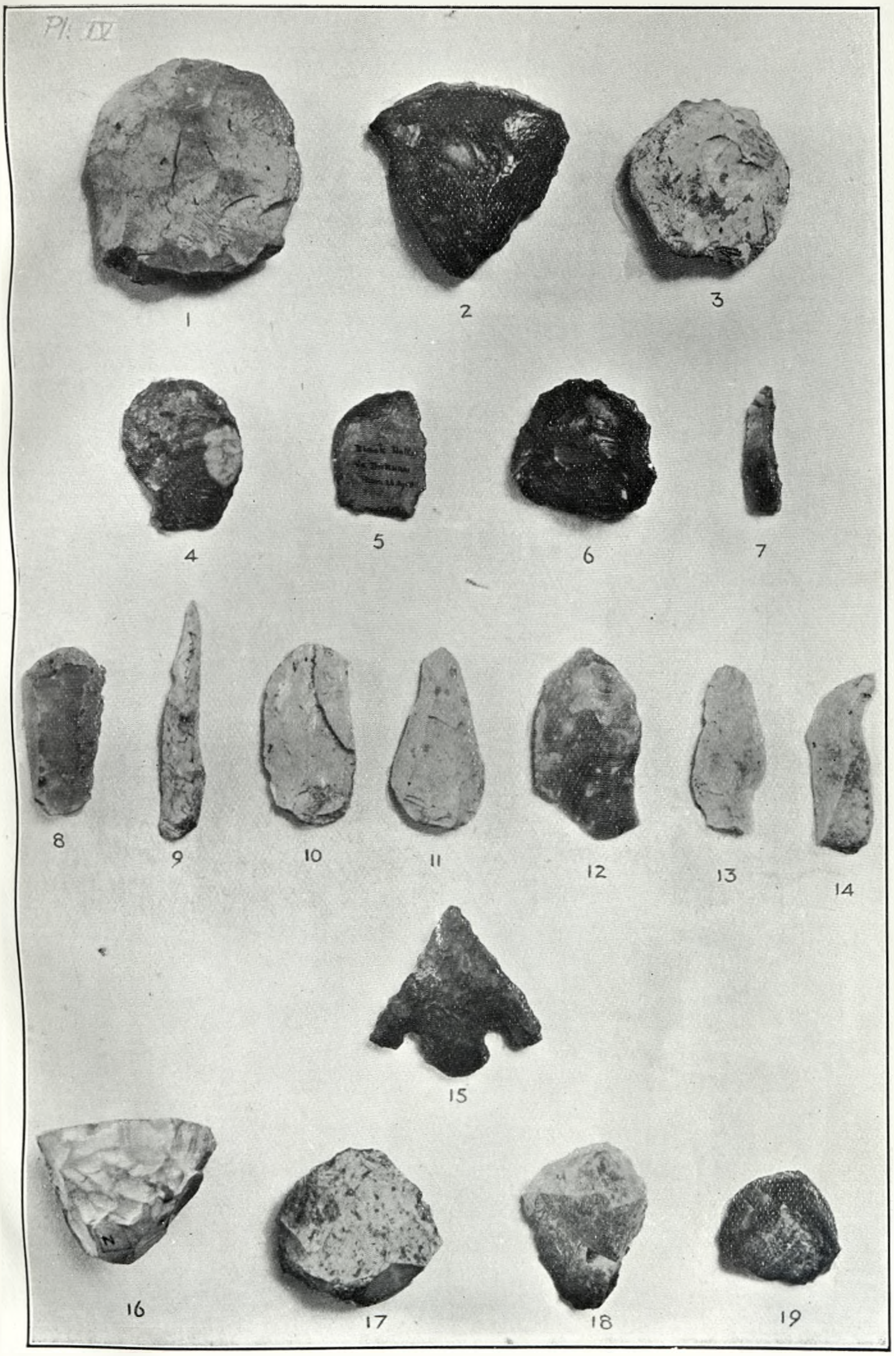
NEOLITHIC IMPLEMENTS.
Teesdale, Weardale, Allendale.



NEOLITHIC IMPLEMENTS.
Blackton in Teesdale.



NEOLITHIC IMPLEMENTS.
Horden.



NEOLITHIC IMPLEMENTS.
Coast of Durham and Northumberland.

Fig. 10. Base of an arrowhead, the point missing.
„ 11. Scraper, yellow flint.
„ 12. Scraper, yellow flint with part of crust of pebble.
„ 13. Scraper, fragmentary, in reddish flint.
„ 14. Scraper, light grey flint.
„ 15. Scraper, "duck bill" form.
„ 16. Flake with trimmed edges.
„ 17. Flake. A symmetrical specimen of light coloured flint.
„ 18. "Fabricator" of quartz.
„ 19. A "pigmy" implement.
„ 20. Part of a polished greenstone axe.

All specimens figured on Plate V. are from the coast chipping site at Horden.

Plate VI.

Fig. 1. Scraper, pink flint. Bleached by exposure. Black Halls.
„ 2. Scraper, brown flint. Near Crimden Dene, Durham coast.
„ 3. Scraper. Rough specimen bleached white. Black Halls.
„ 4. Scraper, yellow flint. Durham coast.
„ 5. Scraper, yellow flint with crust of nodule. Black Halls.
„ 6. Scraper, pink flint. Black Halls.
„ 7. "Pigmy" implement, grey flint. Black Halls.
„ 8-14. Flakes and splinters of various forms. Black Halls.
„ 15. Arrowhead, brown chert. Midden near Bamborough Castle.
„ 16. Core, grey flint bleached white. Newbiggin, Northumberland.
„ 17. Implement of weathered pink flint. Newbiggin.
„ 18. Scraper of grey flint. Newbiggin.
„ 19. Scraper, brown flint. Newbiggin.

The Glacial Geology of Northumberland.

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Introduction and References.

Much has been written about the glacial geology of Northumberland, but the information is of a localised kind which precludes the formation of broad views on the subject. The present paper (the material for which has been collected in the author's spare time during the last five years) is an attempt to remedy this defect by a consideration of the glacial phenomena exhibited over the whole county. Special reference is, however, made to that portion which is bounded on the north by the Tweed Valley, on the west by the Redewater and North Tyne, on the south by the Tyne Valley, and on the east by the sea, for it is in this tract that the most interesting and complex phenomena are met with. The author's indebtedness to other workers in this field is acknowledged in the text, references to the publications in the following list being given by the numbers in square brackets. The list is not intended to be exhaustive, but it may be taken to contain most, if not all, of the important papers on the subject; the arrangement is chronological.

1. The Polished and Scratched Rocks in the Neighbourhood of Alnwick. G. Tate. Trans. Tyneside Nat. Field Club, 1849, vol. i., p. 348.
2. On the Glaciation of the Counties of Durham and Northumberland. R. Howse. North of England Inst. Min. Eng., 1862–4, vol. xiii., p. 169.
3. On the Drift of the North of England (Abstract). J. Curry. Quar. Jour. Geol. Soc., 1867, vol. 23, p. 40.
4. Outlines of the Geology of Northumberland. G. A. Lebour. 1873. Second Edition, 1886, pp. 7–20.

5. Memoirs of the Geological Survey. The Geology of the Country around Otterburn and Elsdon. Hugh Miller. 1887. Sheet 8, New Series.

6. The Geology of the Cheviot Hills. C. T. Clough. 1888. Sheet 5, New Series.

7. The Geology of Plashetts and Kielder. C. T. Clough. 1889. Sheet 7, New Series.

8. On the Origin of the Upper Drift Sands and Gravels of Northumberland. G. W. Bulman. The Naturalist, 1891, pp. 43–45.

9. On Certain Surface Features of the Glacial Deposits of the Tyne Valley. G. A. Lebour. Trans. Nat. Hist. Soc. of Northumberland, Durham, and Newcastle. 1891. Vol. xi., p. 191.

10. Memoirs of the Geological Survey—The Geology of Part of Northumberland, including the Country between Wooler and Coldstream. W. Gunn and C. T. Clough. 1895. Sheet 3, New Series.

11. The Geology of the Country between Norham and Tweedmouth. W. Gunn. 1897. Sheet 1, New Series.

12. The Geology of the Coast South of Berwick-on-Tweed. W. Gunn. 1897. Sheet 2, New Series.

13. The Geology of Belford, Holy Island and the Farne Islands. W. Gunn. 1900. Sheet 4, New Series.

14. Evidences of Ancient Glacier-dammed Lakes in the Cheviots. P. F. Kendall and H. B. Muff. Geol. Mag., 1901, New Series, Decade iv., vol. viii., no. xi., pp. 513–5.

15. The Evidence for Glacier-dammed Lakes in the Cheviot Hills. P. F. Kendall and H. B. Muff. Trans. Edin. Geol. Soc., 1902, vol. viii., pp. 226–230.

16. The Glaciation of Teesdale, Weardale and the Tyne Valley and their Tributary Valleys. A. R. Dwerryhouse. Quar. Jour. Geol. Soc., 1902, vol. lviii., pp. 572–607.

17. The Superficial Deposits and Pre-glacial Valleys of the Northumberland and Durham Coalfield. D. Woolacott. Quar. Jour. Geol. Soc., 1905, vol. lxi., pp. 64–96.

18. The Glacial Phenomena of the Country between the Tyne and the Wansbeck. J. A. Smythe. Trans. Nat. Hist. Soc. Northumberland, etc. 1908. Vol. iii., New Ser., pp. 79–109.

19. On the Superficial Deposits around Newcastle-on-Tyne. E. Merrick. Proc. Univ. Durham Phil. Soc., 1909, vol. iii., pp. 141–153.

20. Reports of Boulders Committee. Univ. Durham Phil. Soc. Four Reports in the Proceedings, vol. ii., 1905–6, p. 271; vol. iii., pt. 2. 1907–8, pp. 61–62; vol. iii., pt. 3, 1908–9, pp. 175–176; vol. iii., pt. 5, 1909–10, pp. 331–333.

21. The County History of Northumberland. Geology of the Parishes by E. J. Garwood.

22. Geology in the Field—The Jubilee Volume of the Geologists' Association. Chapter on Northumberland by E. J. Garwood. 1910. Pt. 4, pp. 661–697.

Besides these sources, some isolated facts, especially in connexion with striations and the occurrence of erratics and boulders, are contained in various county and parish histories and in the proceedings of local societies. The Drift Maps of the Geological Survey furnish valuable information on striations and the distribution of boulder clay and later glacial deposits. All the striations recorded in the various publications mentioned above, as well as many new ones personally observed, have been entered on the map accompanying this paper.

In the treatment of the subject, the evidence of direction of ice-movement supplied by the striations is taken first; then, that deducible from the distribution and contents of the boulder clay and the overlying deposits. After this, the great system of dry valleys in the eastern half of the county is described and their bearing upon the subject indicated. Lastly, brief mention is made of the effects of the glaciation on the drainage of the country.

I.—*The Striations.*

Two general directions of striation can be observed in Northumberland, one from west to east, the other from north to south. The former direction varies locally, becoming E.S.E. in the valley of the North Tyne and E.N.E. in the country between the Redewater and the Aln. Towards the coast the direction swings to the S.E. and S., conforming to the trend of the coast-line. The west-to-east series frequently bears no relation to the surface features, crossing deep valleys and the tops of lofty hills. Some of the greatest elevations striated in this direction are the Wanny Crags 1050-ft., Callerhues Crag 1,100-ft., Darden Fell 1,150-ft., Harbottle Crag 1,135-ft., Padon 1,190-ft., and Corsenside Common 1,190-ft. This series can be traced from the Cumberland border to within a few miles of the coast.

The north-to-south series is well developed in the country between Wooler and the coast due east of that town, thence southwards along a strip of land about ten miles wide. The highest surfaces bearing these striæ are about 800 feet: most of them are of much less height. Near the coast a few examples trend slightly to the west of south (Tate records one at Swinhoe bearing S.W.; this observation lacks confirmation). Frequently, the same rock-surface shows both series of striations, and in one or two favoured instances, as at Burradon and South Charlton, it is apparent that the southerly trend is later than the easterly one. At Little Mill the directions are to the south and west of south, and the former is of earlier date than the latter [20].

The igneous rocks of the Cheviot area do not appear suitable for the preservation of striæ. Two striæ have, however, been recorded in this district by Clough [6], one on the Baker

Crags pointing a little east of south, the other a little east of the top of Thirlmoor, pointing E.S.E.

No striæ have been recorded from the high border fells and the adjacent valley sides between the North Tyne and the Rede; other evidence indicates that this district escaped the invasion of foreign ice.

The evidence of the striæ thus points to the overriding of practically the whole county, outside of the Cheviots, by ice from the west, followed by the movement of a sheet southwards from the Tweed around the flanks of the Cheviots towards the Aln, and down the whole coastal area to the Tyne. In the large valleys, *e.g.*, the North Tyne [16] and the Coquet, there is evidence of the flow of moderately large glaciers at the close of the glacial period.

II.—*The Boulder Clay.*

Under this head may be grouped a great variety of glacial deposits, which have clay or rock-meal as their chief constituent. These deposits differ greatly in character and composition according to their position and origin, and though in the great pre-glacial valleys some classification of the component beds seems possible [19], this is impracticable when the whole area is considered. What may be called the typical Northumbrian boulder clay is a bluish or grey plastic clay charged with well scratched boulders of limestone and sandstone; whinstone, too, is a common constituent east and south of the outcrop of the Whin Sill. This clay occurs, with but slight modifications of texture, in places over the whole county apart from the Cheviots, and is generally that particular clay which rests on the rock-surface. In the Cheviots its place is taken by a less impervious deposit, more of the nature of broken rock than clay. In hilly districts outside of this region (the Carboniferous uplands) a boulder clay of local origin is frequently encountered, the boulders being but little polished and scratched and the matrix more sandy. Many sections show this local till to rest upon the typical clay.

The boulder clay passes upwards into less stony, prismatic clays of various colours and sometimes different boulder-content. Occasionally there are evidences of local unconformities between the lower and upper clays, as at Hadston Carrs [21], near Sea Houses [13], at Brunton and Blyth; again, the junction is frequently marked by a course of large boulders laid flat, as at Hadston Carrs and Horsebridge Head. The sections at the places last named show the clay-beds dipping towards the pre-glacial valleys south of the exposure, the dip being about the same as the slope of the pre-glacial surface. In the larger drift-filled valleys some of the upper clays are black and leafy, and have evidently been deposited under water ; from some clay-pits near Newcastle animal tracks in these clays have been described [19].

Composition of the Boulder Clay.—Though much field work remains to be done before any particular boulder-clay can be traced with anything like certainty to its source (or sources, for the contents are often greatly mixed), yet certain broad lines of transport can be recognised without great difficulty. Of the rocks exposed in Northumberland, those of the Cheviots are the most important for determinative purposes. Curiously enough, the characteristic augite-granites of that region are of comparative rarity in the drift deposits of the county; what specimens have been transported by ice occur to the east of Cheviot, and usually in the form of fairly large erratics. The porphyrites, however, have spread out to all points east and south of their source. They dwindle in number and size in the Tweed valley and on the North-East Coast. They occur in great numbers on the high fells between the Rede and the Coquet, on the Simonside hills up to 1,100 feet, and on Darden Fell at 1,250 feet; they abound in the Pont valley, are scarce in the Hart and absent from the Upper Wansbeck. The western limit passes down the Rede water, over the Ottercaps, then south of the Hart Burn to the Wansbeck at Bolam; thence it runs almost due south to the neighbourhood of Heddon.

The Whin Sill furnishes a great number of boulders east and south of its outcrop. On Alnwick Moor the drift to the west of the local outcrop is charged with whin boulders. The supply has evidently come from a more northerly outcrop, for a drift of boulders can be traced from the neighbourhood of Belford southwards in a direct line with Alnwick Moor.

Some of the whin dykes west of the Whin Sill furnish streams of boulders which indicate the direction of ice-movement over limited areas. Thus boulders from the High Green dyke can be tracked in an easterly direction, and those from the Acklington dyke at Clennel are carried north of the Netherton Burn [6]. Similarly, the characteristic quartz felsite of the dyke at Quickening Cote is found near Linbrig, and the purple porphyrite of the Long Crag dyke is the source of many boulders about Coppath and Castle Hill [6].

In the Upper Coquet a general carry from the west has been recognised by Clough; Redesdale basalts are found in the Lumsden and Ramshope burns, and in the Coquet as far as Philip, Silurians from Harden Edge (1,772 feet) are carried on to the porphyrites of Thirlmoor (1,750 feet), glossy porphyrites of the Upper Coquet are borne east of their source as far as Cushat Law and Wether Cairn, and drift from the Carboniferous area south and west across the southern flanks of the Cheviots up to 1,000 feet [6].

Transport from the north is indicated by the drift of sedimentary origin which clothes the eastern flanks of the Cheviots to a height of 1,000 feet. Further east the pink limestone with green crinoid stems from Budle Bay occurs at Ellingham [21] and South Charlton, and the reddish sandstones from the neighbourhood of Tweedmouth are traceable for some distance down the coast.

Though, according to Tate [1], the drift of the neighbourhood of Alnwick contains no rocks more recent than the Carboniferous, such rocks do occur further south. Magnesian Limestone has been noted in the drift on the coast at many places between Hadston Carrs, near Amble, and the Tyne;

chalk boulders (one striated) have been found in the boulder clay at Walker and Heaton [20], and chalk flints in a comparatively stoneless clay (Howse's so-called Scandanavian Drift) resting on the boulder clay proper at Tynemouth [1], and in a similar clay at the foot of the Lyne Burn.

Of far-travelled rocks, the most conspicuous are from the Lake District and the South of Scotland. Representatives of the former are andesites of the Volcanic Series of Borrowdale, Threlkeld "granite," gabbro from Carrock Fell and the rock of the Armboth Dyke. Many occurences of these rocks, associated with Silurians, have been recorded in recent years [20]. The northern limit of these rocks in the eastern part of the county is, roughly, the divide between the Blyth and the Wansbeck. West of this it passes through Sweethope and along the Prestwick Burn. On the other side of the North Tyne they have been traced by Dwerryhouse [16] as far north as the Houxty Burn, though they are scarce north of the Roman Wall. Isolated patches of drift containing andesites, possibly of Borrowdale origin, have been recorded as far north as the Darden Burn [5].

Mixed with the Lake District rocks are many granites of Scottish origin (Criffel, Dalbeattie) and red sandstones probably of Permian age. They persist on passing northwards, after the Lake rocks have died out, up to the fells of the western border (Larriston, Caplestone, etc.). The drift of the Lewis and Whickhope Burns contains, in addition to the Galloway granites and Silurians, a great amount of a local, black, cherty limestone. These rocks can be traced along the right bank of the North Tyne to Bellingham, over the Wanny Crags and down the Wansbeck as far as Morpeth.

The drift of the Tweed Valley is particularly rich in Silurian rocks; to this source must be referred many of the boulders of greywacke in the north-east of the county.

No classification of the boulder clays of Northumberland seems possible, though, locally, there is frequently evidence of at least two clays of different origin. Thus a reddish clay with few stones occurs on the coast, and inland from Bambrough to Ellingham, rising to 200 feet, which can be proved in places to overlie the typical bluish clay; and the two clays, preserving the same relationship, can be traced southwards along the coast as far as the Wansbeck. From the rock-contents, it would appear that the grey clay had, in the main, a westerly origin, the reddish clay a northerly origin (Tweed Valley?). In the Spartley Burn some sections show a reddish clay charged with porphyrite boulders, overlain by a grey clay containing many sedimentary rocks, the evidence thus indicating a later movement from some point south of the porphyrite area. Near Sweethope Lough the top clays contain many Dalbeattie granites; the underlying clays, though alike in character, seems to be free from Scottish boulders. Local clays, as already pointed out, frequently rest on typical boulder clay, the difference in composition and glaciation of the boulders being occasionally strongly marked.

Only two tracts of limited area appear to have escaped invasion by foreign ice at maximum glaciation; the one includes Carter and Peel Fells and the region south of these as far as the Blakehope and Plashetts Burns [7], the other comprises Cheviot, Hedgehope, Comb Fell, and Cushat Law in the Cheviots [6]. Foreign boulders are extremely rare in the drainage area of the Tarret and Tarset Burns, and in fact over the whole tract lying between the North Tyne and the Redewater; also on the Simonside Hills above 1,100 feet; but the presence of glaciated and striated surfaces in these districts shows that some overriding by foreign ice took place.

III.—*The Glacial Sands and Gravels.*

This term embraces many deposits of different origin which are alike in being of more recent age than the boulder clay on which they usually rest. They form conical or elliptical hillocks (kaims) either isolated, or strung together like a chain of beads, or massed confusedly with crater-like depressions and land-locked hollows, or finally in belts, the longer axes of the individual hillocks being parallel to the general direction of the belt. Occasionally they occur as ridges, either straight, or sinuous, or a combination of these. The material of these deposits varies from clean sand and gravel to partly water-worn, morainic matter mingled with dirt. Often associated with these are flat, featureless deposits of sand and gravel. In the drift-filled valleys they form extensive terraces, difficult to distinguish, except at times in size and contents, from the ordinary river-terraces. Smaller delta-like deposits occur at the mouths of many of the dry valleys, and will be considered later.

It has been pointed out [9] that the contour and characteristic bedding of the kaims may occasionally be the result of underground, post-glacial denudation. The coincidence in direction, however, of the longer axes of isolated kaims (and the same applies to the drumlins or hillocks of boulder clay), and the trend of aligned kaims with the glacial striæ over considerable areas would seem to preclude the possibility of the formation of most of the kaims herein described in this way. One may thus regard their peculiar features as original, that is, as due essentially to their glacial origin.

A few examples of the various types of kaims may be mentioned. Isolated kaims occur at Loansdene Hill and Fenrother, near Morpeth; at Whelp Law and Coquet Cairn in the upper Font; aligned kaims are well represented along the Erring Burn, about Throp Hill on the Wansbeck, north of Alnmouth, and west of Lordenshaw near the Forest Burn. Massive kaims containing kettle-holes occur near Hepscott, on Langlee Moor (Shipley) and in the Till Valley, and a kaim belt, capping the drift dam, crosses the Wansbeck between Angerton and Meldon. Of the ridged gravels (eskers) there are three good examples. One crosses the Blanch and Newbiggin burns and shows stream-like windings, six in number, to great perfection; the material is clean coarse gravel, cemented in places (Photograph 1). A similar ridge, almost a mile long, with many convolutions, occurs south of the Hallington Reservoir. The Bradford kaims include a similar long ridge, one portion of which is straight and of uniform height for a considerable distance. This gives place to a winding ridge at the south end. The material of this ridge is, in places, rather morainic than gravelly.

The flat terraced deposits of sands and gravels occur most extensively in the larger drift-filled valleys, though not confined exclusively to these. They are well developed in the valleys of the Till and Aln, the Coquet below Felton, where they cover a triangular patch of about five square miles flanked on the east by the Crowden Hill Ridge (*v. post.*, p. 97); in the Font at Netherwitton and at the junction of the Font and Wansbeck. Sections of the last near Mitford show these deposits resting on a great thickness (over 80 feet) of boulder clay, and composed of lenticular patches of sand, pebbles, rounded and subangular, boulders with striæ in all stages of demolition, and thin bands of clay containing scratched boulders. Traced southwards, from the exposures on the Font to those on the Wansbeck, these beds pass into a clean, compact, cemented conglomerate (Photograph 2.). At Netherwitton the size of the terraces is out of all proportion to that of the modern haughs. Near Rothbury, as noted by Topley, the contents of these deposits are chiefly sedimentary rocks, in marked contrast to the modern porphyrite-bearing haughs of the Coquet.

These facts point to rapid erosion of glacial (and other) materials and deposition in torrential waters at the close of the ice-age, when the modern streams, greatly swollen by melting ice and the bursting of ice-dams, were coming into being and their valleys were yet uncut. When foreign ice held the catchment, as in the case of the Coquet, the composition of the detrital matter differed from that transported after the ice had melted and new species of rock had become exposed within the drainage area.

Though these various deposits have been described separately, there is much evidence to show that they are connected in part and belong to the same order of phenomena. This has been emphasised by Hugh Miller [6] who noted the transition from kaims to moraines in the ascension of the Lisles Burn and Whiskershiels valleys and the passage upwards of morainic matter into well-rounded shingle in the same section. Similar relationships are clear in many parts of the county. The drumlins of Hartburn and Middleton are continuous with, and point in the same direction as the kaims of Throp Hill, and there is no break between these and the terraced deposits of Mitford. The morainic dams of Roughlees and Coppath show the passage upwards into gravel and sand. The Bradford kaims are morainic in some parts, gravelly in others, and they are closely associated with drumlins and sandy ridges which show convex bendings towards the main ridge, sometimes blending completely with it. The Wansbeck drift barrier near Meldon is capped with a belt of kaims, the directions of the individual members being parallel to that of the barrier as a whole. Lastly, a drift ridge, remarkably uniform in height and breadth, stretches from Whitefield on the Wansbeck to the Coquet near Felton, and this shows the transition from gravel at the south end, through boulder clay, to gravels with kaim-like arrangement at Crowden Hill and sand at the northern end. (This ridge may be called the Crowden Hill Ridge for ease of reference, and is marked as such on the map).

The Composition of the Glacial Gravels.—The glacial gravels sometimes resemble in composition the clay on which they rest, whether this be purely local, as at Camp Hill (Shipley Burn), Whetstone House, and Linnheads (Lisles Burn), or far-travelled, as at Blanch Burn, where Cheviot porphyrites are common. Occasionally kaims not far removed may exhibit considerable differences in composition from one another. The Eachwick kaims, for example, abound in Lake District rocks and hold but few Cheviot porphyrites; the Kirkley kaims, only three miles away, contain few Lake rocks, and many of Cheviot origin.

Some of the upper gravelly deposits, however, are strikingly different in composition from the underlying clays. This fact was observed long ago by Tate [1] in the Alnwick district.

He writes on the subject as follows: "The gravel beds differ from the boulder clay as to the source of their rocks; in the former the rocks are chiefly those which are not found *in situ* in the immediate neighbourhood; in the latter the boulders are chiefly of local origin" (p. 352). The gravels referred to in this extract are charged with Cheviot porphyrites, which are so abundant in places as to be the main constituent, and this Upper Cheviot Drift, as it may be called, can be traced down the valleys of the Aln and Eglingham Burn, through Alnwick and Alnmouth and southwards in a sinuous line, from two to six miles from the coast, through Crowden Hill to Whitefield on the Wansbeck. A conspicuous mound of the same porphyrite gravel occurs by the Haydon Letch, two miles north of Ashington. Similar porphyrite-bearing gravels overlying boulder clay containing chiefly local rocks have been described by Garwood [21]. They occur near Budle. Another striking example of the same phenomenon occurs in the valley of the Erring Burn, the kaims of which contain Lake District rocks and Galloway granites in abundance, but are practically free from whin pebbles, though the Whin Sill crops out only a mile or two to the north-west, and the country around is strewn with erratics derived from it.

Two gravel beds may now be referred to, which are exposed on the coast and contain a variety of rocks, some of which have not been noted as occurring in the boulder clays. One is exposed at Horsebridge Head about half-a-mile north of the mouth of the Wansbeck. It occupies a valley-like depression in Carboniferous shale and sandstone, and is overlain by typical boulder clay. The contents are chiefly local sandstones; Carboniferous limestone is rare, dolomitic limestone (with Permian fossils) common; many chalk flints and one pebble of chalk have been found. Of the igneous and metamorphic rocks present, whinstone is the most abundant, porphyrites, many of undoubted Cheviot origin, are common, and, in order, come granites, mica and hornblende schists, syenites, quartz porphyries, andesites and glossy porphyrites (Cheviot), mica porphyrites and diorites. Though the mode of formation of this bed is unknown, the evidence seems to indicate that it marks the site of an early glacial stream which flowed in a south-westerly direction, possibly towards the pre-glacial Wansbeck.

The other bed stretches northwards for half-a-mile from the mouth of the Lyne Burn. It is from 6 to 15 feet thick, rests on boulder clay, and is covered with drift sand. Its base is about 10 feet above high water mark. At the south end the gravel is clean and firmly cemented in places; towards the north the pebbles are less developed and embedded in dirty sand. Sandstones and limestones (many reddish in colour) are the chief constituents, and whinstone and magnesian limestone are abundant. Of the far-travelled rocks the most conspicuous are Cheviot porphyrites. Chalk and chalk flints occur here, as at Horsebridge Head, along with greywacke, mica schists, garnetiferous mica schist (Pitlochrie?), syenite, quartz porphyries, trachyte and chert.

From its position this bed might reasonably be regarded as a raised beach. One may look upon it, on the other hand, as a glacial gravel which has been laid bare by marine erosion. If this view be provisionally accepted, then its relationship to the Horsebridge Head deposit comes out in a clearer light. Both are distinguished by containing chalk flints, magnesian limestone, Cheviot porphyrites, and igneous and metamorphic rock, probably of Scottish origin. One occurs below typical boulder clay upon which rests a reddish prismatic clay, the other lies on reddish prismatic clay underlain by typical boulder clay, and in both cases the typical clay rests on the rock-surface in the immediate neighbourhood. These facts point to a drift of ice from the north both before and after the formation of the typical boulder clay, which has a more westerly origin. The source of the later rocks (Permian and Cretaceous) is unknown, but may possibly be some outcrop in the North Sea.

Summary of Evidence of Ice-Movement derived from Striations and Transport of Glacial Material.—A cursory inspection of the facts so far detailed will suffice to make clear the complexity of movement of the various ice-sheets which struggled for mastery during the glacial period in Northumberland. Much of the evidence is, at first sight, contradictory; thus Cheviot rocks have been carried south, and sedimentary rocks north on to the flanks of the Cheviots, and the striations often give no clue to the origin of the neighbouring drift. In the open country, where striations are almost exclusively observed, it seems probable that they mark only the latest phases of ice-movement, and only occasionally were conditions favourable for the preservation of two series. The interpretation of the data is thus a matter of considerable difficulty and not a little uncertainty. Three stages of glaciation can, however, be readily recognised, viz., the early stage, the period of maximum glaciation and the period of melting and retreat.

At the beginning of glacial conditions, it is evident that the Border hills between the North Tyne and Cheviot sent forth considerable streams of ice in all directions. The ice from the porphyrite area was hemmed in its western progression by the ice from Carter and Peel Fells ("Carter Ice") and driven down the left bank of the Redewater. The Carter ice was similarly barred by the great western sheet of ice from the Solway district and driven along the left bank of the North Tyne. The three great streams converging near Redesmouth were impelled in an easterly direction along the Wansbeck and then south-east towards Tynemouth. The pressure of the Solway ice evidently increased with time, the Carter ice being driven towards the Coquet and the Cheviot ice diverted until the Aln valley became the locus of its outflow. At maximum glaciation it is probable that the western sheet held complete sway almost as far as the coast. On the northern side of the Cheviots, ice flowing down the Tweed valley seems to have checked the flow of Cheviot ice in that direction and to have surmounted even the outlying spurs of the hills.

There is some evidence that a sheet of ice flowed southwards along the coast at an early stage of glaciation. Towards the end pressure from the North Sea had become a prime factor, its effect being recognisable to a distance of 14 miles from the coast. As a result of this the Tweed and local ice was thrust up the valley of the Till, but was barred near Hedgeley by the Cheviot ice. This, restrained to the south by the great western sheet, was driven down the Aln and diverted near Alnmouth along the coast, which it traversed in a southerly direction. The position of equilibrium of these sheets at the latest stage of retreat will be considered after the next line of evidence has been treated of, viz., the evidence derived from the glacial lakes.

IV.—*The Forsaken Water Courses.*

The occurrence of these in the district lying between the Tyne and the Wansbeck has already been recorded [18]; further investigation extending over the greater part of Northumberland has disclosed many others, and about seventy are marked on the accompanying map (No. 1). They occur in two positions; firstly, and most frequently, cutting the watersheds between the pre-glacial valleys or the spurs and subsidiary water-partings connected therewith; secondly, as trenches running along a hill-side, roughly parallel to the water-parting. Occasionally, as on Harden Hill, the two types are combined, the upper part of the watercourse cutting along one side of the ridge, then swerving sharply across the divide and dropping abruptly in cascade-fashion down the other side. A great number of these valleys are quite dry; when of considerable length they usually carry small streams in their lower parts, the upper parts being dry or at most flooded in wet weather with stagnant water. As the gradient at the intake is often very slight, a small artificial dam suffices to convert them into lakes; such is the origin of the Rothley Lakes near Ewesley. Natural dams are formed in them either by the meeting of screes from opposite sides, when a series of basins is produced (as at Middledene and The Kettles, D2 and C16 in map No. 1), or by detrital matter thrown down by an entering stream. The latter type (the "corroms" of Kendall) is not uncommon on a small scale, and frequently results in the diversion of local drainage near the intake.

No connexion can, in general, be traced between these "dry" valleys and faults. In one case, that of Fawdon Dene, the direction of the dene does coincide with an important fault bringing up Silurians against porphyrites. In other cases the reverse holds; thus Selby's Cove (B7 in map 1) is cut directly across a fault, and, in addition, a thick whin dyke.

On the higher ground the dry valleys are often confused by branched courses which isolate steep-sided rocky hillocks (see Photograph 6); below the 500 feet contour they are usually simple with, at most, a double loop at the intake. Some are of great depth; they are grouped irrespectively of the present drainage system, and it may not be unnecessary to mention, in view of recent utterances (Pres. Address Brit. Assoc., 1910), that they are often cut through drift and are thus of later age than some of the glacial deposits.

Washed deposits of three kinds are associated with these valleys, viz., kaims and their attendant featureless deposits of sands and gravels about the head of them, fragmental river-terraces along the sides, and deltaic spreads at the foot. The connexion with the kaims is two-fold, for the dry valleys are best developed in those districts where kaims mostly abound, and the maximum height of a given series of dry valleys marks the limiting elevation of the kaims in the immediate neighbourhood.

The distribution of the dry valleys is clearly not haphazard. All the ridges trending eastward to the coast between the Tyne and the Aln are breached by them at heights varying from 170 to 490 feet. Other important groups of them are found on the watershed between the Font and the Coquet, between the Spartley Burn and the Aln, and on the northern and eastern flanks of the Cheviots. They seem to be practically absent from the district drained by the North Tyne and the Redewater, with the exception of the eastern watershed; a few, which have not been fully investigated, occur along the line of the Roman Wall, and one very large one, which carries the Tipalt Burn in its lower course, connects the valley of the Irthing at Gilsland with that of the South Tyne.

According to the views advocated especially by Kendall, these old watercourses or dry valleys are the overflow-channels of ice-dammed lakes which had a temporary existence during the last stage of the glacial period. In a former paper [18] the old Northumbrian word "swire" was proposed as a suitable term to connote anomolous slacks or valleys having the characteristics briefly sketched above. As the word is short and has other recommendations, it will be frequently employed in the sequel.

If Kendall's hypothesis of the origin of the swires be accepted, then it is evident that their position and grouping, taken in conjunction with the evidence derived from striations and rock-transport, throw important light on the extension of the ice-sheets during the last stages of their existence and the progress of their retreat. In addition, some peculiarities of the swires themselves find explanation. Thus, the frequency with which large erratics occur near the heads of the swires suggests that they have floated in from the lakes on ice-rafts, which have become stranded in the shallowing waters of the stream. Again, the frequent occurrence of a multiple intake may be explained by slight movements, either forward or backward, of the ice-dam; and a peculiarity often noted in the trenches which run along hill-sides, viz., the absence at fairly regular intervals of a bank on the down-hill side of the trench, is explained by assuming that the ice itself formed the bank at these places.

The interpretation of the evidence furnished by the swires will now be attempted. For the correct understanding of the matter it may be well to mention that the evidence so far adduced all points to the existence of two great ice-sheets, the western and the northern, during the latest stages of the glacial period. Small, but still important factors, are the two local ice-flows from the Cheviots and Carter and Peel Fells. The positions occupied by these have been briefly indicated. It may be assumed that on melting, land would first be uncovered where the ice was thinnest, that is as far as possible from the supply of ice. When two or more sheets were confluent, this position would be along the junction. Once cleavage of the ice-sheets has taken place, the position of their edges and the contours of the ice-free land lying between would alone determine whether ice-dammed lakes could be formed along the edges of all, some or none of the sheets. The position of the glacial lakes, as indicated primarily by their overflow-channels or swires, thus enables one, in cases where the contour of the land is favourable, to determine the lines of confluence of ice-sheets at the period of melting and to trace various stages in the retreat of the sundered sheets.

In the accompanying map (No. 1) the swires are lettered A to E; those which are produced by the same ice-flow bear the same letter, and the numbers attached refer to the probable order of formation.

The Glacial Lakes South of the Coquet.—South oι the Coquet the northern and western sheets held sway at the close of the glacial period. The first evidence of cleavage is in the Pont valley near to Dissington, the lake held up by the northern sheet overflowing through the gap A 1 (height of intake 400 feet).* The western sheet in its retreat south of the Wansbeck was unable to obstruct the drainage, the northern one, on the other hand, was in a favourable position with reference to the contour, and lake-conditions were prolonged. The "Pont Lake" [18] thus shifted its position slowly from west to east, its level becoming lowered owing to the erosion of its overflow-channels; and new outlets A 2, A 3, A 4, at progressively lower elevations (340, 298, and 268 feet) were cut when the containing ridge became bared of ice below the level of the next higher notch [18]. It seems probable that when the Pont lake was draining towards the Ouseburn valley through A 4, it was receiving water from the Wansbeck valley through A 5 (345 feet) and a small lake, impounded near Newbiggin, overflowed into the Ouseburn through A 6

* The contrast in composition of the Eachwick and Kirkley kaims noted above, and the coincidence of their positions with those of the ice-edges postulated here seems to be more than accidental.

(300 feet), the flooded Ouseburn valley discharging its waters to the south through Walbottle Dene [18].

The line of cleavage between the two sheets after crossing the Wansbeck swept towards the west along the high ridge parting the Font from the Lyne, Tod and Forest Burns. The northern sheet appears to have itself divided in an easterly direction, causing the Pont waters to flow through A 7 (250 feet), and the Wansbeck waters through A 8 (240 feet), initiating thus the course of the Sleekburn. Further recession of the two portions then brought about the opening up of the post-glacial reaches of the Ouseburn, Blyth and Wansbeck.

The position of the parted ice-sheets north of the Wansbeck is first indicated by the swire A 9 (340 feet). This is the only channel which drains in two ways, from which it would appear that slight oscillations of the sheets caused the pent-up waters to flow at various times from west to east and *vice versa.* The slow retreat of the northern sheet towards the Coquet opened up the important channel of Haredene, A 10 (480 feet), and a more rapid recession gave rise to the less important gaps A 11 to A 17, the heights of the intakes of which are, in order, 460, 380, 320, 280, 270, 190, and 170 feet. Of these it seems probable that A 11, A 12, and A 13 were in operation simultaneously. The next stage of retreat is marked by the melting of ice in Lower Coquetdale and the initiation of the post-glacial portion of the Coquet.

Coming now to the western sheet, the first opportunity for the production of ice-dammed lakes at its edge occurred, as indicated above, at the position A 9 (or B 1). Further recession of the edge flooded the valley of the Newbiggin Burn, the northern tributary of the Font, and the overflow of the lake produced a fine series of swires, B 2 to B 6, at 900, 750, 720, 600, and 525 feet respectively. Probably at some time during this stage a slight advance of the ice-remnant on Simonside caused the blocking of the Ousen Sike and the notching of the ridge parallel to this hill, producing thus the deep cleugh of Selby's Cove, B 7 (1,090 feet), one of the most perfect of the swires outside of the Cheviot area (Photograph 3 and map No. 2). The next stage of withdrawal corresponded to the clearing of the ice between the Whiskershiels and Fallowlees Burn, the consequent cutting of B 8 (1,010 feet), B 9 (950 feet), the marginal channels near Eastnook on the right bank of the Whiskershiels valley, and eventually the huge swire B 10 (630 feet) at the head of the Grasslees Burn. Meanwhile the edge of the great sheet was retreating along the high land between the Fallowlees and Hart Burns, and was next in a position to impound water when it lay across the broad, drift-filled valley of the Delf Burn. The overflow was now over the Rothley Crags, and the deep gill of that name, B 11 (650 feet), was cut. Similar conditions would again hold two miles south of this position, and would result in the formation of the post-glacial valley of the Hart Burn.

Indications of the last stages of retreat of the western ice east of the North Tyne are found on the Ottercaps and in the Erring Burn valley. The Ottercaps ice evidently became independent and sent small tongues of ice down the adjacent valleys. The moraines in the Lisles Burn and Whiskershiels valley are evidence of a westerly flow from this ice-cap. In the Erring Burn valley two positions are marked by the swires B 12 (680 feet) and B 13 (650 feet). Possibly some of the notches in the Whin Sill, as at New Onstead near Bavington (B 14), were produced then. At this stage the direction of movement had changed slightly, possibly owing to expansion of the Tyne glacier following upon the relaxation of pressure from the main western sheet. The ice was thus pushed in a direction somewhat north of east, parallel to the outcrop of the Whin Sill. A recorded striation in the district near Bavington and the divergence in composition of the upper gravels from the boulder clay, as commented on above, confirm this view. West of the North Tyne there is little record of the retreat of the Solway ice, and the contour of the country and direction of retreat would lead one to expect little. On the western watershed, however, opportunity again occurred for the formation of an ice-dammed lake, and the record of this is the great swire near Gilsland (Mackinder's "Tyne Gap.")

The Glacial Lakes North of the Coquet.—The dry valleys north of the Coquet are divided into two great series, the eastern and the western, and these are separated by the Carboniferous uplands which form the great ridge of the Chillingham Fells and the hills between the Aln and the Coquet, stretching eastward as far as Alnwick Moor. Though these uplands were completely overridden by foreign ice at maximum glaciation, it is probable that the flow of native ice from them was considerable during the melting stage.

The Eastern Series.—After the clearing of the Lower Coquet, the northern sheet retreated towards the Aln, its western edge being confluent with the ice in that valley and with that on the adjoining uplands. The swires marking stages in this period are A 18 to A 22 (height of intakes 420, 360, 490, 250, and 400 feet). Some of these, A 19, A 20, and A 21, are of great depth, pointing to slow recession of the ice. North of the Aln, two channels of moderate size, A 23 (350 feet) and A 24 (380 feet) give evidence of the position of the northern sheet. A small kaim, thrown half way across the latter slack, marks a temporary advance of the ice in this region. Beyond Belford the country has not been examined in detail.

The Western Series.—This great series of swires requires for its interpretation the co-existence of three ice-sheets, evidence of which has been already given. These are the northern sheet, sweeping down the Tweed valley along the northern flanks of the Cheviots and diverted up the valley of the Till; the Cheviot ice flowing in particular down the Breamish valley and forced eventually into the valley of the Aln; and the western sheet, impelled from the Redewater, overriding the southern flanks of the Cheviots, towards the head of the Aln. These sheets cleaved in the neighbourhood of Ingram, and in their retreat produced striking effects. The northern sheet blocked up the Breamish valley, forming a lake which drained across the watershed into the Aln, the huge gorge of Shawdon Dene, C 1 (300 feet), being thus eroded. The retreat of this sheet northwards and westwards corresponded with the gradual clearing of local ice from the hills fringing the granitic central mass. Temporary tarns were thus held up in the land laid bare between the ice-edges, and these in overflowing notched the many spurs which radiate from the massif. A great series of swires was thus generated; most of these have been described by Kendall and Muff [15], and reference for details may be made to their paper. In the map the most important of these are marked C 2 to C 17. For reference, the approximate heights of their intakes may be given; these are, in order of numbering, 700, 625, 1,000, 1,025, 900, 900, 800, 1,000, 960, 900, 800, 725, 700, 600, 500, and 400 feet. (Photograph 4).

The line of cleavage between the Breamish ice and the western sheet followed the lofty ridge running from East Hill to High Knowes. The Breamish ice has marked its retreat by notching four water-partings, D 1, D 2, D 3, and D 4 at 900, 900, 950, and 1,000 feet respectively. Of these, D 2, Middle Dene, is very deeply cut, and the erratic of Cheviot granite near its intake bears witness to the source of the ice which produced it.

In no place are the phenomena accompanying the retreat of foreign ice better shown than on the south side of the above ridge, in the neighbourhood of the Spartley Burn and the head of the Aln. The edge of the western sheet there lay parallel to the ridges and across the Spartley and Biddlestone Burns, the result being the production of a great number of marginal trenches along the ridge sides and direct cuts across the water-partings. The first cut E 1 (1,020 feet) occurring on Northfield Hill is small, with a double intake, and is the only one of the series which drains westward. An important one follows next in Fawdon Dene, E 2 (700 feet), a huge cleugh draining towards the Breamish and connected with several marginal trenches west of its intake (Photograph 5.). A slight recession now produced the marginal channel E 3 (660 feet). The upper part of the Spartley valley was now free from ice, and, being dammed lower down, overflowed by Coppath, cutting the swires E 4 and E 5 (920 and 900 feet), and at Castle Hill E 6

(700 feet), and Screnwood E 7 (550 feet). The last two are enormous valleys, their eroding waters being fed from the Biddlestone Burn, through E 8 (1,100 feet) and E 9 (1,000 feet), and through the great series E 10 to E 15 (950, 930, 900, 800, 700, and 680 feet) on Harden and Ewe Hills. (Photographs 6 and 7.) Many of the last are marginal trenches, and indicate that the ice-edge lay parallel to the direction of the Harden Hill ridge. E 10 is marginal in the western part of its course, then it crosses the water-parting, making a very conspicuous gap in the sky-line, and falls abruptly on the north side of the hill (Photograph 7).

The occurrence of a small but well-cut swire (E 16) and several marginal trenches on the right bank and near the foot of the Barrow Burn (Alwinton) may indicate a further stage in the retreat of the western ice.

Near the head of the Coquet there is evidence, both from striations and the transport of boulders, of ice-movement from the north and west; and the occurrence of three swires, apparently belonging to the same series, points to a general movement from the north-west at the close of glacial conditions. The first is Graham's Cleugh, F 1 (1,320 feet), connecting the Philip with the Ridlees Burn; the second F 2 (1,300 feet) cuts the ridge between the Gable and the Deerbush Burns; and the third F 3 (1,250 feet) notches the water-parting between the Trows and Barrow Burns. This series possibly marks the flow of Tweed ice across the Border, and this is further indicated by two isolated gashes, viz., between Broadhope Hill and Scald Hill at 1,500 feet, and between Windy Gyle and Mozie Law at 1,600 feet. Both of these require a flow of ice from the Scottish side of the Border to account for their position.

Summary.

The glacial period in Northumberland resolves itself into a struggle between (1) local ice-flows, especially those from the Cheviots and the Carter Fell district, (2) a great sheet impelled from the west, across the Cumberland border and down the Tweed Valley, and (3) either a sheet or pack-ice which pressed from the North Sea area. It is evident that the last touched land to a very limited extent, and the name "Northern Sheet" has been given in the foregoing account rather to those portions of the Tweed and local ice which were impelled southwards by its agency. The problem to be solved is the determination of the relative positions of these sheets of ice at different stages. The evidence adduced points to the importance of local ice at an early stage, the Cheviot ice then spreading out in a broad sheet to the south and east, its western margin being limited by the Carter and western sheets, its eastern mingling near the coast with ice from a northerly source. The pressure of the western sheet then increased until it almost completely dominated the country, overriding all but the highest hills. Towards the end of the period pressure from the North Sea re-asserted itself, with the result that the ice within 10 to 15 miles of the coast changed direction from east to south, and the local ice from the Cheviots, hemmed on all sides, was forced in a narrow stream down the Aln valley and southwards along the coast.

At the melting stage the lines of confluence of ice from different sources seem, in many cases, to have been positions of weakness (or thinness of ice). The sheets were sundered along these lines and temporary lakes were formed when favourable conditions of contour and ice-edge existed. These conditions were frequently maintained during the retreat of the ice, long after cleavage had taken place, so that various stages in the retreat can be determined.

It will be noted that the evidence of the direction of movement of the various ice-sheets afforded by the striations, along with that of direction and extension furnished by the character of the drifted rocks, especially those in the gravels, agrees with the evidence on these subjects derived from the position of the dry valleys. The last line of evidence has the advantage of enabling the positions of the ice-edges at melting to be determined with some approach to precision. One result of this is to show that the local ice of Cheviot origin had considerable power at the close of the ice-age, and that it retreated *pari passu* with the foreign ice, the glacial lakes existing only in the narrow strip of ice-free land between the sheets. A view somewhat at variance with this has been expressed by Kendall and Muff [15].

The map (No. 3) represents an attempt, confessedly imperfect, to render the complex phenomena accompanying the glaciation of the county somewhat clearer than is possible by any verbal description, weighted as that must be by a mass of details. The data furnished by the swires are in part summarized in this map by the representation of the lines of cleavage on the melting of some of the great confluent sheets.

Brief reference may be made to the vexed question of the origin of the kaims. It has already been noted that their occurrence coincides in general with evidence of the existence of glacial lakes in the near neighbourhood, and also that their maximum elevation is not above that of the highest swires in the locality. This association seems to point to the deposition of the kaim-materials in the waters of the temporary lakes. The fact that in a few cases (*e.g.* in the valley of the Lisles Burn) kaims occur without attendant swires does not invalidate this conclusion, for glacial lakes discharging over the ice might supply the requisite conditions. The transition from kaims to moraines in the ascension of the Lisles Burn and Whiskershiels valley, and the passage upwards from morainic to kaim-like matter in the same section was held by Hugh Miller [5] to indicate "strongly, if not conclusively, ... the morainic origin of the kaims." The recognition of the glacial lakes strengthens this view by supplying a condition which may be conceived as favourable to the formation of kaims.

Appendix.

Pre-glacial and Post-glacial Drainage.

The effect of the glacial conditions upon the drainage of the county has been considerable, and a brief summary of the changes brought about by the agency of ice and drifted material may not be out of place. The existence of several large pre-glacial valleys in the south-east, completely choked with drift, has already been recorded [17 and 18], and to the number may be added that of the Delf Burn, which apparently continued its southerly course from Rothley and discharged into the Wansbeck a little to the east of Wallington. Complete obliteration of a pre-glacial valley by drift, as has already been pointed out [18], is favoured by a situation at right angles to the direction of ice-movement. When similar conditions only lead to the partial filling up of a pre-glacial valley, the drift is thickened on the lee-side of the valley, with the result that the modern stream is displaced towards the other bank. This disposition, noted by Hugh Miller [5], is well shown in the Spartley Burn below Haseltonrig, the Forest Burn at Ward's Hill, the Font near Nunnykirk and Pigdon Banks, and the Redewater above East Woodburn, and results frequently in the cutting of a rocky channel at the edge of the drift-filled valley.

Of the streams which flow in valleys of pre- and post-glacial ages, some evidence has been brought forward in the preceding pages to show that the change from the one to the other course is occasionally the result of diversion by ice. This has been rendered probable in the case of Dewley Burn [18] and the Ouseburn, Blyth, Wansbeck, and Hartburn. The post-glacial denes in which these streams flow are, on this view, swires, which instead of being left dry on the melting of the ice, have been so placed that they have become permanent drainage-outlets.

Smaller effects due to the ridging of the drift are frequently noticeable. The many feeders of the Houxty Burn, for example, flow E.S.E. along lines determined by the drumlins. Near the coast, the long line of the Bradford kaims has diverted the Warren Burn northwards into Budle Bay, and the Crowden Hill drift-ridge which runs parallel to the railway from the Coquet to the Wansbeck, though it has been breached by the Lyne Burn, has diverted the Brock's Burn southwards and constitutes the water-parting for many of the small streams which make-up the Chevington Burn.

In the smaller valleys, the drift is often disposed either in long ridges rudely parallel to the trend of the valley, or forms a barrier across it. In the Harehope Burn both forms exist, the upper longitudinally arranged and composed chiefly of local material, the lower transversely disposed and remarkably porphyritic in character. Other examples of the former kind are met with in the Eglingham Burn and the Barrow Burn near Wilkwood; of the latter type, good examples occur in the Lisles Burn, the Wansbeck between Angerton and Bolam, the Font at Roughlees, the Edingham Burn at Windy Marsh, and the Spartley Burn near Coppath. Many of the drift barriers are crescentic and morainic in appearance. Both forms of ridging have given rise to lakes, some of which still exist, *e.g.* Kimmer Lough in the valley of the Eglingham Burn and Harehope Lough, the latter being partly artificial. In other cases the lake has drained itself, but the lake-bottom and the breached barrier remain as conspicuous features. Perhaps the best example of this is on the Wansbeck about Angerton and Middleton; a small lake-bottom also occurs in the Priestdene Burn above Chathill, the barrier being a low drift ridge connecting two outstanding kaims. The lake-conditions which have left their mark in the Till valley were probably produced by a combination of ice- and drift-damming.

The small lakes or loughs in the open country, with the exception of those near the Roman Wall, which appear to be rock-basins, are clearly drift-dammed in most, if not all cases. Many are now represented by bogs or mosses, and these are frequent where the kaims abound. They nestle among the massed kaims, especially on Langlee Moor, or are barred by drift-ridges when these lie parallel to the contours. Many examples of the latter class can be seen on the western sides of the Bradford kaims.

In conclusion, the author wishes to tender his best thanks to Messrs. R. C. Burton and G. Weyman for their help in examining many of the deposits described in this paper.

EXPLANATION OF THE PHOTOGRAPHS.

1. The Blanch Burn Kaims. This kaim-ridge is cut at the north end by the Blanch Burn and at the south end by the Newbiggin Burn. The former section is shown on the left of the photograph, also the outline of the ridge, but not its delicate meanders.

2. Cemented glacial gravels on the Wansbeck at Mitford. The base of the gravels with immense boulders resting on the clay is seen at the bottom of the photograph.

3. Selby's Cove (B 7) near the intake, with Simonside in the background. This dry cleugh cuts across the ridge between the Ousen and Cove Sikes.

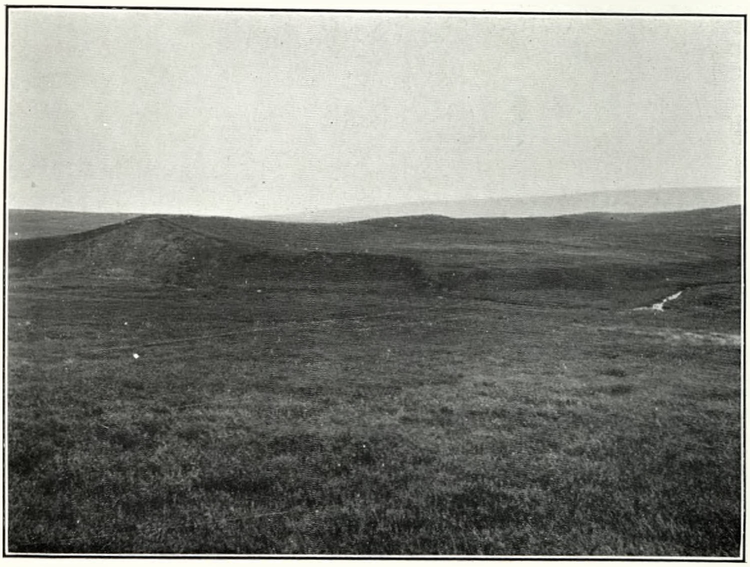
4. The swire at Humbleton Heugh near Wooler (C 12)—a deep dry valley severing a spur of the Cheviot Hills.

5. Fawdon Dene (E 2) near Ingram, looking north.

6. The lower marginal trench on Harden Hill (E 12) looking east, showing the steep rocky hillocks along its course. In the middle distance, on the other side of the Spartley Burn, is seen the rounded top of Castle Hill, and close by in the adjoining wood is the dry channel E 6, in alignment with the one shown in the photograph.

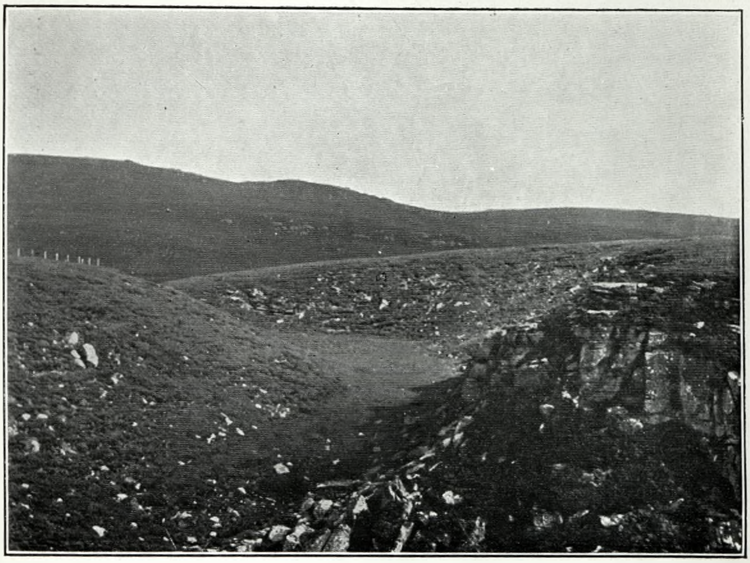
7. Harden Hill from the north. The marginal trench E 10 on the south side of the hill cuts across the ridge, notching the sky-line and tumbling abruptly down the north side of the hill. The photograph shows the notch and the steep portion of the slack.

8. Erratic of fine-grained, reddish sandstone, resting on coarse-grained white sandstone. Harehope Burn, near Blauweary, height 700 feet.



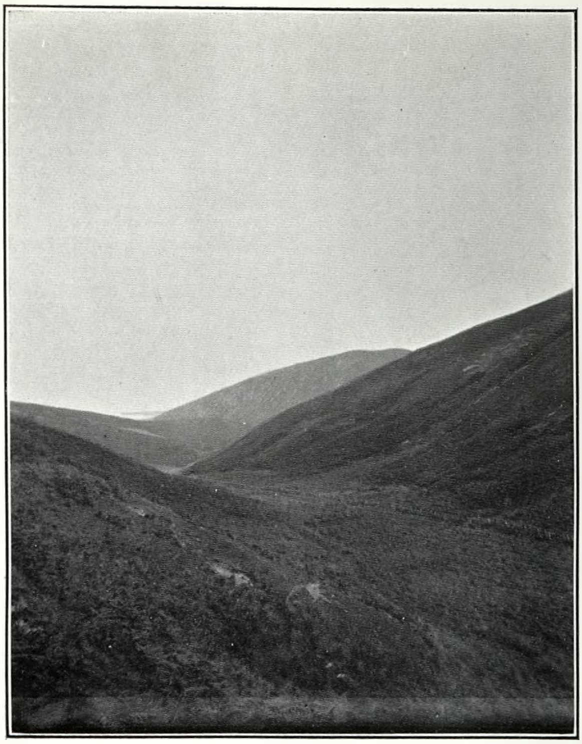
Photograph 1. Blanch Burn Kaims.

Photograph 2. Cemented Glacial Gravels, Mitford.

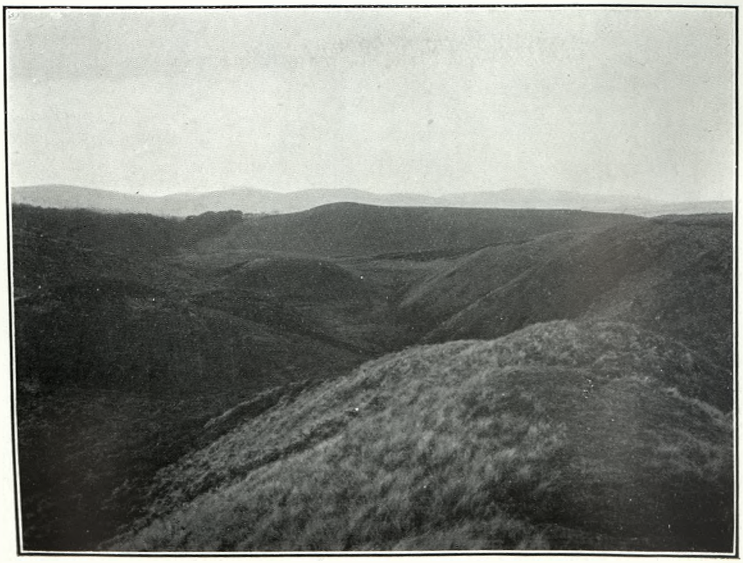


Photograph 3. Selby's Cove.

Photograph 4. Swire at Humbleton Heugh.



Photograph 5. Fawdon Dene.



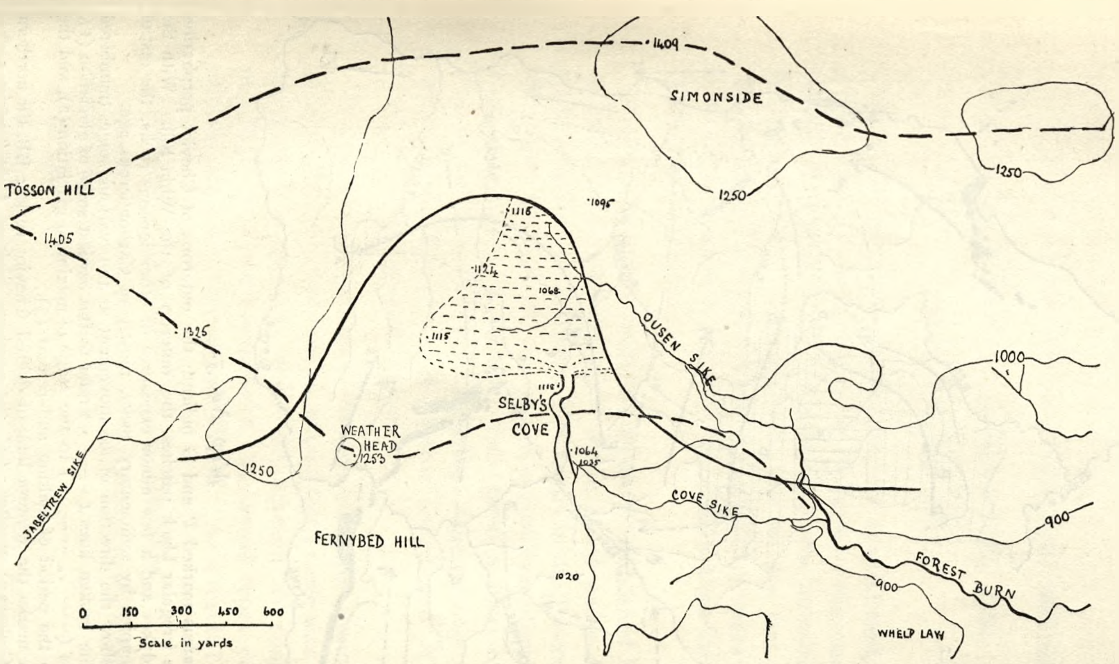
Photograph 6. Marginal Trench on Harden Hill.

Photograph 7. Harden Hill.

Photograph 8. Erratic, Harehope Burn.

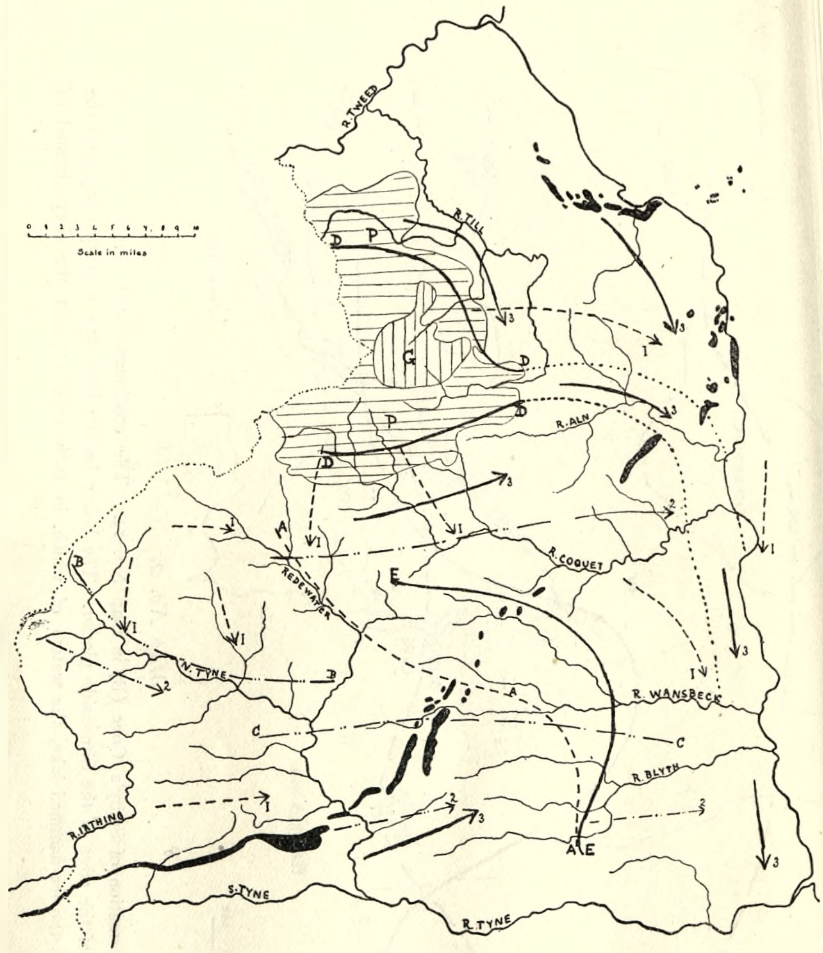
Map No. 1.

Contoured map of East Northumberland, the numbers denoting heights above sea level. Glacial striæ are marked by a circle crossed by a line or an arrow, the arrowhead implying that the direction is unmistakable. The overflow channels of glacier-dammed lakes are represented by short, thick, black lines which are lettered and numbered as explained in the text. The arrows adjacent show the direction of flow of the glacial streams. The thin wavy lines mark some positions of the edges of ice-sheets at the time the glacial lakes were in existence.



Map No. 2.

Illustrating the formation of Selby's Cove (B7 in map No. 1). The continuous wavy line represents the approximate position of the edge of the Simonside glacier. The heavy broken lines are water-partings and the shaded area represents the ice-dammed lake, the waters of which, in their overflow, cut the deep channel of the Cove.



Map No. 3.

The shaded areas marked P and G indicate the outcrops of Cheviot porphyrites and granites ; the irregular black patches, the outcrop of the Whin Sill. With the exception of the dykes and a few minor exposures of other igneous rocks, the rest of the country is occupied by sedimentary rocks, mostly of Carboniferous age.

The arrows show the direction of ice movement at the various stages (numbered 1, 2, and 3). The broken lines (– – – –) refer to the earliest stage of glaciation (1), the lines and dots (—— .. ——) to the stage of maximum glaciation (2), and the unbroken lines to the period of melting and retreat (3).

The line AA marks the western limit of drifted Cheviot rocks ; BB, the northern limit of Scotch (Galloway) granites ; CC, the northern limit of Lake District rocks, and the two lines DD, the limits of sedimentary drift in the Cheviot area.

The lines DD also represent the position of confluence of native Cheviot ice with foreign ice at the period of melting and retreat, and EE the line of confluence of the western and northern ice-sheets, south of the Coquet, at the same late stage. It is in the immediate neighbourhood of these three lines that the swires are most extensively developed.

The upper Cheviot drift occurs abundantly in the tract between the dotted lines (the continuations of DD).

On the British Spiders of the Genus Microneta.

By A. Randell Jackson, M.D., D.Sc.

(Plates VII. and VIII.)

The chief reason for undertaking the present work was that a good deal of confusion had arisen both in this country and on the Continent as to the species of the so-called genus *Microneta*. This, I think, was due to the fact that the descriptions of some of the species did not lay stress upon the distinguishing specific features, but wasted their strength on non-essential characters.

In 1900, when Mr. Pickard-Cambridge published his "List of British and Irish Spiders,"[1] he included under *Microneta* no less than twelve species. Since then in the Proceedings of the Dorset Field Club[2] he has described four others, one in 1902,[3] and three in 1906[4]. This gives a total of sixteen species, but Mr. Pickard-Cambridge subsequently withdrew two of these. These were *M. nefaria*[5] Camb. and *M. territa*[6] Camb., leaving fourteen species.

I have for the purposes of the present paper examined the actual types of all the species about which there was the least doubt, and in order to make my account as complete as possible I have also examined the actual types of all the doubtful species of the genus *Sintula*. As a result I am now

[1] Published by Messrs. Sime and Co., Dorchester.

[2] The full name of this paper is "Proceedings of the Dorset Natural History and Antiquarian Field Club."

[3] *M. cauta* Camb.

[4] *M. passiva* Camb., *M. territa* Camb., *M. beata* Camb.

[5] Sub *Pocadicnemis pumila* Bl., *op. cit.*, 1905, p. 51.

[6] Sub *Metopobactrus prominulus* Camb., *op. cit.*, 1907, p. 131.

able to announce that five[1] of the species of that genus had already been described under *Microneta*, and that three[2] *Micronetæ* were also redundant and are not specific entities.

This leaves us with eleven good species of the old genus *Microneta*, which, with the addition of *Syedra pholcommoides* Camb. and a new species described in this paper, gives a total of thirteen species, closely resembling each other in facies and the structure of the genital organs in both sexes. There are however such differences in the armature of the appendages that I fear it is necessary to arrange them in four groups, which in the present state of Arachnology must be regarded as genera. I have tried hard to persuade myself that their value is only subgeneric, but it will not do.

There is within these four groups a certain amount of variation amongst the species, so that it would be very easy for a person of a "splitting" turn of mind to increase the number of genera still more. These variations are however in my opinion distinctly subgeneric, and I therefore arrange the British Micronetoid spiders as follows :—

Syedra pholcommoides Camb.
Syedra innotabilis Camb.
Micryphantes rurestris C. L. K.
Micryphantes sublimis Camb.
Micryphantes beatus Camb.
Micryphantes mollis Camb.
Micryphantes saxatilis Blackwall.
Microneta viaria Blackwall.
Agyneta conigera Camb.
Agyneta decora Camb.
Agyneta subtilis Camb.
Agyneta cauta Camb.
Agyneta ramosa sp. nov.

[1] *S. oblivia* Camb., *S. aeria* Camb., *S. Frederici* Camb., *S. prominens* Camb., *S. nescia* Camb.

[2] *M. mystica* Camb., *M. jugulans* Camb., *M. passiva* Camb.

Although I now divide these species into four genera there is nothing novel in this arrangement, as none of the genera are new. The distinctions between the various groups have of course struck others. Kulczynski[1] uses three of the genera, and the other was created by Mr. Hull.[2] There is no doubt however that these spiders are all closely related to each other. In addition to the ordinary characters of their sub-family and group they all show the following positive and regular characters :

The metatarsi are short, those of the first pair of legs being very distinctly shorter than the tibiæ and patellæ (taken together) of the same limbs.

Femoral spines are invariably absent, and except in *Syedra* metatarsal spines.

The sexual organs are very characteristic, but it is in the present state of our knowledge difficult to draw hard and fast generic distinctions from them.

In the female sex the epigyne is very similar in all the species. It consists of a chitinous plate which exhibits on its lower border two sexual apertures separated by a median process. This structure exhibits a little variation in itself, and a good deal in its position. The positional changes probably depend on sexual or maternal activity, and are such that the sexual apertures sometimes look almost directly backwards, and at others almost vertically downwards. In the former cases the whole organ appears somewhat flattened, and in the latter the apertures are as a rule placed at the apex of a prominent downwardly directed epigastric process. These changes take place in all the species, and are probably due to some turgescence of the internal organs, but I am not aware of any research that has been made into the matter, which is not of course peculiar to spiders of this group. It is however

[1] Araneæ Hungariæ, vol. ii., pp. 84–88.

[2] Trans. of Nat. Hist. Soc. of Northumberland, Durham, and Newcastle-upon-Tyne, new series, vol. iii., part 3, p. 583.

responsible for some of the errors that are frequently made in the identification of the females of these small species.

The palpi of the male are fairly characteristic. The patella of each is short, and frequently carries one or more setiform hairs on its upper surface. The tibia is short. It is expanded distally to embrace the proximal end of the tarsus, and this expansion may show one or two prominences, which are sometimes sufficiently developed to merit the title of apophyses. This however only occurs in the genus *Micryphantes.*

The tarsus is more or less gibbous above, and in many cases the gibbosity rises up into a conical elevation more or less excavated on the outer side. The paracymbium is large and curiously moulded. It shows numerous ridges and depressions, but the exact nature of these is not very easily made out, the organ appearing very different in different positions.

The palpal organs are compact, the bulb divided into two parts, whilst below and to the outer side of the lower of these is placed the body of the lamella characteristica, the tail of which runs to the proximal end of the organs behind the paracymbium. This organ differs very much in the different species, and gives excellent and reliable specific characters.

The various parts of the palpal organs are very frequently found widely dislocated, and with all their relations altered, and this has been another difficulty in the identification of the species. This condition in spiders generally, is due to sexual turgescence of the hœmatodocha, and that of course is the case in this genus too. But it seems to be a fact that in the present group simple immersion in spirit is able to produce this condition, and this is especially the case in the genus *Agyneta.* It is therefore a comfort to find that although the position and relations of the lamella characteristica are often widely changed, the actual shape of that organ is not altered, and it remains in whatever position it is placed a reliable criterion of the species. As far as I can make out, when turgescence takes place the lamella characteristica is at first usually pushed forward. It then turns through an angle of 90°, so that its anterior end tends to look directly upwards.

The lamella characteristica consists of a wider body and a narrower tapering tail which runs to the posterior end of the palpal organs, between those organs and the inner side of the paracymbium. In each species it exhibits a slight range of variation, but as far as my present experience goes is always easily recognizable. This is the more fortunate, as in these spiders the paracymbium does not yield good specific characters. It does vary in the different species, but the differences are so slight and the organ appears so very different in different positions that it is very difficult to make use of it in the identification of the various species.

Characters drawn from the height of the clypeus and that of the ocular area, and from the exact shape of the profile of the cephalothorax, are so variable that with one or two exceptions they are quite useless in providing specific distinctions. This applies to the females as well as the males. In the former sex the chief specific characters must be drawn from the structure of the epigyne. Careful examination of this organ will in the majority of the cases lead to fairly easy recognition of the species. With the Micronetoids divided into four genera, the generic and vulvar characters work out between them a fairly reliable diagnosis. Occasionally however specimens do occur of which it is impossible to be absolutely certain. With practice these are very infrequent, and they are certainly not more numerous than in several of the other allied genera.

As regards the nomenclature used in this paper, I have not ventured amongst the nice questions of ancient history. I have accepted the names used by Mr. Pickard-Cambridge in his "List of British and Irish Spiders," and have not repeated in my synonymic lists all the names which he had already discarded in 1900. All the changes in nomenclature which I have made have been the result of the examination of such actual specific types as I had at my disposal.

The drawings which illustrate this paper were all made with an Abbé camera lucida. They are therefore only very slightly diagrammatic. In the case of the palpi the principal idea was to get correct representations of each lamella characteristica. The paracymbia, as will be noticed, are not always in the same relative positions.

The drawings were made to scale, as it was intended that the relative sizes of the sexual organs of the different species should be shown. It has, however, been necessary to reduce the size of most of them. The reduction was made to scale, with the exception that figures 6, 6a, and 6b on Plate VII., and figures 1, 5, 6, and 6a on Plate VIII. were not reduced, and hence are larger than they should be in proportion to the others.

I must tender my best thanks to the Rev. O. Pickard-Cambridge for his great kindness in lending me so many actual types and other specimens of these species. Without these loans my paper would have been quite useless as regards nomenclature. Mr. E. Simon and Professor Kulczynski, as well as the Rev. J. E. Hull and Messrs. Falconer, Britten, and Pack-Beresford, have all given me great assistance, and I take this opportunity of thanking them.

Diagnosis of Genera.

1. Metatarsi i. and ii. each bearing a stiff spine above. Central posterior eyes much larger than laterals ... ... **Syedra**

Metatarsi i. and ii. without spines. Posterior eyes subequal **2**

2. A long sensory seta is placed on the upper side of metatarsi i., ii., and iii. near the base. It is absent on metatarsus iv. (This is also the arrangement in *Syedra*) ... **Micryphantes**

A long sensory seta occurs on the upperside of all four metatarsi near the apex ... ... — **3**

3. Falces very small in both sexes. The anterior border bears two teeth, the posterior border one. Palpi of females tumid. No spines on anterior borders of tibiæ i. **Agyneta**

Falces large and strong and very dissimilar in the two sexes. In the male the anterior border bears no teeth, the posterior border five or six. In the female each border bears five. Palpi of female not tumid. Tibiæ i. bear a spine on their anterior borders near the apex ... **Microneta**

In all the above genera the first tibia and patella together are much longer than the first metatarsus. Femoral spines are absent, and tibia iv. always bears two spines above.

Genus I. SYEDRA Simon.

(Arach. de France, v., p. 453, 1881.)

Metatarsi i. and ii. each bear a stiff spine above. These are absent on metatarsi iii. and iv.

Long sensory setæ are present on the first three pairs of metatarsi between the middle and the base of each and on the upper surface. Such are absent on the last pair.

Falces slightly more divergent in the male than the female. The anterior border of the fang groove bears three long teeth. The posterior border also bears three, which are very small and very close together.

The central posterior eyes are much larger than the laterals of the same row. They are distinctly nearer to these than they are to each other.

Syedra pholcommoides Camb.

Linyphia pholcommoides Camb. Spids. Dorset, p. 212, 1879.

Syedra ophthalmica Sim. Arach. de France, v., p. 455, 1881.

Syedra gracilis Menge-Kulcz. Aran. Hung., ii., pp. 84, 85.

Sintula pholcommoides Camb. List of British and Irish Spiders, 1900.

Syedra pholcommoides Camb. Proc. Dors. F. Club, xxvi., 1905, p. 48.

(Plate VIII., figs. 1, 1a, 1b, 1c, 1d.)

The posterior row of eyes is markedly curved, the convexity of the curve being behind. The falces are only very slightly divergent in the male, obliquely truncate in the female.

The anterior tibiæ are in some specimens more deeply pigmented than the others.

The whole spider is slender, graceful, and small; a female measured a shade under 1·3 mm. in total length.

The spider is easily recognized in the female sex by the generic characters and the structure of the epigyne.

In the male the long, slender, semi-diaphanous lamella characteristica, and the toothed and ridged paracymbium make identification easy.

S. pholcommoides Camb. occurs amongst moss, grass, and fallen leaves in woods and hedgerows. It has been found in Dorset, Surrey, Yorkshire, and Northumberland.

A female specimen was sent to Mr. Simon, who declared its identity with his *S. ophthalmica.* He also stated that he believed the species to be identical with *S. gracilis* Menge. Professor Kulczynski's specimens of *S. gracilis* Menge, were examined years ago by Mr. Pickard-Cambridge, who pronounced their identity with his *L. pholcommoides*, which name is used in the "Araneæ Hungariæ" as a synonym of *S. gracilis* Menge. Professor Kulczynski has also sent me drawings which have convinced me that *S. gracilis* Menge-Kulcz. *is* identical with *S. pholcommoides* Camb. It is therefore possible that the present spider should be called *S. gracilis* Menge. I have, however, followed Mr. Pickard-Cambridge in retaining a name known to be correct instead of adopting one which to say the least of it is doubtful, since no modern arachnologist appears to have seen Menge's types in the flesh.

Syedra innotabilis Camb.

Microneta innotabilis Camb. List of British and Irish Spiders.

(Plate VII., figs. 8, 8a, 8b, 8c.)

The posterior row of eyes is straight, and all its eyes are very large, the centrals however being easily the largest.

The falces of the male are distinctly but slightly divergent, those of the females obliquely truncate. The whole spider is rather robust and bulky, a female measuring 1·62 mm. in total length.

In the male sex the lamella characteristica easily separates the species from the other British Micronetoids. In the female the vulva is not unlike that of several of the *Agynetæ*, but the generic characters, and especially the great size and inequality of the posterior eyes, easily distinguish the species.

Those who are interested in the formation of new genera will have no difficulty in creating one for this species.

S. innotabilis Camb. occurs amongst moss and dead leaves on the ground, but is most commonly found in the crevices of the bark of standing trees, of which the larch and the lime are already recorded as providing its habitation.

In this country it ranges from Dorset to Perth, and has occurred in several Irish localities.

Genus II. MICRYPHANTES[1] C. L. Koch, 1833.

Metatarsi i. and ii. without spines.

Long sensory setæ present on the first three pairs of metatarsi between the middle and the base of each above. Such are absent on the last pair.

Falces very dissimilar in the two sexes. In the male they are extremely divergent, attenuated towards the apex, and hollowed out on the innerside. In the female they are merely obliquely truncated. On the anterior border of the fang groove each falx bears three, four, or five large teeth, rather widely separated. The posterior border also bears three, four, or five teeth, but these are smaller and more closely grouped. Individual and specific variation in the number of the teeth occurs within the above limits.

[1] I am aware that there is some doubt whether this name ought really to be applied to this genus, but Kulczynski has already so used it in the "Araneæ Hungariæ."

The posterior eyes are subequal and never very inequidistant. If not entirely equidistant the centrals may be slightly nearer the laterals than to each other.

Single spines may, or may not, be present on the posterior borders of tibiæ i. and ii. between the middle and the apex.

Micryphantes rurestris C. L. Koch.

Microneta rurestris C. L. Koch – Camb. List of British and Irish Spiders.

Micryphantes rurestris C. L. Koch – Kulcz. Aran. Hungariæ.

(Plate VII., figs. 1, 1a, 1b, 1c, 1d, and 2 [*M. fuscipalpis* C. L. K.])

No spines on posterior borders of tibiæ i. and ii.

Male palpal tarsus strongly conical above, bearing a blunt, almost erect prominence on the innerside of the proximal part of the dorsal surface near the base. Palpal tibia showing a feeble external apophysis on the outerside near the distal end. Lamella characteristica is distinctive. In most positions it appears truncated at the extremity; in reality it is slightly bifid.

The epigyne shows a rather narrow median process and almost parallel sexual apertures.

The coxæ and legs are usually of a clear light yellowish brown. In the female palpus the femur and patella are of a light yellow brown, the tibia and tarsus dark brown.

Examples of this species were sent by me to Professor Kulczynski, who declared their identity with his Hungarian examples, at least in the male sex. The females seem indistinguishable from those of *M. fuscipalpis* C. L. Koch, of which spider I figure the lamella characteristica of a Hungarian male kindly sent me by Professor Kulczynski. This species has not yet occurred in Britain.

M. rurestris is abundant throughout Britain. Individuals can be obtained throughout the year, but are most numerous in September. These specimens are, however, smaller than those which are found earlier in the year, and chiefly in July.

Micryphantes sublimis Camb.

Microneta sublimis Camb. List of Brit. and Irish Spiders.
Neriene sublimis Camb. Proc. Berwickshire Nat. Hist. Club, vii., p. 314.
Microneta Grouvellei Camb. – Sim. Arach. de France, v., p. 438.
Micryphantes gulosus L. Koch – Kulcz. Symb. ad Faun. Aran. Austriæ Inferioris, plate i., figs. 37, 38.
Micryphantes gulosus L. Koch – de Lessert. Arach. Graubünders. Revue Suisse de Zoologie, p. 634.

(Plate VII., figs. 3, 3a, 3b, 3c, 3d.)

No spines on posterior borders of tibiæ i. and ii.

Palpal tibia of the male shows an external apophysis differing slightly from that of *rurestris*.

The tarsus possesses no small erect process on the innerside near the base. The base on that side is, however, prolonged into a very large curved process which is very easily seen and recognized. The lamella characteristica is very distinctive, bearing numerous teeth on its upper border.

The epigyne is very like that of *rurestris*; the central process is however broader, and the lateral apertures usually much more obliquely placed.

The coxæ and legs are usually of a deep brown colour. The whole of the female palpus is usually dark brown, but the last two joints are darker than the rest.

The females of this species will not as a rule be confounded with those of *rurestris* if the above points are noticed. Unfortunately, however, none of them are invariable. I have never seen the actual types of *M. Grouvellei* Camb., nor of *M. gulosus* L. Koch. I think that in all probability they are identical with the present species. I have sent examples of our spider to Professor Kulczynski, who declares them identical with his Hungarian examples of *M. gulosus* L. Koch. I have also exchanged specimens with Dr. de Lessert, and there is no doubt of the identity of *M. sublimis* Camb. with *M. gulosus* L. Koch – de Lessert. Mr. Simon has very kindly given me an example of *M. Grouvellei* Camb-Sim., and I think it is identical as a species with our *M. sublimis*. The lamella characteristica in this specimen does however differ a little from that of our form (Plate VII., 3a, 3b). This difference, if constant, would, I think, be enough to show that the range of variation (possibly local) was considerable, but it hardly reaches specific value, and in other respects the specimen does not differ from British examples of *M. sublimis*, which themselves show a certain amount of slight variation in the lamella characteristica.

M. sublimis Camb. seems confined to elevated moors and mountains in this country. It reaches the summits of Snowdon (3,500 feet) and Scafell Pike (3,210 feet), but I have no exact record of its lowest station.

When found it occurs on the ground under stones, and also amongst moss and herbage. It has occurred freely amongst the mountains of Scotland, Northern England, and North Wales, where it is adult in September.

Micryphantes beatus Camb.

Microneta beata Camb. Proc. Dors. Field Club, vol. xxvii., 1906, pp. 90 and 91, and figures.

(Plate VII., figs. 4, 4a, 4b, 4c.)

Tibiæ i. and ii. are each furnished with a long strong spine on the posterior border between the middle and apex.

In the male each palpal tibia shows a long narrow apophysis on the outerside.

The lamella characteristica is large and prominent. It is toothed along its upper border, the exact number of teeth not being constant. The lower border presents a rounded tuberosity. The palpal tarsus is only slightly gibbous above; it is not produced into a conical prominence.

The epigyne is smaller than that of the two preceding spiders. The central process and sexual apertures are longer and narrower. This and the posterior lateral spines on tibiæ i. and ii. render the recognition of the female quite easy.

M. beatus occurs amongst grass and herbage in various parts of Britain. It is adult in early summer, and specimens have been obtained in Dorset, Surrey, Sussex, Yorkshire, Cumberland, and Northumberland.

Micryphantes mollis Camb.

Neriene mollis Camb., 1871. Trans. Linnean Soc., p. 439.
Linyphia oblivia Camb., 1873. Trans. Linnean Soc., p. 446.
Linyphia aeria Camb., 1875. Annals and Mag. Nat. Hist., p. 251, and figure.
Linyphia Frederici Camb., 1879. Spiders of Dorset, pp. 186, 187.
Microneta mollis Camb. List of British and Irish Spiders, p. 35.
Sintula oblivia Camb. List of British and Irish Spiders, p. 36.
Sintula aeria Camb. List of British and Irish Spiders, p. 37.
Sintula Frederici Camb. List of British and Irish Spiders, p. 37.
Sintula aerius Camb. – Kulcz. Aran. Hung., ii., 88, 89.
Sintula aeria Camb. – Simon. Arach. de France, v., 449, 450.

(Plate VII., figs. 6, 6a, and 6b.)

Tibiæ i. and ii. each bear a strong spine on the posterior border between middle and apex.

Palpal tarsus strongly gibbous, almost conical above.

Lamella characteristica highly distinctive; narrow, pointed, and toothed below and on the outer side.

The central process of the epigyne is more triangular than that of the other species, and the whole organ is very small.

An adult male measured 1·3 mm. in total length.

An examination of the actual types of the above species shows their identity. An example sent to Professor Kulczynski settled the identity of his species. Specimens exchanged with Mr. Simon proved the same as regards the *S. aeria* of "Les Arachnides de France."

This little species occurs amongst grass and herbage within woods and on sandhills near the coast. It is adult in September, and has been found in Dorset, Gloucester, Glamorgan, Essex, and Warwick.

Micryphantes saxatilis Blackwall.

Microneta passiva Camb. Proc. Dors. Field Club, vol. xxvii., 1906, pp. 89, 90, figs. 22–26, *female only.*

Microneta rustica Sim. Arach. de France, v., pp. 430 and 431.

Microneta saxatilis Bl.-Camb. List of British and Irish Spiders.

(Plate VII., figs. 5, 5a, 5b, 5c.)

Tibiæ i. and ii. show a long strong spine on their posterior borders between the middle and apex.

Male palpal tibia shows, at the distal end, a large median apophysis curving towards the outer side.

Lamella characteristica very complicated and difficult to see without dissection. It presents on its upper border four very diverse processes, and one wonders whether the whole organ is homologous with the lamella characteristica of the other species, or whether a part only should be so interpreted.

Epigyne very broad and characteristic. Mr. Cambridge gives an excellent figure (sub *M. passiva*), in which case the drawing was made from below and rather behind.

The external genital organs and the lateral spines on the first two pairs of tibiæ will enable this spider to be recognized with ease in either sex.

Mr. E. Simon, to whom I sent examples, informs me that the species is identical with his *M. rustica.*

M. saxatilis Bl. is abundant in most localities during the summer, where it is found near the ground amongst herbage of all sorts. It is recorded for a dozen English counties, and occurs also in Scotland, Ireland, and Wales.

Microneta simplicitarsis Sim. (Arach. de France, vol. v., 435 and 436) is a true *Micryphantes*, and agrees with *M. beatus*, *mollis*, and *saxatilis* in possessing spines on the posterior borders of the first two pairs of tibiæ between the middle and apex of each.

The lamella characteristica and epigyne are quite characteristic. The species, of which Dr. de Lessert has kindly sent me examples, has not yet occurred in Britain.

Genus III. MICRONETA Menge, 1868.

Metatarsi i. and ii. without spines.

Long sensory setæ present near the *apices* of *all four* metatarsi.

Tibia i. with an extra spine near the apex on the *anterior* border.

Posterior eyes subequal, the centrals a shade nearer to the laterals than to each other.

The falces show great sexual dimorphism. Those of the male are very attenuated towards the apex, highly divergent and much hollowed out on the inner side.

The anterior border of the fang groove shows no teeth, but near it are placed one large and several small dentiform hair-bearing tubercles. The posterior border shows five or six strong teeth, the second from the proximal end being the largest.

The falces of the female are obliquely truncated. The anterior border of the fang groove shows five large, well separated teeth; the posterior border also possesses five, but these are very small and very closely placed.

Microneta viaria Blackwall.

Neriene jugulans Camb. Spids. of Dorset, pp. 138, 139.
Sintula nescia Camb. Proc. Dors. Field Club, vol. xxi., 1900, pp. 32 and 35, and figures.
Microneta viaria Bl. – Camb. List of British and Irish Spiders.
Microneta jugulans Camb. List of British and Irish Spiders.
Sintula nescia Camb. List of British and Irish Spiders.

(Plate VII., figs. 7, 7a, and 7b.)

This being the only species of the now restricted genus, the generic characters need not be repeated.

The palpal patella bears about five very long, almost straight setæ, which are directed forwards. The tarsus presents a rounded tubercle near the base on the innerside; it is only slightly gibbous above. The lamella characteristica is very complicated and possesses numerous branches.

The vulva shows a certain amount of individual variation, chiefly connected with the pigmentation. It looks very different in different positions.

The male of this species is distinctly larger than the female, two average examples taken at random measuring 2·59 mm. and 2·14 mm. respectively.

M. viaria Bl. is very abundant throughout the country, occurring chiefly amongst dead leaves and low herbage in woods.

Genus AGYNETA Hull.[1]

Metatarsi i. and ii. without spines above.

Long sensory setæ are present near the apices of all four metatarsi. Tibiæ i. possess no lateral spines.

Falces short and weak in both sexes. They are, however, divergent and attenuated towards the apex in the male sex,

[1] Trans. Nat. Hist. Soc. of Northumb., Durham, and Newcastle-upon-Tyne, new series, vol. iii., part 3, p. 583.

obliquely truncated in the females. The anterior border of the fang groove bears two teeth, and the posterior one, in both sexes.

Posterior eyes of medium size, subequal and nearly equidistant.

The clypeus in this genus is frequently very high, but this is a most variable character.

The tibia and tarsus of the female palpus are tumid, and together form a more or less club-shaped termination to the limb. The width of this varies in the different species.

Agyneta conigera Camb.

Neriene conigera Camb. Zoologist, 1863, p. 8583.

Neriene mystica Camb. Annals and Mag. Nat. Hist., 1879, vol. iv., ser. 5, p. 201.

Sintula prominens Camb. Proc. Dors. Field Club, 1900, vol. xxi., p. 28, and figures.

Microneta conigera Camb. List of British and Irish Spiders.

Microneta mystica Camb. List of British and Irish Spiders.

Sintula prominens Camb. List of British and Irish Spiders.

(Plate VIII., figs. 2, 2a, 2b, 2c, 2d.)

The examination of the types of the above species completely establishes their identity.

The male of this spider is easily recognized by the lamella characteristica of the palpus. In addition to this, the extremely high and conical dorsal prominence of the palpal tarsus is distinctive, although the height is rather variable. The female is easily recognized by the palpus, the epigyne and the cephalothorax.

In the first place the palpus is only very slightly tumid. The last two joints are thickened, and have a transverse diameter of about ·09 mm.,[1] that of the palpal femur being about ·06 mm. The termination of the limb is thus only

[1] Measured across the dorsal surface of the widest part.

slightly club-shaped in all the specimens I have yet seen. There seems to be very little variation in the tumidity of the tibia and tarsus.

The epigyne is very broad, and its shape is quite characteristic in all specimens whether sexually active or not.

The profile of the cephalothorax is peculiar on account of the depression between the caput and the thorax at the occiput, and because of the very hollow clypeus. These irregularities cause the ocular area to appear very prominent, and rather isolated from the rest of the cephalothorax. In the other species of the genus this is not the case. For the rest the spider is rather variable in the pigmentation of the cephalothorax and ocular area. There is usually a dark transverse mark at the thoracic juncture, and dark lines radiating from this to the posterior eyes. The ocular area is frequently deeply pigmented, and the eyes may be placed on black spots. Sometimes however this pigmentation is vestigial, and occasionally the cephalothorax is of a uniform pale yellow-brown, the eyes in such cases not being placed upon black spots. In both sexes of this spider the proximal tooth on the anterior border of the fang groove is very small indeed, and so is the single tooth on the posterior border. In the other species of the genus these two teeth are much longer.

Agyneta conigera Camb. is a common and widespread spider in the British Isles. It is found on the ground amongst moss, heather, and herbage, as well as on the trunks and branches of trees. It is adult in early summer.

The remaining species of the genus are all very much alike. No reliable characters can be drawn from the relative sizes and shapes of the different parts of the cephalothorax. Specific differences cannot be founded upon the position of the eyes. The lamella characteristica of each species readily furnishes easy characters for identifying the males, but the females must be recognized from the structure of the vulvæ, which is not at all times easy.

Agyneta decora Camb.

Neriene decora Camb. Trans. Linn. Soc., 1871, p. 438.
Microneta clypeata F. Camb. Annals and Mag. Nat. Hist., series 6, vol. xiii., p. 90, and figures.
Microneta decora Camb. List of British and Irish Spiders.

(Plate VIII., figs. 3, 3a, 3b, 3c, 3d, 3e.)

A comparison of the types of *M. clypeata* F. Camb. showed their identity with the present species. Both the Cambridges had, however, recognized this before.

In this and the remaining species of the genus the anterior border of the fang groove bears two strong teeth, of which the proximal one is the weaker. The posterior border bears a single tooth of medium size opposite the distal anterior tooth.

The lamella characteristica easily distinguishes the male of this species. The body of this process is shaped something like a humân brain; it is generally semi-diaphanous, and can be recognized instantly in any position of the palpal organs. The low palpal tarsus is also distinctive.

The epigyne is smaller than in the closely allied species, and can usually be recognized with a little practice (see figures). The female palpus in all the examples I have seen is markedly tumid as to its last two joints. These joints have a transverse measurement in most specimens of about ·18 mm., but there appears to be some slight variation in the actual breadth.

The whole spider is usually deeply pigmented, and the tibiæ of the first and second pairs of legs are frequently deeper in colour than the rest. Quite pale specimens are however occasionally met with, and I have seen them almost colourless.

The clypeus is usually much higher than the ocular area; the exact shape of the cephalothorax is subject to a good deal of variation, but the occipital depression is always slight and the clypeus never very hollow.

A. decora Camb. occurs on the ground amongst moss and grass. It is occasionally found in woods, but generally affects more open places like fields and moors. It is adult in May and June. I have received it from Dorset, Cheshire, Lancashire, Yorkshire, Northumberland, and Ireland.

Agyneta subtilis Camb.

Neriene subtilis Camb., 1863. Zoologist, p. 8584.
Neriene anomala Camb., 1863. Zoologist, p. 8585.
Microneta subtilis Camb. List of British and Irish Spiders.

(Plate VIII., figs. 4, 4a, 4b, 4c, 4d, 4e, 4f.)

The types of this species, and all the other specimens Mr. Pickard-Cambridge possessed under the above names, were conspecific. Thus there is no doubt at all as to the nomenclature.

A. subtilis is usually a yellowish-brown, rather stoutly built beast.

The lamella characteristica of the male palpus is very distinctive and constant in shape. Anteriorly it looks something like a double-headed bird, while posteriorly it exhibits the usual tapering tail. Near the middle of the upper border is a tooth-like prominence arising from the inner surface of the body.

The tarsus of the palpus shows a high dorsal elevation, higher than that of *A. decora* Camb., but lower than that of *A. conigera* Camb. There is also a short knob-like process at the inner side of the upper surface near the base. This is usually too short to be seen from the outer side of the palpus, as it is then concealed behind the convexity of the dorsum of the tarsus.

The female palpi are always tumid, but there is in this species great variety in the amount of tumidity. Some specimens in my possession measure ·18 mm. in the transverse diameter of the tumid part, and in other cases the greatest breadth is only half that. There are however very few forms which can be described as intermediate, all of the specimens being either very broad or very narrow. Possibly this great variation may be seasonal, but I have not noticed it in the other species, in all of which the variability in this particular seems to be slight. In every case however the two terminal joints *are* tumid and broader than the femur.

The epigyne is usually distinctive enough, but sometimes examples do occur of which it is impossible to be certain. The main features are the narrow, very slightly bifid central process, and the fine almost vertical striæ which ornament it on each side. The whole organ is larger than that of *A. decora*.

Unfortunately the height of the clypeus and the shape of the cephalothorax are very variable, and are unreliable as specific guides except to differentiate the present species from *A. conigera* (Plate VIII., 4e, 4f).

A. subtilis Camb. is a widespread form, and has occurred to my knowledge in Dorset, Devon, Glamorgan, Derbyshire, Cheshire, and Northumberland. It seems, however, to be commoner in the South than the North. Probably it is local in the northern counties.

It occurs chiefly amongst moss in woods, fields, and swampy places, but seems to prefer damp places in woods.

Agyneta cauta Camb.

Microneta cauta Camb. Proc. Dors. F. Club, vol. xxiii., 1902, p. 31 and figs., *male* not female.

Microneta passiva Camb. Proc. Dors. F. Club, vol. xxvii., 1906, pp. 89, 90, and figs., *male* not female.

Microneta passiva Camb. Proc. Dors. F. Club, vol. xxxi., 1910, p. 53 and figs., *female*.

(Plate VIII., figs. 5, 5a, 5b, 5c, 5d, 5e, 5f.)

The above specific types were carefully compared. The female described (sub *cauta*) in 1902 is *A. subtilis* Camb., whilst that described in 1906 (sub *passiva*) is *Micryphantes saxatilis* Bl.

I believe the female described in 1910 (sub *passiva*) is the true partner of the typical *A. cauta*, as it occurs freely with the males of that species in unmixed collections sent to me from Yorkshire by Mr. Falconer, and has also occurred with males of *A. cauta* taken in other localities.

A. cauta Camb. almost exactly resembles *A. subtilis* Camb. in size, colour, and facies. It can, however, be separated by the structure of the sexual organs.

The lamella characteristica is very distinctive; it forms in front a sort of comb beset with very numerous short teeth. The exact number of these teeth varies, but I have never seen a specimen of which there was the slightest doubt.

On the inner side of the palpal tarsus near the base, and close to the dorsal surface, there is a process similar to that of *A. subtilis*. In the present species, however, it is much larger, and dilated at the extremity. It can easily be seen from the external side of the palpus rising over the dorsal surface of the tarsus near the base (see 5e).

The epigyne is usually larger and darker than that of *A. subtilis* Camb., and the central process is very deeply cleft at the extremity. There is probably some variation in this respect, but typical examples are very easily recognized.

The shape of the cephalothorax provides no trustworthy information as to the identity of this species.

The female palpi are always tumid in the specimens I have seen. All that I have examined have been very similar in the breadth of the terminal joints, which measured about ·18 mm. on the transverse diameter of the upper surface. Slight variation was frequently seen, but not the gross differences noted in *A. subtilis*.

A. cauta Camb. has occurred pretty freely in Northumberland, Cumberland, Yorkshire, and Cheshire. It appears rare in the South, but the typical male was found in the mountainous districts of Glamorganshire. It may be found in company with *A. subtilis* Camb., but is common amongst moss and herbage in elevated and exposed situations, and especially in swampy places.

Agyneta ramosa sp. nov. (Plate VIII., figs. 6, 6a, 6b.)

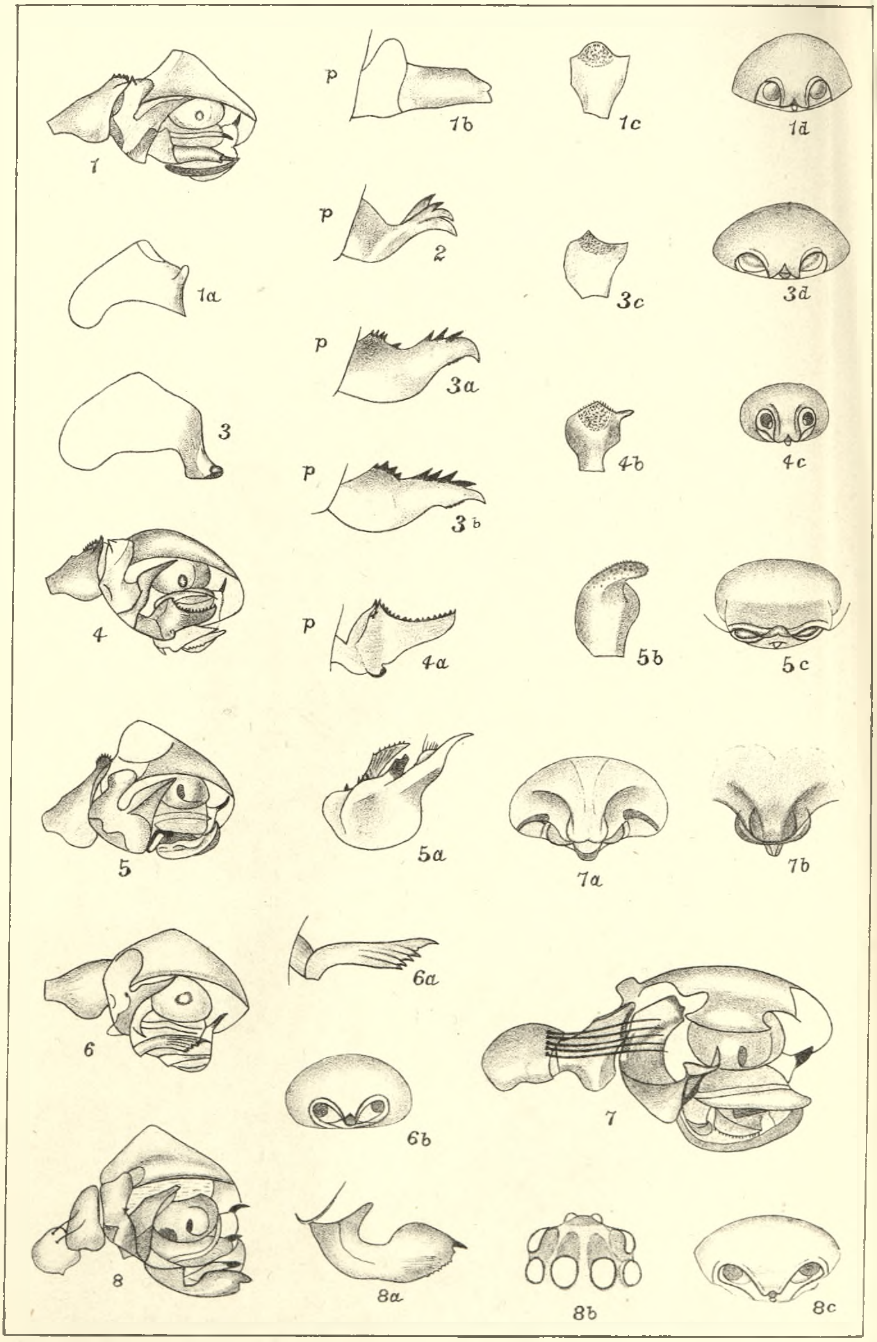
Of this species I only know the male, four specimens of which have so far turned up. Of these one example was found in the New Forest, and three in Delamere Forest, Cheshire. All were found amongst moss in swampy places surrounded by trees, and the Delamere examples occurred in company with *A. subtilis* Camb. and *A. cauta* Camb. One of these Delamere specimens is in the possession of Mr. W. Falconer.

The total length of a male of this species was 1·87 mm., and in size, colour, and facies the species is similar to *A. cauta* Camb. and *A. subtilis* Camb.

The palpi are, however, readily recognizable. The lamella characteristica has a small body bearing several forwardly directed teeth, the exact number and position of which is only very slightly variable. From the anterior part of the tail, however, arises a long curved process running towards the inner side of the palpal organs, and provided at its extremity with three strong teeth. This resembles a sort of curved trident, and it will be noted that the whole lamella is quite unlike that of either *A. cauta* or *A. subtilis*, and is in no sense intermediate between them.

The palpal tarsus possesses on its inner side near the dorsum and towards the base a process resembling that of *A. cauta* Camb., but the process itself and the adjacent inner basal angle of the tarsus are shaped rather differently. This difference was constant in all the four examples.

It is necessary to elevate this form to specific rank, as it is impossible to assign it to any of the other species. To throw it into one of the other species as a race is in my opinion out of the question, as it is really more distinct from *A. subtilis* and *A. cauta* than either is from the other. Its distribution quite bars the notion of it being a mere local form. The lamella characteristica has proved such a useful and constant character in these allied genera that I do not know how such a startling variation could possibly be treated except by the creation of a new species. It is worthy of note that amongst the very numerous males of *Agyneta* in which I have examined the lamella characteristica there has not been one in which there was the slightest doubt of the identity of the species, or in which any marked variation in this organ occurred.



A. Randell Jackson, del.
W. West, lith.

E. Wilson, Cambridge.

BRITISH MICRONETOID SPIDERS.

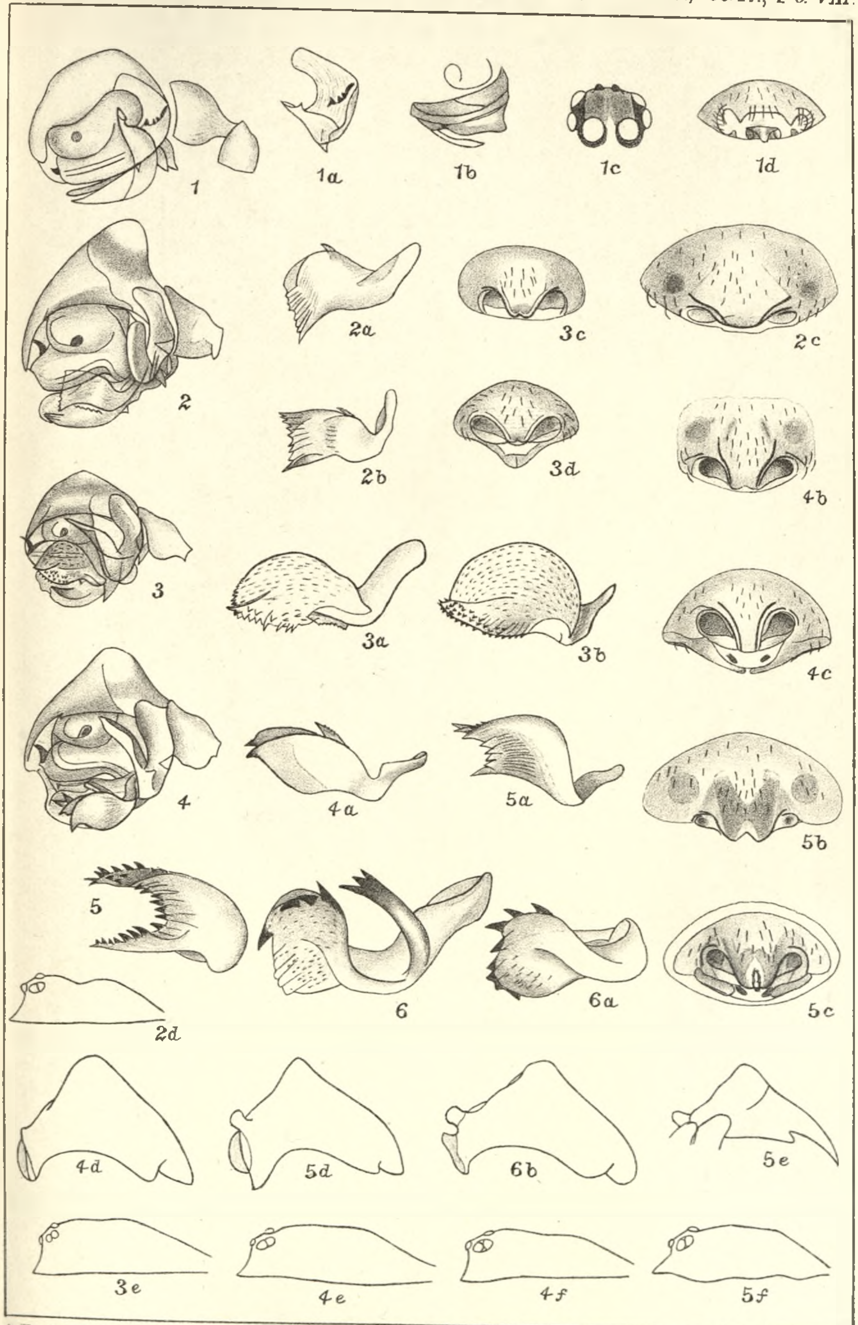
EXPLANATION OF PLATES.

Plate VII.

1. *Micryphantes rurestris* C. L. Koch. Right palpus from outerside.
1a. ,, ,, ,, Right palpal tarsus from innerside.
1b. ,, ,, ,, Right lamella characteristica from outerside. P. in this and the subsequent figures represents the paracymbium.
1c. ,, ,, ,, Right palpal tibia from above.
1d. ,, ,, ,, Vulva from below.
2. *Micryphantes fuscipalpis* C. L. Koch. Right lamella characteristica from outerside.
3. *Micryphantes sublimis* Cambridge. Right palpal tarsus from innerside.
3a. ,, ,, ,, Right lamella characteristica from outerside.
3b. ,, ,, ,, The same from a specimen of *M. Grouvellei* Camb.-Simon.
3c. ,, ,, ,, Right palpal tibia from above.
3d. ,, ,, ,, Vulva from below.
4. *Micryphantes beatus* Cambridge. Right palpus from outerside.
4a. ,, ,, ,, Right lamella characteristica from outerside.
4b. ,, ,, ,, Right palpal tibia from above.
4c. ,, ,, ,, Vulva from below.
5. *Micryphantes saxatilis* Blackwall. Right palpus from outerside.
5a. ,, ,, ,, Right lamella characteristica from outerside. The lower border of this figure is diagrammatic.
5b. ,, ,, ,, Right palpal tibia from above.
5c. ,, ,, ,, Vulva from below and rather in front.
6. *Micryphantes mollis* Cambridge. Right palpus from outerside.
6a. ,, ,, ,, Right lamella characteristica from outerside.
6b. ,, ,, , Vulva from below.
7. *Microneta viaria* Blackwall. Right palpus of male from outerside.
7a. ,, ,, ,, Vulva from below and rather behind.
7b. ,, ,, ,, Vulva from below.
8. *Syedra innotabilis* Camb. Right palpus from outerside.
8a. ,, ,, ,, Right lamella characteristica from outerside.
8b. ,, ,, ,, Eyes from above.
8c. ,, ,, ,, Vulva from below.

Plate VIII.

1. *Syedra pholcommoides* Camb. Left palpus from outerside.
1a. ,, ,, ,, Left paracymbium from outerside.
1b. ,, ,, ,, Right bulb and lamella characteristica from outerside.
1c. ,, ,, ,, Eyes from above.
1d. ,, ,, ,, Vulva from below.
2. *Agyneta conigera* Camb. Left palpus from outerside.
2a. ,, ,, ,, Left lamella characteristica from outerside.
2b. ,, ,, ,, The same in a slightly different position.
2c. ,, ,, ,, Vulva from below.
2d. ,, ,, ,, Left profile of female cephalothorax.
3. *Agyneta decora* Camb. Left palpus from outerside.
3a. ,, ,, ,, Left lamella characteristica from outerside.
3b. ,, ,, ,, The same from the outerside but more anteriorly.
3c. ,, ,, ,, Vulva from below.
3d. ,, ,, ,, Vulva from below and behind.
3e. ,, ,, ,, Left profile of female cephalothorax.
4. *Agyneta subtilis* Camb. Left palpus from outerside.
4a. ,, ,, ,, Left lamella characteristica from outerside.
4b. ,, ,, ,, Vulva from below.
4c. ,, ,, ,, Vulva from below and behind.
4d. ,, ,, ,, Left palpal tarsus from innerside.
4e and 4f. ,, ,, Left cephalothoracic profiles of two different females.
5. *Agyneta cauta* Camb. Left lamella characteristica of male palpus from the antero-exterior aspect.
5a. ,, ,, ,, Left lamella characteristica of another specimen from the outerside.
5b. ,, ,, ,, Vulva from below.
5c. ,, ,, ,, Vulva from below and behind.
5d. ,, ,, ,, Left palpal tarsus from innerside.
5e. ,, ,, ,, Right palpal tarsus from outerside.
5f. ,, ,, ,, Left profile of cephalothorax of female.
6. *Agyneta ramosa* sp. nov. Left lamella characteristica of male palpus from outerside.
6a. ,, ,, ,, The same from in front, below, and a trifle externally.
6b. ,, ,, ,, Left palpal tarsus from innerside.



A. Randell Jackson, del.
W. West, lith.

E. Wilson, Cambridge.

BRITISH MICRONETOID SPIDERS.

On the Occurrence of Brachychaeteuma, Titanosoma *and* Polymicrodon *in England.*

By DR. K. W. VERHOEFF (of Pasing, near Munich).

The author's 48th paper on Diplopoda.*

(With Plates IX. and X.).

The richness of the European Diplopod fauna has shown itself in no order more strikingly in the last quarter of a century than in the Ascospermophora. In this group it has appeared not only in regard to species and genera, but also in respect of still higher groups. Only recently I had the opportunity of bringing before zoologists the two remarkable genera *Xylophageuma* from south-west Germany and *Tessinosoma* from southern Switzerland. Scarcely had I finished working out these forms when I received from Mr. R. S. Bagnall for examination a series of Diplopods from the county of Durham, which contained several important forms, and especially a representative of the Ascospermophora which is of the highest interest because it falls into none of the previously known families of this group, but must be regarded as constituting the type of a new family. I take this opportunity of expressing my great indebtedness to Mr. Bagnall, who has most kindly placed at my disposal a number of English Diplopods, and has exerted himself in other directions for the advancement of this branch of science.

BRACHYCHAETEUMIDÆ Verhoeff, n. fam.

Abdomen consisting of thirty segments, without definite lateral keels. The usual three pairs of dorsal bristles are decidedly short on all the abdominal segments. Abdomen nearly circular in section; but externally near the posterior bristles there arises a small prominence. Dorsal surface fairly smooth, that is, without coarse granulation and without pointed tubercles, also without longitudinal grooves. Antennæ resembling those of the Orobainosomidæ, that is

* Translated from the German MS. by E. L. Gill.

to say, with the fifth joint not strikingly enlarged. Inner palpus of the gnathochilarium with only 2 + 2 freely projecting sense organs.[1] The anterior part of the mentum, that is the triangular portion which is posteriorly inserted between the lamellæ linguales, is plainly separated from the rest of the mentum (promentum) by a transverse suture. Eighth abdominal segment of the male with two pairs of coxal sacs, which belong to the eighth and ninth pairs of legs. These sacs contain a fine-grained sperm. The eighth and ninth pairs of legs are otherwise of simple structure; even the femora bear no kind of process. First to seventh pairs of legs in the male likewise lacking conspicuous characters; on the third to the tenth the sucker-discs are wanting altogether. Pseudoflagella are lacking on both pairs of gonopods. The anterior gonopods are placed upon a depressed transverse sternite, and consist of syncoxite and telopodites. The syncoxite is widely expanded in the middle line, and exhibits three processes in front and two behind. Anteriorly it is separated from the telopodites by a wide transverse pocket. The telopodites resemble a couple of drinking horns; they are hollowed out in the form of a sac in the basal half, and come into contact with one another in the middle line. The posterior gonopods are likewise placed upon a depressed transverse sternite. The latter, however, possesses tracheal pockets with tracheæ and stigmata. The posterior gonopods are conspicuously three-jointed, the joint following upon the coxa being directed backwards, and the last joint outwards. The coxites possess no special internal characters.

Female unknown.

Relationships of the Brachychaeteumidæ to other Families of the Ascospermophora.

The Trachysomidæ, Chordeumidæ, Caseyidæ and Verhoeffiidæ are easily distinguished from our new family by the

[1] In reference to the mouth-parts of the Diplopods, *cf.* K. W. Verhoeff, Die Diplopoden Deutschlands, parts 2-4, general introduction, etc.; Winters Verlag, Leipzig, 1911–1912

shape of the abdominal segments. The Metopidiotrichidæ differ in various characters of the head of the male, in the possession of thirty-two abdominal segments and of only one pair of coxal sacs. Though their posterior gonopods are three-jointed, they are extremely unlike those of *Brachychaeteuma*; their anterior gonopods are at present unknown, though this much is certain, that they can have no close resemblance to those of our genus. That the Chordeumidæ present fundamental differences, not only in facies but also in the structure of all their reproductive organs, is too obvious to need further emphasis.

The genera of the Conotylidæ are all more or less unsatisfactorily described; it is plain however that they have no near relationship with *Brachychaeteuma*. Their anterior gonopods are yet for the most part quite unknown. A general resemblance exists between *Brachychaeteuma* and the Mastigophorophyllidæ, and there is a further agreement between them in the absence of sucker-discs. In the male reproductive organs, on the other hand, we find extensive differences, which are not confined to the pseudoflagella. The syncoxite of the anterior gonopods shows in *Brachychaeteuma* a strong central compression, and exceeds in size the telopodites, which are pressed together in the middle. In the Mastigophorophyllidæ both the coxites and telopodites remain separated in the middle line, and the latter are so strongly developed that the former only constitute a narrow base for them. Scarcely less important are the differences in the posterior gonopods. Correspondingly, *Brachychaeteuma* exhibits structures for the conveyance of the sperm which are widely different from those of the Mastigophorophyllidæ. To the Orobainosomidæ, *Brachychaeteuma* shows similarity not only in the form of the abdominal segments, but also in regard to the posterior gonopods. Again, however, there are conspicuous differences: gonopods and sternite entirely different; and telopodites adapted indeed to receiving the sperm, but with sacs which open towards the syncoxite, without any fine canal. Furthermore, in contrast with the present genus, the Orobainosomidæ possess the greatly developed bristles on the abdominal segments, the tarsal sucker-discs of the male, and the specialised structure of the eighth pair of legs. The resemblance in regard to the three-jointed posterior gonopods, which appears even in the fusion of coxa and pre-femur, is also accompanied by important differences which will be dealt with later. The Heterolatzeliidæ and Neoatractosomidæ are separated by their possession of tarsal sucker-discs, by the form of the abdominal segments and of the copulatory organs. The posterior gonopods are never three-jointed, the anterior always essentially differently organised, with pseudoflagella, graphiæ, or with loosely attached syncoxal joints and very small telopodites.

Most of the Craspedosomidæ differ from *Brachychaeteuma* in the form of the segments, and usually also in the possession of cheirites on the anterior gonopods. When the latter, however, are not present, other and equally striking differences are found, as for example leg-like posterior gonopods, or procheirites on the anterior gonopods. In any case no genus in this extensive family is known which could be placed in near relationship to *Brachychaeteuma*.

Finally I have the Anthroleucosomidæ to consider. The genera of this family agree with *Brachychaeteuma* both in general form and in the absence of tarsal sucker-discs. *Anthroleucosoma* approaches *Brachychaeteuma* also in the absence of ocelli and in poverty of pigment. But here also both pairs of gonopods show such a fundamental difference of organisation that there can be no question of any near relationship. In the anterior gonopods, for example, the syncoxite is absent, whilst the posterior gonopods are only one-jointed, and spring from a strong sternite which bears a conspicuous median process. The Anthroleucosomidæ are further distinguished from *Brachychaeteuma* in the fact that the sperm appears in egg-shaped masses.

In spite of these differences I must place the genus *Brachychaeteuma* nearer to the Anthroleucosomidæ and Mastigophorophyllidæ than to any other family. One might be tempted to regard the horn-shaped telopodites of the anterior gonopods as a step towards the telopodites of *Mastigophorophyllon* and its relatives, as indeed in a restricted sense they are. That we have not, however, to do with an actual phylogenetic development is abundantly evident from the central fusion of the anterior gonopods of *Brachychaeteuma*.

Any close relationship of our genus with the families of the Trachysomidæ, Chordeumidæ, Orobainosomidæ, Verhoeffiidæ, Neoatractosomidæ, Heterolatzeliidæ and Craspedosomidæ can be definitely said to be excluded.

BRACHYCHAETEUMA, n.g.

Ocelli altogether absent. Body white, without pigment. The processes (X. 3) *(verrucæ fissæ)* on the lamellæ linguales near the central body are three-pointed.[1] In addition to the two pairs of prominent sense organs on the inner palpus, a third is only feebly indicated.[2] The labrum of the male, in addition to the usual three middle teeth, is further characterised by a notch on the anterior edge, so that it appears to be divided into four points (X. 2). The anterior pleurite of the head,[3] which projects outwardly, possesses on the underside a rib which is plainly toothed for its whole length (X. 1); the serration is especially conspicuous in the anterior third.[4] Third to fifth pairs of legs in the male somewhat thickened. On the pleurotergites of the abdomen the prozonites are strongly reticulated, the metazonites for the most part smooth; the neighbourhood of the small prominence is rather roughened. On the anterior side of the posterior gonopods arises a longitudinal rib which extends over the region of the coxa and prefemur (IX. 2, *k*).

[1] In the *Orobainosomidæ* I found them four-pointed.

[2] The *Orobainosomidæ* possess 4 + 4 prominent sense organs on the inner palpi.

[3] In reference to the head-pleurites of the Diplopods I would refer to the third volume of my "Diplopoden Deutschlands," 1911–12.

[4] In the *Orobainosomidæ* this rib is only faintly striated, not serrated.

Brachychaeteuma bagnalli n. sp.

Male 7 mm. long, uniformly white with a slight inclination towards yellowish. Body not much narrowed posteriorly. The very short dorsal bristles occur on almost all the segments; only the three last possess somewhat longer bristles. Prozonites showing close reticulation over a great part of their surface. Reticulation much weaker and less extensive on the metazonites, which are for the most part smooth; such reticulation as they exhibit is clearest in the neighbourhood of the small prominences (IX. 1, *h*). The latter, when the segment bearing them is looked at from in front, are seen to be slightly but definitely hooked inwards towards the hinder bristles. When, on the contrary, the segments are looked at from the side, it appears that most of the prominences are decidedly hollowed out in front of the hinder bristles. The bristles themselves spring from little papillæ, those of the inner bristles being the most weakly developed, and those of the hinder the most strongly; the papillæ near the lateral prominence form a slight swelling (IX. 1, *b*). The anterior bristles occur on a line about midway between the inner and hind bristles. On the kidney-shaped collum the bristles are also somewhat longer than on most of the other segments, and the lateral prominences are wanting. The second pleurotergite, unlike any of the other abdominal segments, possesses small lateral keels, which end off anteriorly at an obtuse angle from the surface of the tergite, and bear posteriorly on their inner side, on a prominence, the hind bristles. The collum and the second pleurotergite are almost completely lacking in reticulation.

Antennæ bearing specially long sensory bristles, one each on the second, fourth and fifth joints, two on the sixth joint; the seventh joint with a sensory bristle which is tubularly expanded at the base and contains exceedingly fine granules. The sixth and seventh pairs of legs in the male are much slenderer than the third, fourth and fifth. This is specially seen in the seventh pair, in which the femur is hooked at an obtuse angle against the pre-femur, and the tarsus, which is longer and thinner, is more strongly bent back. For the rest, however, the seventh pair of legs shows no really striking characters; at the most, three somewhat stronger bristles on the inside of the femur may be mentioned. Four or five similar stiff bristles occur in the same position also on the eighth to tenth pairs of legs. The posterior gonopods (IX. 2) are connected by weak transverse muscles with their tracheal pockets. They are placed upon a simple transverse depressed sternite, which presents no special characters in its middle part, but is somewhat expanded at each side in the neighbourhood of the stigmatic groove. No considerable movement of the hinder gonopods upon their sternite seems to be provided for; the basally expanded coxites are, in fact, attached to the sternite by a broad and three-cornered base. The most anterior of these three corners forms a longitudinal thickening (IX. 2, *k*), which extends through the basal half of the pre-femur, along the front of the coxite, and ends over the stigmatic groove. Internally the coxite ends in a toothlike projection; otherwise however it possesses none of the distinguishing characters seen in the Orobainosomidæ. The longitudinal thickening has an obtuse-angled bend, though without showing any suture between coxa and pre-femur. This suture is completely obliterated in front, while it remains clearly discernible behind. Over it a rounded knob from the pre-femur projects towards the base of the appendage (IX. 3, *a*). For the rest, the two joints are contrasted with one another in that the coxa is naked and distally narrowed, whilst the pre-femur bears bristles and is narrowed proximally. The remaining joints of the appendage are represented by a hook let into the outer side of the end of the pre-femur and directed backwards.

The anterior gonopods (IX. 4) form a strikingly narrow and compressed appendage upon their much broader sternite, which latter is somewhat trapezoidally expanded towards the base. To give a complete description of these highly complicated organs from a single example of the male is scarcely possible; I think, however, that the following account comprises the most essential points. The sternite forms a ring which completely embraces the anterior gonopods. This ring consists of two extremely dissimilar halves. The hinder half (IX. 5, *q*) is like a narrow transverse buckle somewhat broken in the middle line and embraced at its outer ends (*v*) by the much wider front half. The latter is much higher at the sides than in the middle. The side-pieces are furthermore less clearly marked off from the gonopods than is the middle piece, so that it is difficult to decide whether the rounded flap (IX. 4, *a*) belongs to the sternite or to the gonopod. A small transverse furrow (*x*) may be regarded as the remains of a stigmatic groove. The gonopods, which arise from within the frame formed by this sternite, might be spoken of as a syngonopodite, since they are more or less fused in the middle line for nearly the whole of their length. When looked at either from in front or behind, two parts are clearly discernible, separated from one another by a strong groove; in correspondence with those of many other representatives of the Ascospermophora, these two divisions may be described as coxite and telopodite. The fusion of the coxites to form a syncoxite is very pronounced both in front and behind, whilst the telopodites are united with one another only in their basal half.

Anteriorly the syncoxite appears as a transverse piece which rises in the middle line as a long unpaired slender finger, and at either side forms a broad hook bending over towards the middle. Posteriorly the syncoxite is more strongly raised, and consists of two paired pieces forming strong knobs externally and horns internally. The knobs (*no*), which are almost triangular and rounded at the ends, are scarcely visible from in front, whilst the horns (*co*) project far out at the sides, but in their basal half are brought closely together in the middle line. Behind the horns the syncoxite is divided from the telopodites by a deep groove (IX. 4, *fo*) on each side. Anteriorly, behind the cross-ridge of the syncoxite, there is seen a transverse furrow, which both externally at each side and distally between the telopodites is drawn out as a channel. Although the telopodites are sharply enough marked off from the syncoxite, they do not appear to be capable of any movement upon the latter; their fusion with the syncoxite is evident both from in front and behind in the depth of the channel-like groove.

The telopodite may best be compared with two inverted drinking-horns grown together where they expand to form the cup. Their cavities are almost hemispherically shaped, and obviously serve for the reception of the sperm. This assumption is at any rate fully justified by analogy with other Diplopods, in which sperm has often been detected in similar cavities of the gonopods. The cavities are well protected through the fact that their openings are directed basally, and that the three processes on the front ridge of the syncoxite rise up opposite to them. Strong muscles run from the crests of the sternite of the anterior gonopod to the base of the side processes in front of the syncoxite, and to internal pegs (*z*) which occur between these processes and the sternite.

Occurrence: For the single known example of this genus—a male—I am indebted to Mr. R. S. Bagnall, who collected it in Gibside, Co. Durham, in the North of England. Gibside is an old piece of woodland chiefly consisting of beeches. Its occurrence in such a situation is evidence that we are dealing with a form which is truly endemic in England.

The discovery is of very special interest, and is important both from a geographical and a biological point of view; geographically, because this form is up to the present quite isolated, and England during the Ice Age was furthermore only free from ice in its most southerly part; biologically, because so far, among the many Ascospermophora, only a single blind form has been found at the surface of the ground, viz., the still very problematical "*Scotherpes*" *mamillatum* of E. Haase from Upper Silesia. Unfortunately Haase (according to his own account), in making his preparation of this precious animal, lost certain organs, so that his description of it is very incomplete; but his fig. 4 apparently represents posterior gonopods, and in that case points rather to a relationship with the Anthroleucosomidæ than with *Brachychaeteuma*. In general appearance Haase's animal is distinguished by "light reddish brown" coloration and strong dorsal bristles, and is therefore unlike *B. bagnalli*.

Titanosoma jurassicum Verh.

In the "Zoologischer Anzeiger," 1910, nos. 6 and 7, in my forty-second paper on Diplopods, "Neue Polydesmiden aus Mitteleuropa und ihre Verwandten," I described amongst others, on pages 142–144, the new genus *Titanosoma*, based upon a representative of the Polydesmoidea discovered near Kehlheim in the valley of the Danube. In the summer of 1911 I received from Mr. R. S. Bagnall a series of very small Polydesmids which he had collected in the Wear Valley in the North of England. These occurred in some numbers near Fencehouses, Co. Durham, in a restricted area in an old wooded dene opening into the river Wear. Since then single examples have been taken by the same captor on the Wear banks near Penshaw, and at Gibside in the Derwent Valley, all in the county of Durham.[1]

It appears that we have here once more to do with a Diplopod with parthenogenetic reproduction, like several others which, as is well known, we have become acquainted with in recent years. In addition to ten larvæ in different stages, there were about thirty females with nineteen abdominal segments, but not a single male nor any larvæ of males. In these females with nineteen segments I have likewise not detected vulvæ. These English specimens agree so completely with my type from the Danube district that I am unable to point out the slightest distinction between them.

In completion of my previous description, for which I had

[1] Later records sent by Mr. Bagnall: one female in garden, Penshaw, and a few in garden at Oxford, including a young example of the male.

only a single female at my disposal, I should like to add the following particulars. My previous supposition that *Titanosoma* reaches a stage with twenty abdominal segments, and that therefore my type specimen represented the last larval stage, appears very improbable in view of the fact that I now have numerous examples with nineteen segments, but none at all with twenty. The fact that I detected no vulvæ might be partly due to their small size, partly to the parthenogenetic reproduction.

If adult *Titanosomæ* have nineteen abdominal segments, we must regard Brölemann's *Macrosternodesmus* as the most nearly related genus. As characterising this genus in contradistinction to *Titanosoma* the following particulars are all that can be brought forward for the time being :

"Tous les téguments présentent une structure réticulée, due, semble-t-il, à de minuscules verrues plates, régulièrement distribuées sur toute la surface ; sur les prozonites ces verrues sont orientées longitudinalement, de façon à former des rangées transversales." "Somite préanal long, en forme de grand crochet rapidement aminci et courbé vers le sol ; sa pointe tronquée dépasse le niveau du bord des valves anales, qui sont cependant très proéminentes."

In *Macrosternodesmus* it therefore appears that the pleurotergites, and especially the prozonites, possess a much stouter structure than in *Titanosoma*, since this form shows dorsal plates which are for the most part smooth ; only under strong magnification (about two hundred and twenty diameters) is it possible to see here and there a fine reticulation, which is most clearly recognisable as a wavy cross-furrowing in front of the transverse constriction. In the neighbourhood of the pleuræ, and especially above the stigmata, the reticulation is much plainer. The anal segment of *Titanosoma* is unquestionably different from that of *Macrosternodesmus palicolus*. In side view the process of the telson appears short and rounded, somewhat thickened at the end, and not bent towards the underside. On the dorsal side of the telson there are sixteen bristles, viz., 4 + 4 in the middle part, 2 + 2 above the end on small papillæ, 2 on the end itself and 2 close under it. The bristles of the most anterior row are shorter than the rest. There is no doubt therefore in regard to a specific difference between *palicolus* Bröl. and *jurassicum* Verh. On the other hand a generic union of *Macrosternodesmus* and *Titanosoma* is still a matter for consideration. In regard to this only a more detailed description of the position of the defence glands in the former genus can make a decision possible.

The fact that I succeeded in detecting well-developed eggs in several *Titanosomæ* with nineteen segments may be taken as removing the last doubt as to these animals being really sexually mature. The condition of these eggs is furthermore of special interest. In the female from Kehlheim they are five in number and thickly packed with yolk globules, round to oval in shape, slightly separated from one another, arranged in line one behind the other, and, so disposed, measuring together half to two-thirds of the width of a segment. They occur in the region of the twelfth to the sixteenth segments. In two of the females from England I found only four similar eggs in each, likewise in the region of the twelfth to sixteenth segments. Here, however, they appeared two by two, pressed together by their ends to such an extent as to produce flattening, and much more drawn out in shape, for the most part one and a half to two times longer than broad. This linear arrangement of a small number of eggs is in striking contrast to what has been observed up to the present in other Diplopods, most of which are capable of laying forty to two hundred eggs. There is here further a noteworthy biological parallelism with certain small land Isopods, especially with many Trichoniscidæ, which in similar contrast to their larger relations carry only a few embryos in their brood-pouches. In the case of *Titanosoma* there appears to be a still more scanty progeny, and this circumstance, in conjunction with the small powers of locomotion of such delicate and extremely small representatives of the Polydesmoidea, is probably sufficient to explain the rare and sporadic occurrence of these remarkable millipedes.

The Larval Stages of Titanosoma.

It is owing to the care with which Mr. Bagnall collected these Diplopods in the field that I have been able to bring together a complete developmental series. I give in the first place the following summary :—

1st larva	with	3	pairs of legs,	7	abdominal segments,[1]	5	antennal joints.
2nd	,,	6	,,	10	,,	7	,,
3rd	,,	11	,,	12	,,	7	,,
4th	,,	17	,,	15	,,	7	,,
5th	,,	21	,,	17	,,	8	,,
6th	,,	23	,,	18	,,	8	,,
7th. Adult		29	,,	19	,,	8	,,

The appendages of the first larva are as follows :—

Collum-segment	0	pair of legs.
2nd abdominal segment	1	,,
3rd ,, ,, ...	1	,,
4th ,, ,, ...	1	,,
5th ,, ,, ...	0	,,
6th ,, ,, ...	0	,,
Pre-anal and anal segment... ...	0	,,

The number of appendages of the abdomen agrees therefore in the first larval stage with those of *Polydesmus*. On the contrary, in many of the first larvæ of other Diplopods only a single segment without limbs occurs between the telson and the third limb-bearing segment: this is the case for example in the *Thaumaporatia* larvæ which I investigated last year.

The first larvæ of *Titanosoma* are distinguished from all the others by the characters of their bristles; for whilst the second to sixth larvæ show, like the adults, exceedingly short bristles on the pleurotergites, the first larva possesses much longer bristles. Their arrangement in three rows is the same as in subsequent stages, but the individual bristles are not only two to three times longer than in these stages, but are also

[1] The telson is reckoned as a single segment.

gradually thickened towards the end and slightly grooved longitudinally at the end itself.

If we compare this stage of *Titanosoma* with the same stage, already well-known, of *Polydesmus*, and especially with the one given by Latzel on page 52 of his work on Diplopods, we find an agreement in many details. In two points however there is an important difference; firstly in that the second *Polydesmus*-larvæ possess only "nine" abdominal segments, but especially in the dissimilar increase in the number of pairs of legs. In the possession of three, six, eleven and seventeen pairs of legs in the first to the fourth larval stages there is agreement between the two genera; but in *Polydesmus* the fifth to the seventh larvæ increase their pairs of legs in the female from twenty-three to twenty-seven and twenty-nine, whilst it is remarkable that the fifth and sixth *Titanosoma* larvæ lag behind, with twenty-one and twenty-three pairs of legs respectively. Still more remarkable, and conclusive as evidence of sexual maturity, is the fact that *Titanosoma* in the seventh stage suddenly acquires twenty-nine pairs of legs. It will be seen further from what has already been said that a condition with four (five) legless posterior segments continues uniformly in *Titanosoma* from the second to the sixth larval stage. On the basis of the statements made above, the *Titanosoma* larvæ may easily be separated into the following divisions :—

(a) Large bristles on the pleurotergites; 5-jointed antennæ			1st larva
(b) Small bristles on the pleurotergites; 7-8 jointed antennæ	4 (5) legless posterior segments	7-jointed antennæ	2nd–4th larva
		8-jointed antennæ	5th–6th larva
	2 (3) legless posterior segments		Adult with 19 abdominal segments

The jointing of the antennæ of *Titanosoma* deserves special consideration, because it offers us a favourable opportunity of studying the growth of these organs. In the last few years I have repeatedly dealt with this increase of the antennal joints in the larvæ, and in connexion with the larvæ of *Thaumaporatia*[1] I came to the following conclusion : "a comparison of the first larva with the adults and with the later stages of development shows that the later seven-jointed larval antennæ arise from the five-jointed through the division of the second and third joints." It may be pointed out as particularly interesting that the process of growth in the antennæ of *Titanosoma* is somewhat different : in this genus it is not the second and third joints, but the first and second which undergo division. For whilst in the first larva of *Thaumaporatia* the first joint of the antenna is extremely short and disc-shaped, and therefore very unsuited for a later division, the second joint is not only very slender, but shows already a clear indication of a later constriction, and in the third joint the slender basal third also points to a subsequent segmentation.

In *Titanosoma* on the contrary the first antennal joint of the first larva is not only decidedly larger, but it indicates clearly that a division is to follow, in that it shows externally an obtuse-angled nick. Behind this nick it bears bristles, in front of it it is naked. The somewhat club-shaped second joint is scarcely longer than the first, and already bears above the end a sense organ. The third joint is obviously identical with the sixth joint of the adult antenna—not only in its spherical shape, but also in its great width and in the possession of a group of sense organs. Now since in the adult antenna the sense organs appear on the fifth and sixth joints, it appears perfectly plain that in *Titanosoma* the whole increase in the number of antennal joints takes place in the basal half. And since the first larva with five-jointed antennæ is followed by a second larva with seven-jointed antennæ, it appears that the latter arise from the former through the first and second joints being each divided into two by a transverse

[1] See Nova Acta der deutschen Academie der Naturforscher, Halle, 1910, pp. 116-117.

constriction. It will be evident from what has been said above, that no part in the increase can be taken by the broad and spherical third joint of the first larva. The seven-jointed *Titanosoma* antennæ are then converted into eight-jointed antennæ through the second joint dividing once more into two, as may be inferred from the fact that the second joint, in the second to the fourth larvæ, undergoes a lengthening, and that in the fourth larva it is twice as long as the first and third joints, and has no bristles on the basal half. The same conclusion follows moreover from the fact that in the fifth larva, with eight-jointed antennæ, the second and third joints are each only slightly longer than the fourth, simply because these second and third joints have arisen from the division of the former second. With the complete material available, therefore, the development of the antennæ in *Titanosoma* is clear beyond any doubt, so that I am able to present it in the form of the following table :—

<table>
<tr><td>5-jointed antennæ ...</td><td colspan="2">1</td><td>2</td><td>3 4 5</td></tr>
<tr><td>7-jointed antennæ ...</td><td>1</td><td>2</td><td>3 4</td><td>5 6 7</td></tr>
<tr><td>8-jointed antennæ ...</td><td>1</td><td>2 3</td><td>4 5</td><td>6 7 8</td></tr>
</table>

In spite of the differences which have been described, the following common features in the development of the antennæ in the Diplopods may be regarded as established :—

1. The growth of the antennæ is distinctively post-basal.
2. The two last antennal joints (the seventh and eighth), including the sense organs of the last one, are already developed in their final form in the first larva.
3. The sixth antennal joint is also, at least as regards its distal half, developed in final form in the first larval stage.
4. The further constricting-off of joints in the basal half of the antennæ may proceed in different ways, but the original second joint always undergoes a division later.

I would here refer to my determinations regarding the development of the antennæ in the Dermaptera,[1] which in comparison with the Diplopods present us with features both of agreement and difference. The antennæ of the Dermaptera behave differently in that the peduncle, and also the basal joint of the flagellum, possess their final form from the beginning, and the peduncle stands in strong contrast in structure and function to the rest of the antenna. The development is also different in the fact that the original third joint (the second of the flagellum) alone undergoes further division. There is agreement, however, in regard to the zone in which growth takes place, since in these insects also it must be described as post-basal.

The post-basal growth of the antennæ is in complete contrast with the growth of vegetable shoots. For whilst in the latter we find the youngest portion (the vegetating-point) at the end, and the older parts lower down, in the antennæ of the Diplopods and Dermaptera the oldest joints occur for the most part at the point, and the younger joints insert themselves between the base and the middle. This process of growth of the antennæ is also interesting in that it is analogous with the method of increase in the number of the abdominal segments, for the most recent of the segments formed from the budding zone insert themselves between the telson and the rest of the body.

Polymicrodon latzeli Verh.

In 1891, when I was a student, in my "Beitrag zur mitteleuropäischen Diplopodenfauna,"[2] I described amongst others, on page 127, an "*Atractosoma*" *latzeli* from the South of England (probably from the neighbourhood of London), of which I

[1] See Nova Acta der deutschen Academie der Naturforscher, Halle, 1904, pp. 16–20, in my paper "Ueber vergleich. Morphologie des Kopfes niederer Insecten, mit besonderer Berücksichtigung der Dermapteren und Thysanuren, nebst biologisch-physiologischen Beiträgen."

[2] Berlin. entomol. Zeitschr., 1891, H. 1, pp. 115–166.

only had at my disposal a single and not very well preserved male example. When I subsequently, in 1897, undertook for the first time a thorough re-investigation of the genera of the Ascospermophora, in the fifth paper of my "Beiträge zur Kenntniss paläarct. Myriap."[1], I instituted for this "*Atractosoma*" *latzeli* the genus *Polymicrodon*. I had before me, however, some further species from the Balkan Peninsula, which I separated from *Polymicrodon s. str.* as a second sub-genus *Dyocerasoma*. From Mr. Bagnall I have received a series of *Polymicrodon* from various localities in the North of England, and among them are two adult males which enable me to complete our knowledge of this genus in several particulars. I was able especially to convince myself that *Polymicrodon* is at least as closely related to *Macheiriophoron* as to *Dyocerasoma*, and that the latter must be completely separated from *Polymicrodon* as an independent genus.

I have come to the conclusion, further, that my first account of *latzeli*, written in 1891, is incorrect in certain points, unless we are dealing with a second English species of *Polymicrodon*, which I consider unlikely, because the specimens from the North of England, though showing among themselves a few slight and unimportant differences, agree in the main with the typical *latzeli* from France.

In 1895, in no. 476 of the "Zoolog. Anzeiger," I described in my "Aphorismen," etc., from Boran-sur-Oise a *latzeli gallicum*, and in 1896 I published figures illustrating it in the fourth paper of my "Beiträge,"[2] plate 14, figures 63 and 64. Figure 64, showing the anterior gonopods, agrees so completely with those of the specimens from the North of England that I am led to the conclusion that my figures 4 and 5 in the Berlin. entom. Zeitschr., 1891, are diagrammatic, or that incorrectness has been introduced through maceration and distortion of the specimen. The particular differences, therefore, on the strength of which I separated the sub-species *gallicum* I no longer consider valid. If it should prove, how-

[1] Berlin. Archiv f. Naturgesch., 1897, Bd. 1, H. 2, pp. 129-138.

[2] Archiv für Naturgesch., 1896, Bd. 1, H. 3.

ever, that these French examples do represent a distinct form, this distinction must be renewed and confirmed by other characters which are dealt with in what follows.

The relationship of *Polymicrodon latzeli* with *Macheiriophoron* is expressed in both gonopod segments. I would here refer especially to my thirty-seventh paper on the Diplopods,[1] on "Deutsche Craspedosomiden," since I have there concerned myself specially with *Macheiriophoron*. The coxites of the anterior gonopods in this genus I have discussed on pages 28 and 29, where I state, "the coxites remind one not a little of those of *Polymicrodon*; they possess especially, like those of that genus, a comb-like section, which in *Macheiriophoron* is placed upon a laterally compressed leaf-like structure which I will call the sickle-plate, because it is always hooked over towards the rear more or less in the form of a sickle, with a process directed backwards. Anteriorly these coxites are hollowed out into thick flaps, whilst at the base of the sickle-plates a side-arm rises up." These laterally compressed sickle-plates, which with their processes and points are backwardly directed, remain in *Macheiriophoron* completely separated in the middle line, so that in this genus we cannot speak of a syncoxite. Although there is a distinct syncoxite in *Polymicrodon*, there is yet a resemblance in many points with the coxites of *Macheiriophoron*, for here also we have parts which we can not only describe as sickle-plates, but which correspond in structure; for we have, as illustrated in pl. X., fig. 4, a comb-like section (*gr*), a large, pointed process (*s*) projecting over it, a deep cavity formed by these two parts, and at the proximal side of the cavity a shorter process (*z*), and finally also thick cushions (*p*) at the base of the coxites.

We must not, however, forget a number of considerable differences from *Macheiriophoron*, and these appear in the fact that in the cavity of the sickle-plates there stand, not short and simple points, but long rod-like awns, whilst shorter spikes, easily overlooked (X. 6, *b*), project at the base of these awns. Further, the sickle-plate does not end in two

[1] Sitzungsberichte d. Gesellsch. nat. Freunde, N. 1, 1910, Berlin.

projections, on to the interior of which the points extend more or less, but there is a single long process sharply marked off from the section bearing the awns. The most important difference lies, however, in the structure of the syncoxite, the peculiarities of which may be appreciated from pl. X., fig. 5. The coxites of *Polymicrodon*, precisely because they are united into a syncoxite, give one a very different impression according as they are looked at from in front or behind or in profile. Fig. 5 shows the syncoxite from almost exactly behind, so that it is easy to recognise that a complete union between the two halves has taken place in the middle line right to the base of the long distal processes. The syncoxite ends in a rounded median flap (*e*), and basally also there is a small flap (*l*) to be observed between the processes. By suitable preparation it is possible to tear apart the halves of the syncoxite; one can then recognise at the base of the distal processes the spot at which the two halves have been torn asunder (X. 4, *x*).

The hinder gonopod-sternite and the vestiges of the hinder gonopods I have figured for *latzeli gallicum* in the Archiv f. Nat., 1896, plate 14, fig. 63. I can here only state that this figure represents the corresponding organs of the specimens from the North of England almost perfectly. This hinder gonopod-sternite, together with the remains of the gonopods, differs from that of *Macheiriophoron* in the absence of a median sternal spine and the absence of coxal spines. The sternite is proportionately altogether more developed, and the remains of the gonopods are weaker, being embraced both internally and externally by portions of the sternite. In place of the median sternal spine there is in *Polymicrodon* a large median saddle-shaped process, that is to say, a broad process which is divided into two lateral processes by a deep excavation in the middle. External processes of the sternite embrace the gonopod-knobs from without and rise up in the form of pegs; their ends are somewhat hooked over towards the exterior. The hinder gonopods are therefore, in comparison with those of *Macheiriophoron*, much less developed; they either form a mere rounded knob upon the end of which a more or less evident vestige is to be found, or instead of this rudiment of a telopodite there appears a small, strongly pigmented joint, forming a sort of knot on the coxal knob. In this case there is to be seen at the end of the knot a faint indication of still another joint.

As regards *P. latzeli gallicum*, its justification as a subspecies must be tested by means of a longer series of specimens. As points of difference from the typical *latzeli* I am at present able to name only the following: there are no flaps between the distal processes of the syncoxite; the excavation in the saddle-like process on the sternite of the hinder gonopod-segment is deeper.

The cheirites of *Polymicrodon* (X. 7) are very peculiar; they agree with those of *Macheiriophoron* in the presence of a projecting process hooked backwards at the end, but this is found in a different position in the two forms, in *Polymicrodon* at the end, in *Macheiriophoron* at the base. Altogether, in fact, the two cheirites are very differently constructed, that of *Macheiriophoron* strongly inflated, that of *Polymicrodon* hollowed out posteriorly, and the cavity (X. 7, *fo*) overhung by a striated flap (*lo*). The distal process is bent back towards the flap and the cavity in the form of a grapnel.

Let us now glance again at the genus *Dyocerasoma*. The cheirites possess neither the inflation of *Macheiriophoron* nor the grapnel and the striated flap of *Polymicrodon*; on the syncoxite there are in the middle two or three flaps, and on either side there is a serrated plate, which certainly recalls the sickle-plate of those genera, but is not overhung by any process. *Dyocerasoma* is especially different from *Polymicrodon* and *Macheiriophoron* in respect of the sternite and the joints of the posterior gonopod segment; for the sternite is depressed and bears no processes either externally or internally; while the joints are developed in the form of large coxites, which come into contact in the middle line at their base, and distally are gradually drawn out into a process. Of a clearly defined telopodite there is nothing to be seen.

The following notes may be given in regard to a few other characters of *Polymicrodon*: Inner palpus of the gnathochilarium with four to five sensory processes on each side. Promentum sharply marked off from the mentum by a furrow. Grooved papillæ broad, three-pointed. Third to eleventh pairs of legs in the male provided with sucker-discs, which on the eighth to eleventh occupy almost the whole of the distal half, but leave the thin portion of the distal claw free. The coxal sacs of the eighth and ninth pairs of legs are strikingly small and contain a fine-grained sperm. There are no other special characters in the third to the eleventh pairs of legs. The inferior margin of the seventh pleurotergite of the male is somewhat hollowed out in two places, more strongly in front than behind, and standing out in a rounded projection between the two excavations.

The form and structure of the abdominal segments in the genera of Craspedosomidæ with which we are here concerned I have already discussed on pages 24 and 25 of my 37th paper; I have there emphasised the fact that it is *Macheiriophoron* which is especially distinguished from its relatives in these respects. In *Polymicrodon* the lateral keels of the abdominal segments are broad, and posteriorly have an almost straight margin. They are further distinguished by specially deep marginal grooves, which are best seen when the specimen is held transversely to the direction of the light. From the side the marginal groove is seen to run from the anterior to the posterior bristle; the latter is placed on a little papilla which plainly projects over the posterior border towards the rear. (In *Macheiriophoron* not only is the marginal groove weaker, but from the side the papilla of the posterior bristle is not seen to project, because the lateral keels are so strongly bent outwards obliquely towards the front.) The posterior edge of the pleurotergites in *Polymicrodon* runs almost straight in the middle, and forms on each side an obtuse angle with the almost straight hinder edge of the lateral keel, whilst in *Macheiriophoron* the posterior edge runs in curves, a rounded flap projecting on each side, and the middle being deeply excavated. It is therefore a circumstance worth noting, in conjunction with the relationships already discussed between *Polymicrodon* and *Macheiriophoron*, that it is perfectly possible to distinguish the two genera with a lens at the first glance by the shape of the pleurotergites.

I have not been able to recognise spermatophores with certainty within the gonopods, but the anterior gonopods appear to be specially adapted for the reception of such, since on the one hand they can be clasped between the grooves and the grapnel, and on the other hand they can also be secured behind the syncoxite underneath the distal processes and between the two rows of awns, in such a way that the parts of the hinder gonopod-segment form an opposing bed.

Distribution: The new locality for *Polymicrodon latzeli* in the North of England is very noteworthy from the zoogeographical point of view, since this is the first time that a Craspedosomid of "Atractosoma-habit" has been recorded from the northern region affected by the Ice Age. This is by far the most northerly record for any such Craspedosomid.

Larvæ of Polymicrodon: In my forty-fourth Diplopod paper[1] I gave for the first time a key to the larvæ with 23, 26, or 28 abdominal segments, belonging to the genera *Ceratosoma*, *Macheiriophoron*, *Orotrechosoma*, *Helvetiosoma* and *Craspedosoma*. The larvæ of *Polymicrodon* should be embodied in this key, and the following therefore is a completion of it.

The *Polymicrodon* larvæ have no longitudinal black bands on the back or low down on the sides; the collum and lateral keels are therefore not strikingly distinguished by their light colour. The animals appear on the contrary for the most part of a uniform grey or brown. All dorsal bristles long, strong and hooked, the inner ones projecting over the hinder border of the pleurotergite. On the upper part of the hinder border of the segments the projecting tubercles are weak, and are not associated near the middle line with any grooves, but

[1] Zur Kenntnis der Craspedosomiden-Gattungen Helvetiosoma und Orotrechosoma. Zoolog. Anzeiger, June, 1911, page 27.

with the close reticulation. The legs of the larvæ have no pointed tubercles. If, now, we disregard *Dyocerasoma*, the larvæ of which have not been particularly investigated, the larvæ of *Polymicrodon* come nearest, among the five genera named above, to those of *Macheiriophoron*. They may, however, be distinguished by the following characters:—

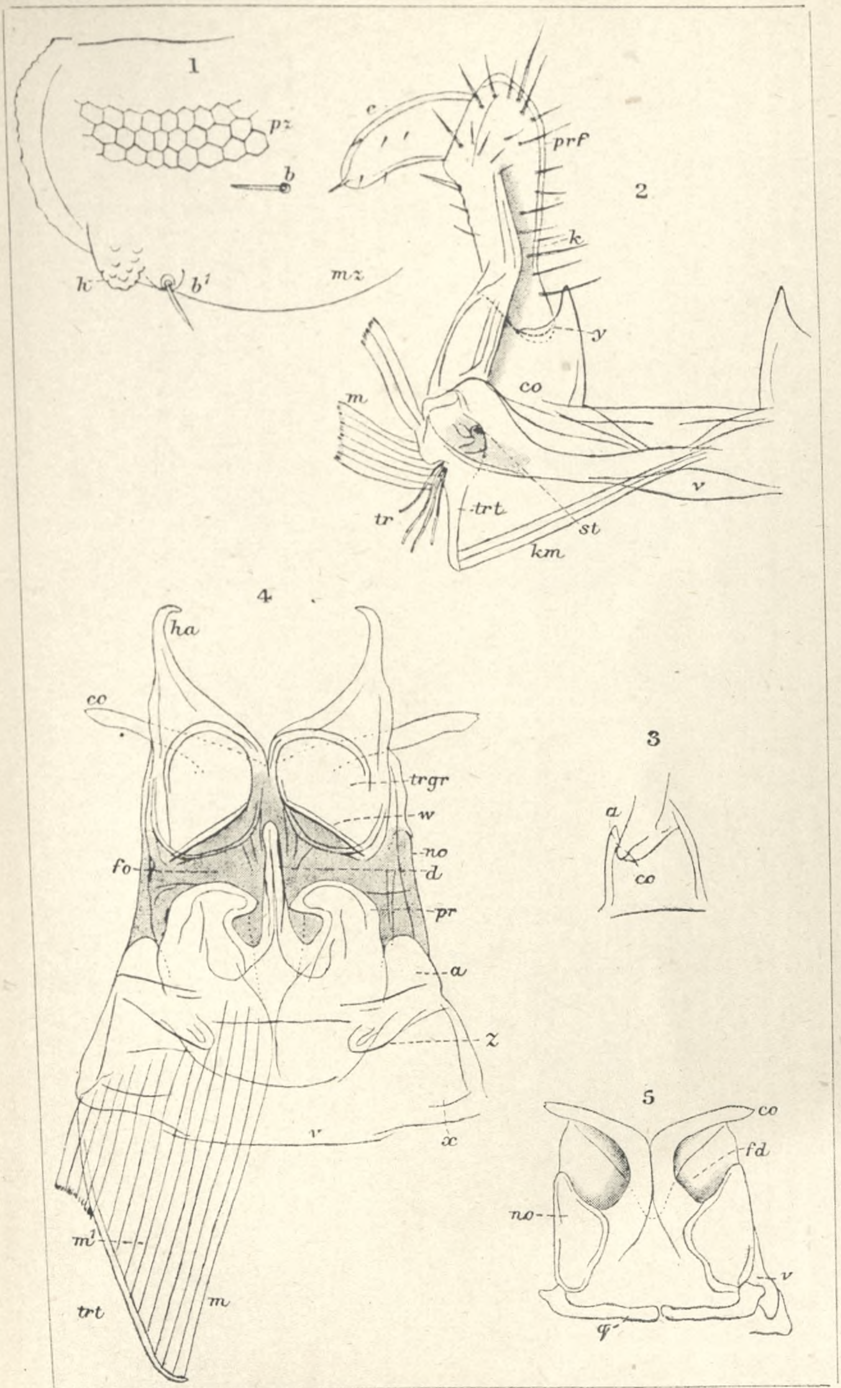
Macheiriophoron Larvæ.

On the lateral keels there are raised longitudinal beads, hollowed out by a groove internally, and sharply marked off externally by a deep longitudinal furrow. These longitudinal beads bend posteriorly and internally obliquely towards the hinder border of the segment. The lateral keels are somewhat obliquely bent outwards anteriorly. The tubercles of the posterior bristles do not project backwards. The longitudinal beads are anteriorly rounded, prominent and wide, posteriorly strongly narrowed in the form of fingers.

Polymicrodon Larvæ.

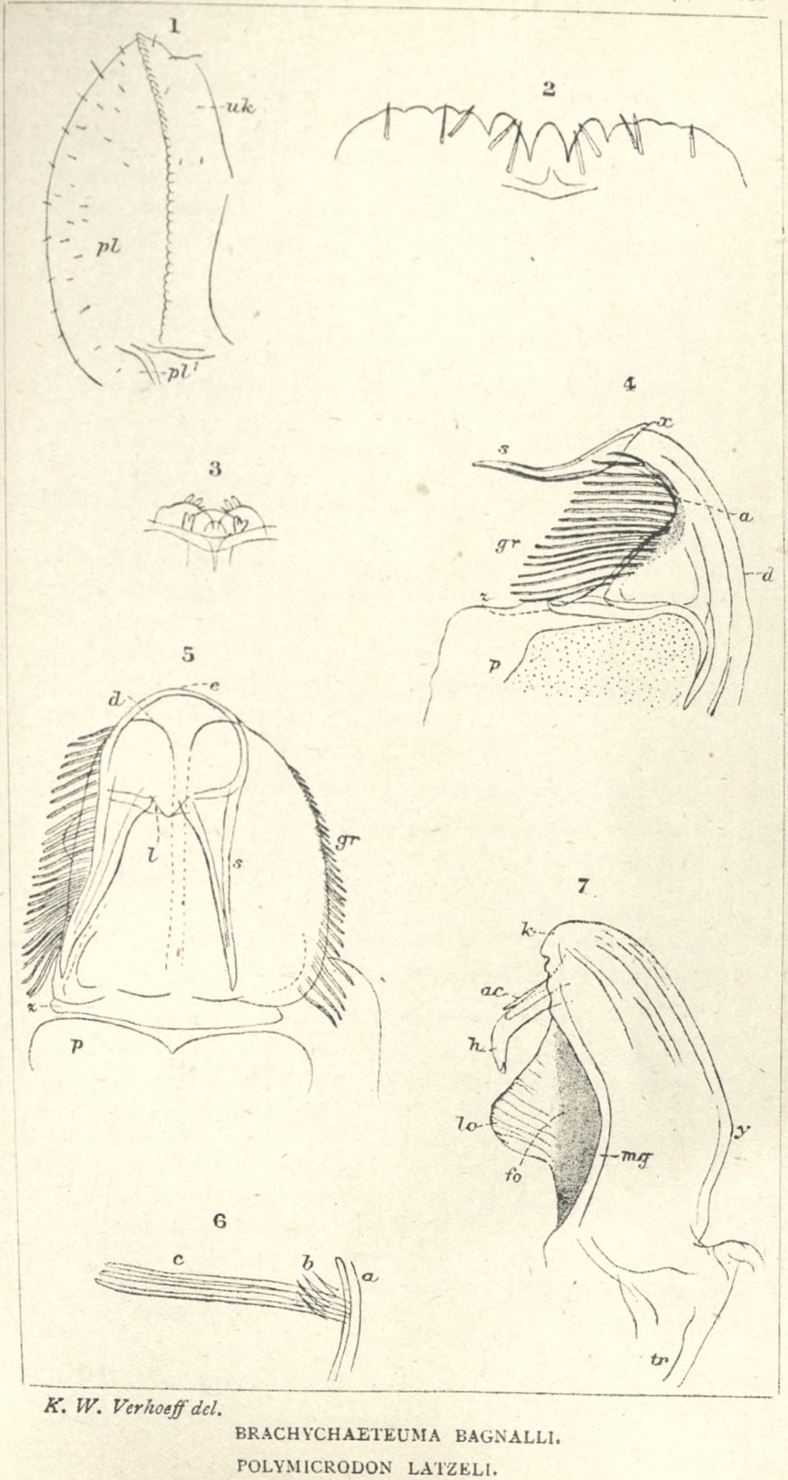
The lateral keels are less arched and have no longitudinal beads hollowed out internally, though externally there is a very deep longitudinal furrow. The lateral keels are anteriorly directed only slightly outwards. The tubercles of the posterior bristles are stronger, and when looked at from the side are clearly seen to project somewhat backwards.

The differences in the larvæ partially correspond, therefore, to those of the adults. The dorsal sculpture of the larvæ is in *Polymicrodon* coarser than that of the adults, whilst in the shape of the hinder borders of the segments there is no striking difference between larvæ and adult males. This is in contrast with the corresponding conditions in *Macheiriophoron*. The larvæ of *Polymicrodon* are easily separated from those of *Craspedosoma* and *Helvetiosoma* by their sculpture; but apart from this character the *Polymicrodon* larvæ are still further distinguished by their much smoother dorsal surface. They are furthermore distinguished from the larvæ of *Craspedosoma* by the deeper longitudinal furrows on the lateral keels, and from the larvæ of *Helvetiosoma* by the absence of tubercles on the coxa, prefemur and femur of the walking legs.



K. W. Verhoeff del.

BRACHYCHAETEUMA BAGNALLI.



K. W. Verhoeff del.

BRACHYCHAETEUMA BAGNALLI.

POLYMICRODON LATZELI.

EXPLANATION OF PLATES.

Plate IX.

Brachychaeteuma bagnalli, nov. gen. et sp., Verh., male.

Fig. 1. Left pleurotergite of the third abdominal segment, seen from above, × 220; *pz* prozonite, *mz* metazonite, *h* lateral prominence, *b* anterior bristle, *b1* posterior bristle.

,, 2. Left posterior gonopod with sternite, seen from in front, × 220; *co* coxite, *prf* prefemur, *trt* tracheal pocket, *tr* tracheæ, *km* transverse muscle, *k* rib on coxite and prefemur, *st* stigma.

,, 3. Coxa and neighbouring process *(a)* of the prefemur of a hinder gonopod, seen from behind, × 125.

,, 4. Anterior gonopod with sternite, seen from in front, × 220; *z* peg, *a* flap, *pr* lateral processes, and *d* middle process of the syncoxite, *m* and *m1* muscles from the support *(trt)* to the syncoxite; *fo* transverse groove-like hollow between the syncoxite and the telopodites, the latter resembling drinking horns and possessing at their base a sac-like cavity *(trgr)*; *w* beaded edge of the latter.

,, 5. Syncoxite of the anterior gonopods, represented from behind, × 125; *co* horn-like processes, *no* lateral thickenings, *q* transverse buckle-piece.

Plate X.

Figs. 1–3. Brachychaeteuma bagnalli, nov. gen. et sp., Verh., male.

Fig. 1. Right pleurite of the head (cheek-piece), seen from below, × 220; *uk* inferior groove, bounded externally by serrated rib; *pl* anterior pleurite, *pl1* posterior pleurite.

,, 2. Labrum of the male, with notched flaps at the sides, × 220.

,, 3. Inner palpus, central-body, and processes (Spaltwarzen; *verrucæ fissæ*) on the anterior border of the lamellæ linguales, × 220.

Figs. 4–7. Polymicrodon latzeli, Verh.

,, 4. One half of the syncoxite of the anterior gonopod, seen from without, × 125; *gr* row of awns, *s* spinous process, *z* tooth-like process, *p* cushion.

,, 5. A complete syncoxite seen from behind and somewhat from the side, × 125. (References as above).

,, 6. A few of the awns of the syncoxite with the small spines at their base, seen from without, × 220.

,, 7. A cheirite seen from the inside, × 125; *h* the grapnel, *lo* the striated flap, *fo* the groove between the flap and the stem of the cheirite.

An Amended Description of Diaptomus Sancti Patricii.

By G. Stewardson Brady, M.D., LL.D., D.Sc., F.R.S.

(Plate XI.).

In a recent volume of the "Proceedings of the Royal Irish Academy,"* attention has been called to the imperfect description of a fresh-water Entromostracan—*Diaptomus Sancti Patricii*—published by me in the "Natural History Transactions of Northumberland, Durham and Newcastle-upon-Tyne," vol. xi., 1891. This description was necessarily imperfect owing to the scanty material then available, but having recently (1909) re-discovered the species in Westmorland I propose now to describe it more fully.

Mr. Scourfield's remarks are as follows—"*Diaptomus Sancti Patricii* Brady. It is very unfortunate that this species is not more certainly characterized, and that it should not have been recognized since first taken by Brady in Connemara. If it is really distinct from *D. laciniatus* it is one of the very few species peculiar to the British Isles. If, on the other hand, it is identical with that species, it is still one of the forms linking the West of Ireland with Scotland and Scandinavia."

Diaptomus Sancti Patricii G. S. Brady. Plate XI.

Female.—Length 1·2 mm. Body slender; seen dorsally the anterior portion (cephalothorax) about three times as long as broad; its anterior extremity obtusely rounded, posterior subtruncate, with acutely produced lateral angles, each ending in a short spine. Genital segment of the abdomen about twice as long as the combined length of the two following segments, considerably dilated in front, and bearing a spine-like bristle on each side; caudal rami short, not much longer than broad. Anterior antennæ very slender, extending, when reflexed, beyond the apices of the caudal setæ. Basal joint of the last

* Clare Island Survey, Part 46. Fresh-water Entomostraca by D. J. Scourfield (Proceedings of the Royal Irish Academy, volume xxxi.).

pair of legs much dilated, and having its outer margin produced into a strong hook-like process; inner branch short, distinctly bi-articulate, not much more than half as long as the first joint of the outer branch, the median joint of which terminates as usual in a strong claw-like process; last joint very small, reaching only about one-fourth as far as the terminal claw. Ovisacs large, rounded, and containing a small number of ova—usually six or seven.

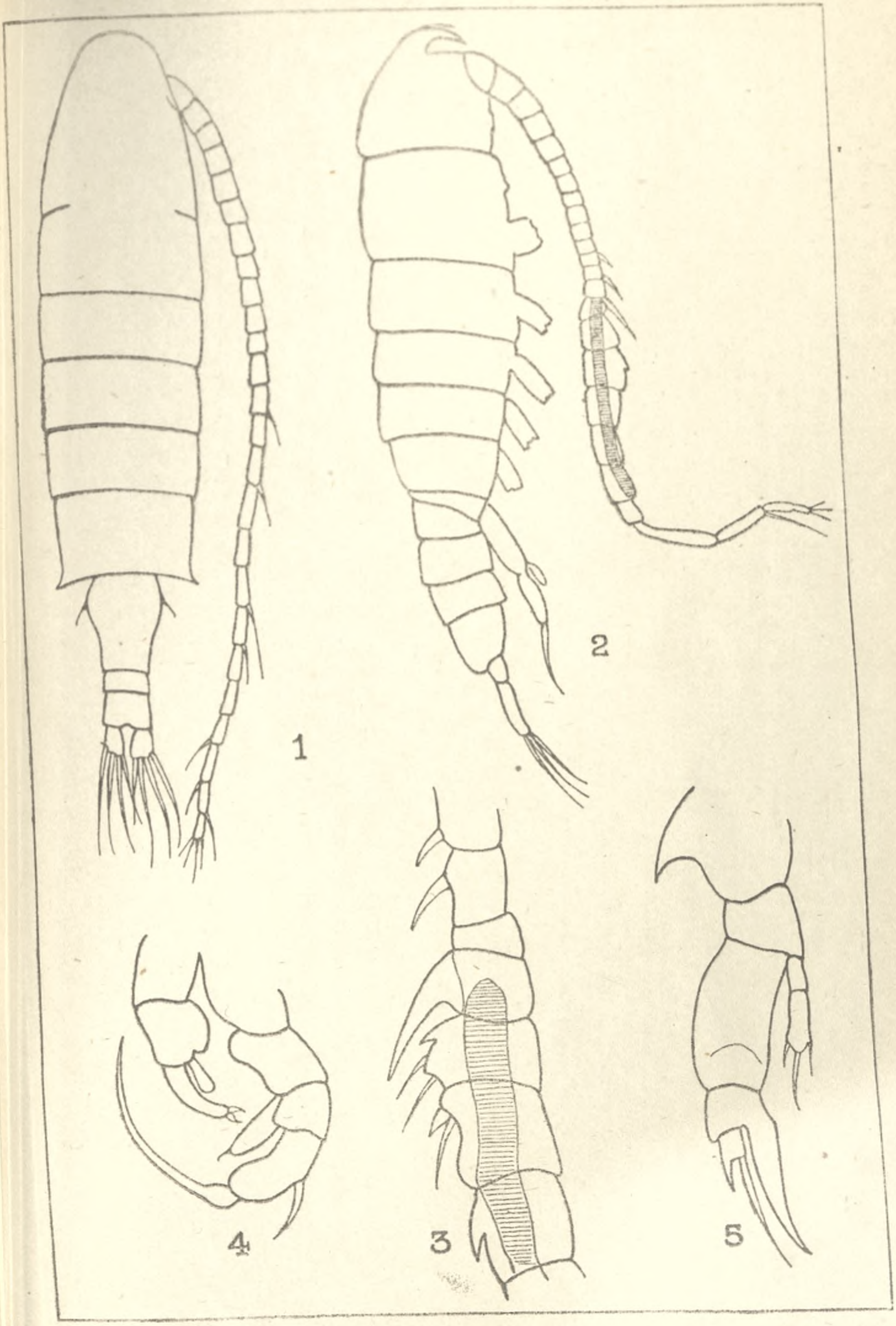
Male.—Somewhat more slender than the female. Right anterior antenna considerably dilated in the middle, tenth and eleventh joints each bearing a small spine on the outer margin, thirteenth joint small and unarmed, fourteenth with a very large and strong spine, the three following joints (15–17) much dilated and bearing a few strong hairs and denticles, antepenultimate and terminal segments simple, filiform, devoid of lateral prominences. Last pair of legs large, the right much the larger of the two, its inner ramus simple, digitiform, much shorter than the terminal joint of the outer ramus, the distal joint of which is more than twice as long as broad, has a long spine attached near the middle of its outer edge, and a long simply curved apical claw; left leg extending somewhat beyond the two proximal joints of the right leg, the second joint wide, its inner margin very tumid but without any distinct angle; and bearing in addition to the simply curved, elongated terminal joint, an additional very short laminar appendage, which is not more than half as long as the terminal joint. Length of the body slightly less than that of the female.

In the original description of *D. Sancti Patricii* I suggested that its nearest described relative was probably *D. laciniatus* Lilljeborg. This was a mistaken view, *D. laciniatus* being separable from it at a glance by the "laciniated" character of the posterior body segments. The species which most nearly approach *D. Sancti Patricii* are *D. gracilis* and *D. graciloides*: from the former it is distinguished by the strongly spined right anterior antenna of the male, which is likewise destitute of any lateral process on its antepenultimate joint—also by slight differences in the left fifth foot of the male; from *D. graciloides* by the contour of the hinder body segments as well as by the character of the antennæ and fifth foot of the male.

The type specimens of *D. Sancti Patricii* were taken in 1865 in some of the small fresh-water loughs of Connemara. Since that time it has not been observed until three years ago (1909) when I found it abundantly in a pond at Heversham, Westmorland.

EXPLANATION OF PLATE XI.

Fig. 1. Female seen dorsally × 84.
2. Male seen from right side × 84.
3. Median portion of right anterior antenna of male × 240
4. Fifth pair of feet of male × 150.
5. Fifth foot of female × 300.



G. S. Brady del.

DIAPTOMUS SANCTI PATRICII.

Further Records of some British Symphyla, with description of a New Species.

By Richard S. Bagnall, F.L.S., F.E.S.

(Hope Department of Zoology, University Museum, Oxford).

Since my papers on the British species of this interesting Order were published I have had the opportunity of examining further material from various parts of Great Britain. This material consists of very many specimens collected by myself in the Wear and Derwent Valleys, in the Cheviot district and in Tynedale, and a few from Whitby, Oxford, the Clyde and Forth areas of Scotland, etc. Dr. Randell Jackson has submitted several interesting species, including examples of a new and distinct form of *Scolopendrella* from Cheshire, and Mr. Evans is now collecting material in the Forth area with his well-known energy and success. To these friends I would wish to express my warm thanks for allowing me to examine such interesting material, and also to Mr. Hirst of the British Museum for a tube of specimens from Devonshire.

The examination of such material has shown that many of the species I recently brought forward are not really uncommon, and are also of wide distribution.

The following table shows the distribution as at present known of the British species in the areas in which they have received at least moderate attention, each district or county (excepting Cheshire) being also subdivided to add to the interest of the table and local workers :—

SYMPHYLA	Scotland			Northumberland			Durham					Yorkshire (including Durham Tees records)			Cheshire
		Clyde	Forth		Cheviot	Tyne-dale		Coast	Der-went Valley	Wear	Tees		Coast	Inland	
SCUTIGERELLA															
S. immaculata (Newp.)	+	×	×	+	×	×	+	×	×	×	×	+	×	×	+
S. spinipes Bagn. ...	+	—	×	+	—	×	+	—	—	×	×	+	—	—	+
S. biscutata Bagn. ...	+	×	×	+	×	×	+	×	×	×	×	+	—	—	+
S. hanseni Bagn. ...	—	—	—	—	—	—	+	—	×	—	—	—	—	—	—
S. caldaria Hansen ...	+	×	—	+	—	×	+	—	×	×	—	—	—	—	—
SCOLOPENDRELLA															
S. notacantha Gerv. ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+
S. subnuda Hansen ...	+	×	×	+	×	×	+	×	×	×	—	—	—	—	—
S. isabellæ Grassi ...	—	—	—	—	—	—	+	—	—	×	—	—	—	—	—
S. dunelmensis Bagn....	—	—	—	—	—	—	+	—	×	—	—	—	—	—	—
S. jacksoni Bagn. ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+
S. horrida Bagn. ...	—	—	—	—	—	—	+	×	—	—	—	—	—	—	—
S. vulgaris Hansen ...	+	×	×	+	—	×	+	×	×	×	×	+	×	×	+
S. delicatula Bagn. ...	+	×	×	+	×	×	+	×	×	×	—	+	×	—	+
S. minutissima Bagn....	—	—	—	—	—	—	+	—	—	—	×	+	×	—	—

Of these districts Durham leads with twelve out of the fourteen known species, followed by Scotland, Northumberland, and Cheshire with seven each, and Yorkshire with six species. Cheshire possesses the two species *S. notacantha* and *S. jacksoni* not met with in County Durham, and there is no doubt that in all these areas, perhaps excepting Durham, more species await to be recorded.

Scutigerella immaculata (Newp.)

Several found with *S. biscutata*, *S. vulgaris* and *S. delicatula* in a garden, Chester, May, 1912 (A. Randell Jackson). Not uncommon in a dene between Blacklaw and Wooler Moor and on Westwood Moor near Wooler; and between Riding Mill and Stocksfield, Northumberland, May, 1912. Numerous specimens, Avonbridge, 13. iv. 12, and a single example from Manuel, East Stirling, 16. iii. 12 (W. Evans). Near Edinburgh, ix. 12 (W. Evans, R.S.B.). In the vicinity of Oxford.

Scutigerella spinipes Bagnall.

A few examples taken by Dr. A. Randell Jackson from his garden, Chester, April, 1912, and two examples (one with ten and the other with eleven pairs of legs) taken by Mr. Evans at Avonbridge, Stirlingshire, 13. iv. 12. I have myself met with further specimens this spring at Hylton and Penshaw, Co. Durham, and at Stocksfield, Northumberland.

These are the first records from Cheshire, Northumberland and Scotland, and an examination of this further material absolutely confirms my opinion as to the validity of the species, which is easily recognized by the characters named in my diagnosis. It is probably a moderately common form.

Scutigerella biscutata Bagnall.

This distinct form has occurred several times in the neighbourhood of Fencehouses and Penshaw, whilst I have taken examples in a quarry near Hylton, on the sea banks at

Blackhall Rocks, Co. Durham; on Westwood Moor near Wooler, and in a Newcastle garden, Northumberland. More recently from Gibside in the Derwent Valley.

Dr. Randell Jackson has submitted several examples from his garden, Chester, and a single specimen from Dringle, Cheshire, May, 1912. I have more lately received an immature example with only 8 pairs of legs taken by Mr. Evans at Avonbridge, Stirlingshire.

First records from Northumberland, Cheshire and the Forth area of Scotland.

Scutigerella caldaria Hansen.

In the Winter Gardens, Sunderland, and the Botanical Gardens at Oxford.

First record for Oxfordshire.

Scolopendrella subnuda Hansen.

Northumberland.—Several with *S. delicatula* in the hills at Skirlnaked near Wooler, and in a garden near Stocksfield-on-Tyne.

Durham.—On the sea banks at Blackhall Rocks, in the vicinity of Penshaw, and at Gibside and Winlaton Mill.

Oxfordshire.—In gardens at Oxford, several examples, November, 1911.

Devonshire.—Several examples taken by Mr. Hirst of the British Museum.

Scotland.—A single example taken by myself near Queensferry in the Forth area.

These are the first records for Northumberland, Oxfordshire, Devonshire, and the Forth area of Scotland.

Scolopendrella dunelmensis Bagnall.

S. isabellæ var. *dunelmensis* Bagnall.

Occurs frequently in its original habitat at Gibside and at another place about three-quarters of a mile away.

Scolopendrella jacksoni sp. nov.

Allied to *isabellæ* Grassi and *dunelmensis* Bagn., of about the same size and build, and differing in the chætotaxy of the scuta, legs and cerci.

The legs of the last pair have only two long protruding dorsal setæ on the metatarsus, and not more than four similar setæ on the tarsus, whilst the recumbent hairs are almost as long as the erect ones.

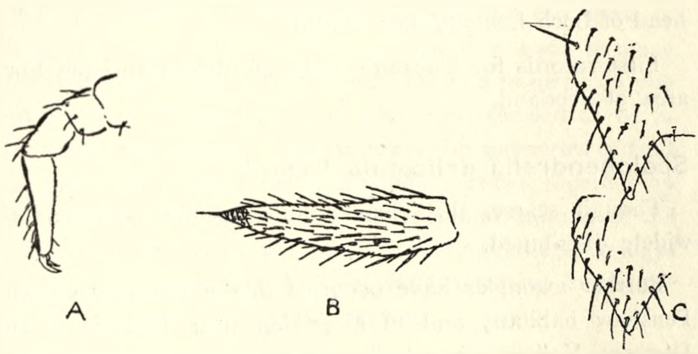


Fig. 1. *Scolopendrella jacksoni* sp. n.

A. Left hind leg.
B. Lateral view of cercus.
C. Left side of 2nd and 3rd dorsal scuta.

The setæ of the cerci are slightly fewer and distinctly longer than in either *isabellæ* or *dunelmensis.* The scuta possess several long prominent bristles on the lateral margin and on the *inner margin* of process also. In the allied species there are no such long setæ on the inner margins of processes. The lateral margin of the second scutum has five long prominent setæ, including the antero-lateral and apical ones, and the inner margin of the process is furnished with two such setæ.

Distribution.—Several examples taken by Dr. A. Randell Jackson at Saltney Ferry, Cheshire, in the spring of this year. I have much pleasure in naming the species in honour of its captor.

Scolopendrella vulgaris Hansen.

I am able to add the following localities, in addition to those already recorded, viz., on the sea-banks near Whitby, Yorkshire; in a quarry at Hylton, April, 1912; and in gardens at Oxford, November, 1911. Dr. Randell Jackson has met with the species in his garden, Chester, and also at Queensferry. Mr. Evans and I have taken the species in the neighbourhood of Edinburgh, whilst I have an example from the head of Loch Lomond, near Ardlui.

First records for Cheshire and Oxfordshire and the Forth area of Scotland.

Scolopendrella delicatula Bagnall.

Though scarce, this slender little species is apparently widely distributed.

Further examples have occurred in the Fencehouses and Penshaw habitats, and in a garden near Fellside in the Derwent Valley. In April, 1912, Dr. Randell Jackson obtained a few examples in his garden at Chester, whilst I discovered several on the sea-banks near Whitby, Yorkshire, and in May, 1912, I found it sparingly with *S. subnuda* in the hills at Skirlnaked near Wooler. In July, 1912, I found a solitary specimen in the gardens of the Hancock Museum. Whilst collecting Protura, etc., with me in a quarry near Edinburgh, Mr. Evans found a pair of this animal, whilst I believe it is represented in a rather large collection of Scolopendrellids made by us on Arthur's Seat. I have not yet had the opportunity of examining this latter material.

I have also taken a specimen on the banks of Loch Lomond near Ardlui.

First records for Cheshire, Yorkshire and Scotland.

REPORT ON THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1909.

READ MARCH 23RD, 1910, BY MR. C. E. ROBSON, CHAIRMAN OF THE FIELD MEETINGS COMMITTEE FOR 1909.

When the winds are blustering outside and the snow is clothing the earth with its white mantle, it is good to muse by the evening fire and allow one's thoughts to dwell on the sunny days of summer—a time when one seemed to be in closer touch with Nature. Pleasant are the memories of field days spent with congenial companions, drawn together by kindred tastes and intent on a better understanding of the handiwork of the great Creator. It is my privilege to-night to recall these days of last summer and to sum-up briefly the work accomplished during the season.

The first meeting was arranged to be held at MITFORD on May 15th. After a long cold spring the outlook was not hopeful; indeed the party, numbering 16, had barely reached Morpeth before rain fell, and this changed into a sharp shower of hail and snow as we went down the Buller's Bank. Here we left the red-tiled houses behind and followed the broad road, bordered by well-grown sycamores and beeches spreading their wide branches: only the former showed leaf and flower. Crossing the Low Ford Bridge, a large bed of butterbur, extending along the right bank of the Wansbeck for some 50 or 60 yards, was a noticeable feature. A weed truly, rank in growth, yet its roots serve the useful purpose of binding the clay bank and preventing its denudation.

Soon the Abbey Mills, where woollen cloth is still woven, were reached. At the tail of the mill race, a solitary fisherman was whipping the water with but little result, the cold being too pronounced for trout to be "on the feed"; lower down the stream two swans (of which Morpeth boasts a number) were apparently more successful. High Ford Bridge, which we soon crossed, gave a view of the solid dam ; beyond this was the fall down which the river came in a silvery sheet. The pipe which leads the water from the Pont to supply the wants of North Shields, somewhat marred the landscape. From this point the highway winds between rich meadow land, a road which under favourable climatic conditions is sylvan in its beauty at this time of year. Even to-day the white blossom is on the sloe and the burnish on the hollies. Further on, the sloping pasture which leads to Spital Hill—the old hospital of St. Leonards—and on which the sun was now shining, was seen to be decked by the celandine, the dog-violet, the primrose and cowslip; while the Adder's Heugh, on our left, was ablaze with the golden gorse. Hereabouts is the meeting of the waters; the Font, rising near the foot of Tosson, joins company with the Wansbeck from the region of the Wanny Crags, and flows over the drift gravels and rocky beds of the millstone grit.

At Mitford Bridge the wagtails were feeding on the shallow bottom of the stream. The elm in this more sheltered spot had burst its brown scales and was throwing forth its leaves, and the bronze spear points of the beech were thrusting out to the sunshine. From the edge of the woods all around came the song poured forth so joyously from the throat of blackbird and thrush, which while similar, are quite distinctive; the one a musical rhapsody, complete, full and clear; the other a prelude, rhythmic and insistent:—

> At the bent spray's edge
> That's the wise thrush : he sings each song twice over
> Lest you should think he never could recapture
> The first fine careless rapture !

Our path now lay uphill, bearing towards the left, where a splendid ash tree, not yet outwardly responsive to the touch of spring, was growing in the dyke with a girth measurement of 12 feet near its base. By the kind permission of the Rector, the Rev. R. C. Macleod, who acted as cicerone, the fine Norman church of Mitford was inspected. Under the same kindly guidance the old Manor House was visited: in the kitchen to the left of the fireplace interest centred in the wheel of a turnspit well preserved in its original place.

In the mature old gardens was a prolific growth of barberry bushes in bloom; a magnificent specimen of the cedar of Lebanon; also a medlar, a tree rarely found so far north. It was hoped that the bullfinch, which nests at Mitford, might be seen, but though we were disappointed in this respect, Mr. Macleod told us that they had already arrived and were vigorously attacking his gooseberry buds.

He then led us up the slope and briefly sketched the history of the Castle, which is now a mere shell. We then took the footpath homeward along the south bank of the Wansbeck, and in the fringing woods found the primrose, moschatel, goldilocks, and anemone in profusion. On reaching the crest of the hill, the ever-welcome note of the cuckoo was heard; and the nest of a spotted flycatcher containing three eggs was found, ingeniously wedged into the angle formed near the base of an oak tree by the bole and a small wicket-gate swinging upon it. We devoutly hoped the birds might be allowed to hatch and rear their young, though as the gate was on the direct path, we rather doubted it. In the Borough woods the garlic was growing plentifully, though not in flower. An old weir, almost dry, afforded a home for the marshmarigold, which spread its golden petals to the sun; and in it the horse-tail shewing the terminal fruit was also abundant. On the banks of boulder clay the recently planted larches, spruces, and Scotch firs showed vigorous growth.

Down by the river, a solitary kingfisher was seen flashing in his brilliant dress of green, blue and chestnut; while the water ousels were dipping their white waistcoats at the edge of the stream, and the distinctive cry of the sandpiper was heard.

Near this spot a member of a comparatively little-known family of centipedes was discovered: a monograph upon which has been published in the Transactions, vol. iii., part 2, p. 462.

Briefly surveying the interesting remains of Newminster Abbey, we wended our way down the High Stanners to Morpeth: there was then barely opportunity to walk past the Castle to the High Church, where there are some remarkably fine yews, leading from the lych gate to the main entrance, before it was time to take train home.

In addition to the ordinary hedgerow birds, the kingfisher, dipper, waterhen and mallard were seen; and of the migrants the sandpiper, chiff-chaff, willow-wren, spotted flycatcher, house martin and swallow.

For a day in the month of May the following list of flowers found is somewhat meagre :—

Anemone nemorosa
Caltha palustris
Ranunculus flammula
,, auricomus
Berberis vulgaris
Cardamine pratensis
Viola canina
Stellaria holostea
Oxalis acetosella
Ulex Europæus
Vicia sepium
Prunus spinosa
Chrysosplenium oppositifolium
Adoxa Moschatellina
Anthriscus vulgaris
Myrrhis odorata
Galium cruciatum
Petasites vulgaris
Veronica hederifolia
Lamium album
,, purpureum
Nepeta hederacea
Myosotis versicolor
Primula vulgaris
,, veris
Chenopodium Bonus-Henricus
Luzula campestris

DIPTON WOODS, the property of His Grace the Duke of Northumberland, were chosen for our second meeting. Permission having been granted by Sir Francis Walker, Chief Commissioner, a party of 15 assembled on Tuesday, June 8th, for this purpose.

The spell of cold weather with which the season opened had continued, but a pleasant change from the northerly and easterly winds had just set in, gentle breezes and sunshine tempering the atmosphere. Leaving Corbridge station by a footpath running alongside the railway, we noticed a prolific growth of beaked parsley; at the end, the bridge led to a hilly road. Alongside the thorn hedge a silver runnel of water was trickling merrily, and under the afternoon sunshine those plants which add a charm to our rustic lanes, the greater stitchwort, herb Robert, yellow geum and wild geranium were resplendent in bloom.

Some score or more of ducklings under the maternal care of a couple of hens paddled about, but quickly scuttled through the hedge on our approach. Mounting a rough stile, an upland meadow was reached, whose greenery was starred by the bulbous buttercup; overhead the larks were singing, and the warblers from the friendly shelter of the neighbouring thickets poured forth their melody.

At Dilston High Town, a pleasantly situated farmstead overlooking the Devil's Water as it flows down into the Tyne, a halt was called to examine the countryside. Equally interesting was an old garden wall of the stone dyke order, upon the top and side of which for a distance of fifty yards the ivy-leafed toadflax had found a home, while in its upper crannies the scorpion grass and shepherd's purse had rooted themselves; the wall of cold grey stone was completely dominated by the lilac tint of the flowers.

Passing through the gate and keeping to the bridle path, a pinewood fringed by beeches stretched down the hillside; in its boggy bottom the dog violet, white and blue milkwort, wood sorrel, and bog stitchwort were noted. In an old dismantled quarry near at hand, whose floor and sides are being rapidly covered by vegetation, a single fine specimen of the dyer's greenweed was noticed; rooted in a cranny of the quarried rock, 9 feet from the ground, it reared a brave blossom of gold to the sun.

Breasting the steep track through the wood, the foothold on the slippery pine needles was uncertain. On all sides the bracken was unfolding its green fronds. At the far edge of the wood a heron was seen sailing leisurely overhead.

Leaving the shelter of the wood, a path was struck across an undulating pasture whose bare, coarse grass was in accord with the poor stiff clay soil; as we entered the gate of the meadow, a curlew flew swiftly past, uttering its characteristic whistle.

At the meeting of the high roads, our route lay through one of the grassy glades intersecting the dark pine woods of Dipton. This was the spot chosen by the entomologists to commence operations. Umbrellas of an early Victorian shape were unfurled, sweeping nets fixed and aprons spread under the flowering Scotch firs. The collectors, on their knees, diligently searched their trawl, and to the Rev. J. E. Hull I am indebted at the end of the day for the following list of spiders captured :—

Prosthesima latreillei	Clubiona comta
Thecidion pallens	Linyphia pusilla
Linyphia montana	Leptyphantes mengii
Micronela cauta	Thyreosthenius biovatus
Walckenaera nudipalpis	Meta segmentata
Epeira cucurbitina	Oxyptila trux
Philodromus aureolus	Tarentula pulverulenta
Lycosa herbigrada	Lycosa pullata

As we penetrated deeper into the darkened woods, the ants' nests, which are frequent in the district, next attracted attention. The scene is a busy one; the colony is one of the red ants; organisation has built a domicile which appears enormous in relation to the architects. Disturbing one of the nests with the point of a stick, the activity and energy of the ants is increased. Workers and soldiers are building or repairing the nests, or carrying off the eggs or larvæ, a white body of equal size to themselves; others are foraging for stores; here is a queen ant and there a drone. At the same time a strong smell of formic acid is emitted. But the interest does not end here, for within the nest are other insects, spiders, flies, centipedes, and the most beautiful of all, a large golden beetle, which apparently forces her way into the nests to lay her eggs. Perhaps the best result of the day's work was the taking of one of the spiders, *Thyreosthenius biovatus*, in the home of the red ant. Some of the guests are carefully attended by the ants and afford an interesting chapter in the study of commensalism. Half-way through the woods we came upon a large clearing, where sawmills have been erected and work was in full swing. Where the timber has been cut, a considerable area has been planted with larches, spruces, etc., under the supervision of Mr. A. T. Gillanders, F.E.S. Pushing along the footpath, the southern part of the woods was reached, and from its steep slope a magnificent view was extended before us: the district of Whitley Chapel through which the Devil's Water winds its devious course; in panoramic succession the hills of Allendale, Alston, Blanchland and Consett.

Turning our steps homeward, the sun at our backs glinting on the lofty perpendicular boles of the Scotch pines, the recesses thrown into shade by the roof of greenery, the red mosaic floor of fallen needles underfoot, one caught the spirit of the cathedral outline. And the silence, too, was there, except for the occasional sad note of the woodwren, the shrill pipe of the titmouse, or the full-throated roulade of the chaffinch, which harmonized with the feeling of the moment.

Pushing along downhill, the village of Corbridge was reached, and after a cheering cup of tea, the long summer evening was still before us. Our party divided, some following the river downwards, and others taking the woodland path to the point where the Devil's Water flows placidly into the Tyne. A magnificent view of the broad winding river, touched by the colour and glory of the setting sun, was before us. On the banks beneath our feet, the tracery of the thrift and the tufty cushions of the cathartic flax enriched the beauty of the short, velvety herbage. The golden gorse was still glowing under the sunshine, and the heavy May blossom was like snowdrifts on the hawthorns.

Evidence of the late spring was still apparent in the late blooming of the flowers, of which the following is a list :—

Cardamine pratensis
Viola canina
Stellaria uliginosa
Polygala vulgaris
Oxalis acetosella
Lychnis diurna
Arenaria verna
Stellaria holostea
Linum catharticum
Geranium Robertianum
,, sylvaticum
Vicia Cracca
,, sepium
Lotus corniculatus
Sarothamnus scoparius
Genista tinctoria
,, anglica
Bunium flexuosum
,, verum
,, mollugo
Veronica Chamædrys
Rhinanthus Crista-Galli
Linaria cymbalaria
Myosotis collina
Primula vulgaris
Armeria maritima
Orchis mascula
Scilla nutans
Arum maculatum

Amongst the birds seen and heard were the

Willow-wren
Chiff-chaff
Woodwren
Whitethroat
Great Titmouse
Greenfinch
Titlark
Pied Wagtail
Swallow
Sandmartin
Housemartin
Woodpigeon
Corncrake
Heron
Curlew
Lapwing
Sandpiper

To my great regret, illness prevented me from attending the third meeting, which was held on July 3rd, in the district lying between Knowesgate and Woodburn, and embracing the Sweethope Lough and Wanny Crags.

Mr. R. Adamson and Dr. J. A. Smythe of Armstrong College, however, took charge of the party, and have kindly supplied me with the botanical, ornithological and geological notes.

Leaving the early morning train at Knowesgate, the Whin Sill was soon exposed as a striking feature along the road to

Whelpington. Higher up, it fringes the north side of the Wansbeck, and about Sweethope rises in a fine series of crags which run south past Bavington. Thick Bernician limestones and massive beds of sandstone add variety. Near Crookdene is a little whin dyke in the bed and banks of the Wansbeck which has many points of interest; among others it contains segregations of the felspar anorthite.

Towards the Lough the sandstones increase in thickness and culminate in the massive beds of the Wanny Crags. Coming on to the Lisles Burn valley, perhaps the most noticeable feature is the glacial drift which partly fills that valley and is cut through, often to the rock beneath, by the burn. Stretching across the valley from Whetstone House is a very fine crescentic ridge of drift, which is one of the few known terminal moraines in Northumberland, and marks a stage in the disappearance of the Ottercaps glacier. There are also kaim-like hillocks of pebbles a little above this, and at Linnheads there is, as the name indicates, a waterfall, which is well worth seeing.

The brackens on the moor were just unfolding, and the belated bloom was still on the hawthorns. The yellow mountain pansy was in flower; and on reaching the bog the butterwort was found in profusion, but the search for the sundew was in vain. The lesser butterfly orchis had been seen earlier in the day on the railway embankment, and the early spotted and marsh species were growing freely.

On reaching the Loughs disappointment was felt, for instead of a large sheet of water, there was a baked surface of alluvial matter interspersed by large cracks. Arrived at the Crags a halt was called to examine the precipitous and rocky height of the great Wanny.

Gulls, sandpipers, stonechats and wheatears were noticed on the route, as well as the common birds of the countryside. The remainder of the walk to Woodburn was somewhat marred by rain.

There was a fairly numerous party present, and the result of the full day's work, extending over a variety of countryside, is both instructive and interesting, viz. :—

Plants.

Ranunculus flammula
Trollius Europæus
Berberis vulgaris
Draba muralis (scarce)
Viola lutea
Polygala vulgaris
Silene inflata
Lychnis vespertina
,, diurna
,, flos-cuculi
Stellaria uliginosa
Geranium sylvaticum
Lotus corniculatus
Vicia Cracca
,, lathyroides
Geum rivale
Comarum palustre
Sanguisorba officinalis
Poterium Sanguisorba
Sedum acre
Chrysosplenium oppositifolium
Hydrocotyle vulgaris
Galium cruciatum
,, palustre
,, saxatile
Valeriana officinalis
Chrysanthemum Leucanthemum
Carduus palustris
,, heterophyllus
Hieracium Pilosella
Crepis virens
Erica tetralix
Scrophularia aquatica
Veronica Beccabunga
,, Chamædrys
Euphrasia officinalis
Pedicularis palustris
Melampyrum arvense
Prunella vulgaris
Thymus serpyllum
Myosotis palustris
Pinguicula vulgaris
Lysimachia vulgaris
Rumex Acetosa
,, Acetosella
Myrica Gale
Orchis mascula
,, maculata
,, latifolia
Luzula campestris
Carex dioica
,, pulicaris
,, leporina
,, stellulata
,, remota
,, paniculata
,, cæspitosa
,, flava
,, distans
,, pendula
Polystichum aculeatum
Equisetum palustre

BIRDS.

Starlings (in immense flocks)
Lapwings (not frequent)
Curlews (fairly common)
Greenfinches
Sandpipers (common—seen several times)
Missel Thrush
Stonechats
Wheatears (seen two or three times)
Titlarks
Skylarks
Black-headed Gulls (common)
Lesser Black-backed Gulls (a few times seen)
Blackbirds (seldom seen)
Redstarts (seen near Woodburn)
Dippers
Chaffinch
Grouse
Partridges

New ground was broken for the fourth meeting on Wednesday, July 21st, the locality chosen being the lower reaches of the RIVER SKERNE above DARLINGTON.

Viewed from the railway, alongside which for part of its course the stream flows sluggishly through flat, bare land, the prospect of a good day's work did not appear great : these fears proved to be ill-founded.

Often have I stood at the confluence of the Skerne with the Tees near Croft, after heavy rains, and wondered how this small stream rose five or six feet while the turbulent Tees, coming from the fastness of the Cumberland hills, swollen by many becks, rarely exceeded a rise of 10 to 12 feet. The reason was to be found to-day by the closer study of the long winding course and numerous feeders. Rising near Wingate, the Skerne twists ere it discharges itself into the Tees, and runs a course of about 35 miles, which may be aptly described by the well-known lines—

With many a curve my bank I fret,
By many a field and fallow,
And many a fairy foreland set
With willow-weed and mallow.

Prof. J. A. Dixon, M.A., B.Sc., and Mr. Stanley Smith, M.Sc., who kindly sketched the programme and acted as guides, met us at Darlington Station. A tramcar bore us beyond the streets to the outskirts of Haughton-le-Skerne: as we crossed the bridge which leads to the village the yellow water-lilies were seen flowering in the backwaters.

Our first objective was the church, which was kindly shown by the Rector, Rev. J. C. Fellows. The west and south doors are good examples of Norman architecture. The pillars which supported the arch of the western door have been placed in the nave : their front surfaces are seriously worn into longitudinal concave depressions, said to be due to the sharpening of swords by the cavaliers as they passed in and out. A fine sample of Frosterly coral marble, probably the coping stone of a tomb, was shown in the churchyard. Inside the church are a characteristic arch-upon-arch between chancel and nave, and two hagioscopes or squints. Chancel and choir stalls are beautifully panelled in oak : on one panel is the roughly scratched outline of a bird, underneath which is the date 1642.

Leaving the church, we proceeded to the hall, the residence of Mr. F. Storey, which, facing south, has a gentle old-world garden sloping to the river. Beyond the cultivated grounds a newly-cut hayfield, through the middle of which a boggy ditch faltered, offered a happy hunting-ground to botanists; here were found the beautiful flowering rush, marsh cinquefoil, spotted and amphibious persicaria, and many other plants favouring a damp habitat. Yellow and white water-lilies were growing freely in the Skerne hereabouts. Our party divided here, some pushing on to Sadburghe to view the old village and church, while the majority wended their way through Haughton, admiring its wide road, grass borders and avenues of old trees, as far as Barmton, where the Skerne was again met with. Along the road most of the summer wayside plants were seen, but most noteworthy was the white bryony festooned in the hedgerows, the female plant in fruit and flower clinging by its ingenious spirals to one side of the road; while the male plant, also in flower, was on the opposite side. The water violet, which is found in the neighbourhood—to the best of my knowledge its most northerly habitat—was unfortunately missed, though seen by one of the Sadburghe party a few days previously. Dammed back by the approaches to the bridge, the Skerne, along whose banks we were to wander, had brought a rich deposit of alluvial soil: on this congenial bed the comfrey, marsh ragwort, greater and lesser willow-herb, and burnet-leafed rose were freely blooming, and at its edge the water-crowfoot and great burweed. Bordering the stream, and dappling its surface as the sunshine threw the tracery of their shadows, were the willows and hazels; while in the stream itself the true bulrush was growing 6 to 10 feet in length.

In the perpendicular side of a sand quarry some 40 to 50 feet in height a colony of sandmartins had honeycombed a large area, and were entering and leaving their nests, feeding their young, rapidly and incessantly. On our approach their activity ceased, but standing motionless and noiseless at the base of the cliff, their fears abated, and we had the opportunity to note the velocity and accuracy with which each bird entered its nest.

On the sloping banks the meadow-brown and small blue butterfly were hovering and fluttering daintily from flower to flower in great numbers, and a fine specimen of the light emerald moth was taken on the grass. Bird life, too, was more frequent; the note of the stonechat was heard. A halt was called after our long tramp by the sandy edge of the stream, where the pretty skull-cap was growing; the cattle were lazily browsing and one felt—

> It is summer, how beautiful it looks;
> There is sunshine on the grey old hills, and sunshine on the brooks,
> A singing bird on every bough, soft perfume on the air.

The district in which we had been working is near and upon the Permian and Triassic formations, but owing to the thick glacial accumulations little of the solid geology is open to investigation. These deposits are awaiting systematic enquiry both as to nature and distribution, but, generally speaking, consist of sand and gravel intercalated between boulder clay; while the boulders scattered in the district are mainly from Shap and the west.

Passing through cornfields and crossing the Roman road, a woodland path brought us to Harrowgate Hill. Within a few miles of this point are Coniscliffe and Aycliffe, which time prevented our attempting to include in the day's work, or we should have seen the Permian rock rising boldly through the glacial mantle, the thinly bedded limestone, with its small sparsely scattered cavities, exposed by quarrying.

After tea at Darlington, votes of thanks were accorded to our hosts, and a visit was paid to the Backhouse Park, a model of what a natural and cultivated recreation ground may be made.

The time of day and of year was not favourable for observing bird-life, the following only being specially noted: magpie, whitethroat, sand-martin, pied wagtail, willow-wren, chiff-chaff, sedge warbler and stonechat. But on the other hand the list of flowers in bloom is full, viz. :—

Thalictrum flavum
Ranunculus aquatilis
,, arvensis
,, Lingua
,, Flammula
Trollius Europæus
Nymphæa alba
Nuphar luteum
Fumaria officinalis
Viola canina
,, palustris
Polygala vulgaris
Lychnis Flos-cuculi
Spergularia rubra
Arenaria trinervis
Stellaria nemorum
,, uliginosa
Malva sylvestris
Hypericum perforatum
,, hirsutum
,, pulchrum
Geranium pratense
Spiræa ulmaria
Comarum palustre
Geum rivale
Rosa canina
,, spinosissima
Agrimonia Eupatoria
Sanguisorba officinalis
Alchemilla arvensis
Poterium Sanguisorba
Bryonia dioica
Sherardia arvensis
Valeriana officinalis
Leontodon hispidus
Crepis paludosa

Anthemis arvensis
Achillea Millefolium
Senecio aquaticus
Veronica Anagallis
,, scutellata
Scrophularia nodosa
Euphrasia officinalis
Mentha arvensis
,, aquatica
Stachys palustris
Scutellaria galericulata
Betonica officinalis
Myosotis palustris
Plantago media
Rumex Acetosa
,, Acetosella
Polygonum amphibium
,, Hydropiper
,, Persicaria
Orchis maculata
Iris Pseudacorus
Alisma Plantago
Triglochin palustre
Juncus communis
,, glaucus
,, uliginosus
,, filiformis
Typha latifolia

With the waning of summer, when the flowers are ceasing to bloom, and the birds have not congregated for their annual migration nor taken up their winter quarters on the shore, the choice of a locality for a Field Meeting is a matter of some thought. Happily this point was solved by the proposal that the salt marshes near GREATHAM, which extend from Seaton Snab inland along the estuary of the Tees for about five miles, should be visited. This again was new ground to us. Unfortunately the claims of business prevented the attendance of our entomologists who had mapped out the expedition; but starting by the morning train on Saturday, Sept. 18th, a small party reached Greatham Station and proceeded past the old salt works, which have been remodelled and put into active operation.

Here an old waggon-way attracted the naturalists' attention, and a somewhat rare member of the groundsel family—*Senecio viscosus*—was found, as well as the corn speedwell, alpine bartsia, and the corn crowfoot, the latter easily distinguished by its prickly carpels. Leaving the waggon-way and entering the fields by a stile, the edge of the marsh, where the saltpans are erected, was soon reached, and revealed its wealth of flowers. Though limited in variety, their character is definitely marked and of considerable interest. The sea milkwort was rapidly fading, but the thrift and sea starwort—our native representative of the aster family—were growing freely. The chief find, however, was the beautiful sea-lavender, which was literally growing as freely on the marsh as daisies and buttercups in a meadow: so plentifully as to dominate the marsh with its lovely tint.

At this point our steps brought us to the banks of the Claxton Beck, which flows into the creek and winds a sinuous course of nearly five miles into the Tees near the sea. A halt was called for lunch; we were fortunate enough to meet and fraternize with a fisherman whose home was a desolate though snug cabin. The tide was out, and the stream was but a silver thread on a wide bed of sand and mud; a home for dabs and eels, in the capture of which our friend employed his time when not plying his craft for salmon. From this lonely dweller by the marsh we learnt that it is a favourite haunt of the curlew, the golden and the green plover, while later in the year a few ducks frequent it.

As we looked across the creek a melancholy stretch of swampy ground extended under the low leaden sky, and we decided to follow the stream downwards upon the banked-up footpath alongside which the sea wormwood was prolific. Few birds were here to gladden the eye or ear; in the distance the cry of the curlew, nearer at hand the sweet song of the robin and the twittering of the starlings. Of the latter, many flocks were noticed feeding near the sheep, to the pasturing of which the poor land was entirely given over. Leaving the stream, in which the water crowfoot was plentiful, the flat waste on which we walked was seen to be covered by the sea plantain, which threw its crimson hue over it, but there were no flowers to be seen except the thistle on the margin of the ditches. Working inland through field and farmstead, the autumn plants—the weeds of the cultivator—were noticed. The harvesters were gathering in their meagre crops as we wended our way through ill-kept lanes to the village of Greatham, tbe redeeming feature of which is the old hall with the sheltering of well-grown trees. Except for the marsh plants the day was somewhat disappointing, and we were not sorry when the train drew into the station to bear us home.

The list of flowers seen is as follows :—

Ranunculus aquatilis	Bartsia alpina
,, arvensis	Ballota nigra
Papaver Rhœas	Anagalis arvensis
Lychnis vespertina	Glaux maritima
Honckenya peploides	Plantago maritima
Lathyrus pratensis	Armeria maritima
Agrimonia Eupatoria	Statice Limonium
Apargia autumnalis	Polygonum aviculare
Aster Tripolium	Euphorbia Helioscopia
Senecio viscosus	,, exigua
Veronica agrestis	

Following the custom of other years it was decided that the last meeting should be on the coast, Druridge Bay and Cresswell being the locality chosen. It was hoped that this would afford the opportunity of observing the gulls and waders which assemble there in autumn. On September 4th, a fine Saturday, the morning train bore us to Widdrington Station; we soon reached the village, which is sheltered from the winds that sweep across the flat land by a belt of old timber. Rounding past the church a by-road leads to the sea; this road is bordered by a ragged dyke and hedgerow which was gemmed by the brilliant scarlet and crimson of the hips and haws, the fading leaves of the wayside plants and the lingering bloom of the ragwort, sow-thistle and nipplewort.

As we tramped along, partially hidden by the straggling hedge, a flock of golden plovers was seen feeding on the poor pasture. Alarmed by our approach, they rose uttering their plaintive whistle and affording us a good opportunity of observing their wheeling flight; then settling to feed again, we noticed a few green plovers in the flock, and further across a curlew. Up in the clear blue of the sky, which is one of the characteristics of the north country in the autumn, the skylarks were hovering and singing their mid-day song. At Houndalee, a mere handful of cottages nestling near the farmstead, the road is met by the sand-dunes across which we followed a cart-track, bringing us to Druridge Bay. The sea was in her calmest mood, reflecting the blue of the sky in deeper intensity, and the beach grading in colour from the greyish white of the finely-ground sands to the rich siennas and umbers of the damper grains. To the north Coquet Island was mirrored, a white mass against the blue sea. But already bird-life was visible; the large herring-gull was winging his strong flight; floating further out a couple of red-throated divers, now plunging into the calm water and rising again at a considerable distance. The receding tide was leaving its treasures on the firm sand; a stranded jellyfish with its liquid iridesence, the pod and sabre razor shell, the common and horse mussel, common and tortoiseshell limpet, pelican's foot, scallop, whelk and grey top were fairly abundant; but the cowrie—the blackamoor's tooth of the children—was scarce.

On the margin of the sands, running hither and thither as the wavelets retreated, was a flock of ring plovers busily feeding; and as we sought the shelter of the sandhills to discuss our sandwiches, a redshank winged his flight over the stilly sea, working direct north. Nature was in one of her quiet restful moods, and one felt the truth and beauty of Browning's lines—

> Oh, good gigantic smile o' the brown old earth,
> This autumn morning! How he sets his bones
> To bask i' the sun, and thrusts out knees and feet
> For the ripple to run over in its mirth;
> Listening the while, where on the heap of stones
> The white breast of the sea lark twitters sweet.

Nearer the southern end of the sands the toll of loosened seaweed was on the shore, chiefly grass and bladder-wrack, tangle, coralline and green laver; and on the stems of the *Laminaria digitata* (oarweed) one could see the typical growths of polyzoa.

The ebbtide had formed a temporary lagoon near Cresswell, between the shore and an exposed reef of low-lying rocks sweeping and whirling over it were the larger gulls, strong on the wing. Near the reef two or three birds were floating, one of them considerably smaller than the others; these swam to the edge and took to the rocks. After preening its feathers the smaller bird rose, and wheeling towards us, was identified—to the delight of our ornithologists—as the little gull, which is but rarely seen on this part of the coast.

Cresswell, with its peel tower, its hall embowered in trees, its undulating village green, lay to our right; but we found the beach with its shells, its crabs, its starfish and its sea-weeds, too interesting to leave. On the short springy turf of the point which we had to cross, the thrift was still flowering; beyond this another bay opened out, bounded by low cliffs of sandstone. At its far end, on the margin of the sands, another flock of gulls were feeding; also a smaller bird, one of the terns, but too far off to identify more closely. As we endeavoured to approach it, bang went a gun, and a couple of men emerged from the other end of the bay. Happily poor marksmen, for the birds escaped.

Marking something down seaward which we had not seen, these men, their dog in leash, proceeded to creep cautiously to the edge of the far rocks; a pair of oyster-catchers rose, foolishly circling overhead in the fashion of the domestic pigeon. After two unsuccessful shots, the gun apparently jammed, and the poor birds got away.

But all chance of watching birds had now gone, for more men with dogs and guns were met with. We were nearing Newbiggin, where the sporting instinct is strong, and wanton destruction of bird life is too common. Nothing except a stray dunlin or ringed dotterel was afterwards seen. On the banks a few flowers had been met with, notably the uncommon *Geranium sanguineum*; also the dove's foot trefoil, tufted vetch, red bartsia, small willowherb, field gentian, campion, fumitory, goatsbeard, nipplewort, and mouse-eared hawk-weed.

On the other hand many interesting birds had been seen, including the following :—

Red-throated Diver	Sanderling
Common Gull	Gannet
Herring Gull	Black-headed Gull
Little Gull	Black-backed Gull
Oyster Catcher	Curlew
Green Plover	Golden Plover
Ring Plover	Tern (probably Arctic)
Redshank	Dunlin

Leaving the beach at the Fairy Rocks, we struck a bee-line across the common, arriving at Newbiggin when the dusk of evening shed a kindly shadow over the somewhat sordid and unlovely approaches of the village.

Thus ended our last day's field work, and it was with feelings of regret that we separated until the advent of another season should bring us together once more.

In addition to these meetings, the Vale of Derwent naturalists extended a cordial invitation to us to join in their expedition to Blanchland in the month of August. Undeterred by a lowering sky and drenching rain, which later in the day gave way to fine weather, several of our members took advantage of this invitation to spend a pleasant and profitable day on the moors.

An endeavour has been made the last year or two to map out a definite day's work for each field meeting. The co-operation of someone who has specialised in one or other department or studied a district has been sought, and in this way the interest in field work has been stimulated and deepened. It is, however, impossible to draw up and carry out a programme with the precision of an archæological meeting or a Cook's tour, for Nature refuses to accept the rôle of showman to order ! The field naturalist must go forth with open mind, expectant and observant, willing to fall in with her moods and seasons, and ready to study whatever offers.

Numerically the attendence at the meetings leaves something to be desired, and enthusiasm is somewhat confined to the older members. This is to be regretted, the more so that school and college life afford the younger members that opportunity of systematic training, the lack of which their elders deplore; yet it is to them that the Society must look for the development and carrying on of outdoor and indoor work in future years.

The existence of several field clubs is evidence of the love of outdoor work in the county of Durham, but there appears to be less interest shown in Northumberland. The work is undertaken chiefly by those living in the busy centres of Tyneside, whose opportunities and field of observation are limited, and one would like to see more interest and activity in the country districts where the work would be less intermittent and therefore of greater value.

Though not much new perhaps has been discovered during the past season, it is well to quarter old ground and compare the results with those of other years. A fair share of success may be claimed this season. Reference has already been made to those who, possessing special knowledge, willingly gave their help; to those our grateful thanks are due, as well as to Mr. Richard Adamson and Mr. Edward Potts, the joint secretaries, who carried out the excellent arrangements of the meetings.

In conclusion I sincerely thank you all for your pleasant and helpful companionship, and for the kind indulgence you have shown to my shortcomings during the year you have been good enough to allow me to occupy the honourable position of Field President.

It may not be out of place here to mention that the year 1909 marked the centenary of the birth of Charles Darwin, to whom not only Britain but the whole world owes so much as a naturalist and a thinker; coincidently it was also the fiftieth anniversary of the publication of his great work on "The Origin of Species."

To honour their master, the University of Cambridge organised a Commemoration in June, to which representatives of the universities and learned societies throughout the world were invited. From Japan to California, from Scandinavia to New Zealand, East touched hand with West, North touched hand with South.

Our Natural History Society was included in this invitation, and it was my good fortune to be honoured by the Council as their representative. The University of Cambridge, whose celebrations are traditional, threw all her colleges and buildings, including the fine new School of Botany, open to her guests, and spared nothing to entertain those who came to join in paying homage to Darwin.

On the first evening a reception was given by the Chancellor, Lord Rayleigh, and the Senate, in the Fitzwilliam Museum; the spacious galleries, the gardens, and those of Peterhouse adjoining, laden with the scent of June roses and acacias, and illuminated by the soft light of Chinese lanterns, was a fitting and charming place in which to receive the 3,000 guests, the majority of whom, British and foreign, were resplendent in their rich academical robes.

On the following morning the delegates, numbering 249, were received and presented to the Chancellor in the Senate House, for the purpose of delivering the addresses of the various societies with which they were entrusted. At this assembly speeches of appreciation of Charles Darwin were delivered by Lord Rayleigh, the Chancellor; Professor Elie Metchnikoff of the Pasteur Institute; Dr. Oscar Hertwig of Berlin; Professor Osborne of New York; Sir E. Ray Lankester, Royal Society.

In the afternoon a reception was given by the Master and Fellows of Christ's College in their grounds, when the rooms occupied by Darwin as an undergraduate, and the collection of portraits, busts, manuscripts, and relics of the "Beagle" were shown. This was followed in the evening by a banquet in the New Examination Hall (used for the first time), when eloquent tribute was paid to the memory of Darwin by the Right Hon. Arthur J. Balfour, Dr. Svante Arrhenius of Stockholm, and Professor E. B. Poulton of Oxford.

On the Thursday morning the Rede Lecture was given by Sir Archibald Geikie, who took for his subject "Darwin as Geologist." The degree of Doctor of Science was then conferred upon Mr. Francis Darwin and twenty of the foreign representatives who had specially distinguished themselves by research work; these were introduced individually by Dr. Sandys, the Public Orator, who in resonant Latin recounted the various services they had rendered to science. Owing to advanced age Dr. A. Russel Wallace was unable to be present, but Sir Joseph D. Hooker, who has been described as the Doyen of British Science, was there hale and cheerful.

Later in the day, Mr. W. Erasmus Darwin, Sir George and Lady Darwin, Mr. Francis and Miss Frances Darwin, Major and Mrs. Leonard Darwin, Mr. and Mrs. Horace Darwin, Mrs. Litchfield and Miss Darwin were "At Home" in Trinity College, kindly placed at their disposal by the Master and Fellows. To meet the genial family of so illustrious a father, themselves distinguished in various paths of science, was most interesting.

The pleasure of the visit was enhanced by the hospitality and kindness shewn to me by Mr. Basil Hammond, M.A., of Trinity, and his charming wife, whose guest I was; while the privilege of being allowed to represent the Natural History Society on such a historic occasion, and of meeting so universal a representation of the domain of natural science, is one which I highly value, and the memory of which will not readily be forgotten.

REPORT ON THE FIELD MEEINGS OF THE NATURAL HISTORY SOCIETY FOR 1910.

READ MARCH 23RD, 1911, BY MR. B. AMSDEN, B.A., B.SC., LL.B., CHAIRMAN OF THE FIELD MEETINGS COMMITTEE FOR 1910.

LADIES AND GENTLEMEN.—I have pleasure in presenting my report on our Field Meetings during the summer of 1910, and in stating that this branch of the Society's work still continues to flourish, though there is room for improvement in the attendance at the meetings and the greater specialisation of the work done. Nevertheless some good and original work has been performed, and in any case the meetings have afforded valuable opportunities for those who are desirous of attaining a general all-round working knowledge of natural history in the field before proceeding to specialise in any particular branch.

The FIRST FIELD MEETING for the year was held on May 21st, a Saturday afternoon, when some 18 members went to ROWLANDS GILL Station, and under the guidance of Mr. R. Adamson proceeded up the south side of the Derwent Valley, crossing by the paper mill, and returning by the north side of the stream. Although the early part of the day was heavy and threatening, the weather improved as the time went on, and the afternoon was bright and pleasant. The heavy rain of the previous day had cleared away all traces of dust, and showed the varied prospect of hill and dale, meadow, forest and river, which the Derwent Valley affords, in the full freshness and beauty of verdant spring. The time of the year was too early to admit of a very large number of plants being found, but about fifty species were collected, including the wood and meadow geraniums, the wood stitchwort with heart-shaped leaves peculiar to the north, and found here and there in clumps on the banks of the Derwent where the seed had been washed up by the flood ; and the bird-cherry, also peculiar to the north, growing in such plenty at Jesmond Dene. The woods also yielded spikes of arum with the spathes filled with midges, occupied, unknown to themselves, in the work of fertilisation, and a specimen of vetch with an ant actually engaged in investigating the toothed stipules for the honey supposed to be furnished for its benefit and to prevent its going further and rifling the flower where its presence is not desired. A series of specimens of coltsfoot were also obtained, illustrating its erect habit when flowering, its drooping state while the seeds are developing and require to be preserved from the wet, and its return to the erect position when the winds are desired to waft the seed to some spot suitable for its growth. Now and then under the feet of the party the garlic and mint gave off their characteristic odour, as also the garlic-mustard, whose white flowers had begun to deck the hedges. The trees were in their first bloom of vernal freshness, displaying their characteristic styles of flowering; the sycamores with their pendent spikes, and the bird-cherries with their showers of falling petals, the apple trees with their clusters of pink and white, and the ash whose unobtrusive flowers appear before the leaves. From a hole in an old pollarded bole a weasel was seen to appear and quickly again to disappear in a hole of the same stem where doubtless he had been robbing some nest. It is unusual to see any of the smaller mammalia abroad during the day, but they are no doubt much more common than is usually thought, as witness the case of the otter and cubs recently killed at the mouth of the Ouseburn. The commoner sort of birds were seen in large numbers, and also two specimens of the magpie, one seen to advantage in full flight, and the other uttering its characteristic notes. The lengthening days and warmer sun had caused the stones in the running streams to be frequented by caddis worms, and the caterpillars had already begun their destructive work on the young leaves, one very large specimen of that of the tiger moth being found, covered with its hairy spines which the cuckoo alone can digest. An inspection of the ruins of the chapel at Friarside added to the interest of a most enjoyable excursion, which terminated with a tea at Rowlands Gill.

The SECOND MEETING was held on Saturday, the 4th June, at PONTELAND and PRESTWICK CARR, when by the kindness of Mrs. Eustace Smith the members were afforded an opportunity of inspecting that small portion of the Carr which still remains in something like its original state. The Carr once formed one of the principal breeding places of wild birds in the north, and was one of the most famous of nature's nurseries. Many specimens were obtained therefrom by Mr. John Hancock, who speaks of it as equally celebrated for both its botanical and its entomological features. But now its glory in these respects has departed and the largest part lies under the plough, affording to our entomologists little more than an unidentified species of wireworm and an intolerable number of the weird looking leather-jacket, the grub of the cranefly or daddy-long-legs, which in its larval state does so much harm to the crops. There remain however a few acres of partially drained peat land covered with heather and small larch trees, which with a few clumps of wood afford shelter to game and the other wild life which is found wherever this is preserved. Traces of their presence were seen in the burrows of the rabbits, the numerous entries of a fox earth, and the still larger hole which was thought to betoken the presence of a badger. The body of a stoat, but lately shot in the very act of devouring a large bird, apparently a sparrow hawk, whose wings and feathers were strewn about the nearest hole, lifted the veil from one of nature's tragedies, and the presence of a large ball stuck round with magpie feathers and suspended from a pole in one of the pheasants' feeding grounds spoke of another of the keepers' enemies—as did also a wire snare picked up by one of the party.

Curlew, snipe, plovers, partridges, redshank, cuckoo, and corncrakes were both seen and heard. The nest and eggs of a whinchat were found, and the broken egg of a missel thrush had its mournful accompaniment in the plaintive voice of the mother bird hard by.

The district is not at present particularly rich in plant life, perhaps the most distinctive feature being the number of plants of the rarer cotton-sedge with its mass of cottony seed vessels at the summit of a single stalk, the ordinary cotton sedge having several pendent clusters below the top of the stalk. Cowslips and marsh marigolds were still to be found; while the water ranunculus and plaintain, with other distinctively marsh plants, were just beginning to show themselves in flower. The warmer sun of the past few days had brought out insects in some abundance. Several rare beetles were found, as also one of those very minute centipedes, Pauropus, of a species which was recorded last year for the first time as British. Three rare Thrips taken from birch and pine were considered by Mr. Bagnall, who is an authority in this little-known department of natural history, to be probably additions to the British fauna, the most interesting being *Oxythrips brevistylis*, previously found in Bohemia and Scandinavia. Spring-tails were abundant, and numerous spiders were taken by Mr. Turner. The party met for tea at the Bungalow, and closed a most enjoyable afternoon with an inspection of the ancient church with its Norman tower, Decorated nave and chancel, and Early English transept, as also the remains of the castle before reaching the railway station, on the way to which they passed the square tower of the old fortified vicarage, a relic of the old moss-trooping days.

The THIRD FIELD MEETING was held on Saturday, the 25th June, at PIERCEBRIDGE and GAINFORD in conjunction with the Darlington Society. The Newcastle contingent left the Central Station at 9.30 and proceeded through Darlington to Piercebridge. This is the site of an old Roman station at the point where Watling Street crossed the Tees, and traces of the mound and ditch are still visible; and it was also the scene of some fighting in the Civil Wars between the troops of Newcastle and Fairfax. The party proceeded up the north bank of the river, noticing the exposures of Permian sandstone in the south bank, and of millstone grit and Yoredales in the river bed, especially noteworthy for their very small inclination, and accounting for the breadth and shallowness of the river. Very noticeable too on the opposite bank, and inspected on the spot later in the day, were the three successive river banks or terraces and the large boulders of rhyolite and Shap granite borne hither in the glacial period, and the smaller and more modern rounded boulders in the river bed. Trout were visible in some numbers, but the united bag of two local anglers for the whole day had only produced one fine specimen of about a pound weight, whose delicate and varied colouring defied the artist's brush: and another of the varied tragedies of animal life was seen in the presence of the bodies of several dead dace on a flat and dry rock in the stream, having been captured and thrown aside to make room for their noble cousins. They are not only coarse of flesh and plentiful in bone, but are suspected of feeding on the smaller trout.

The usual June flowers were present in great abundance, the banks being gay with red campion and ragged robin, while orchids of various sorts were present in some abundance. At one spot in the stream, the monkey flower *(Mimulus luteus)* was growing in a wild state, and this was interesting as showing its naturalisation all over the country, some small streams near Marlborough being practically blocked by it, as also in Derbyshire, and even in industrial Lancashire. Specimens of gromwell and the larger valerian were also found, whilst later in the day a very large quantity of sweet cicely and meadow geranium with escapes of Jacob's ladder were obtained.

The party spent some time admiring the pretty village of Gainford with its well kept gardens and fine old church, and then after crossing the ferry, proceeded to view the old ruined church of St. Lawrence at Barford. This was originally a long aisleless nave and chancel, but later on the structure was cut in half by a transverse wall and the nave turned into a priest's house of ground and first floors, with a squint or hagioscope in the lower south-east corner by the fire-place whence any one there seated could view the elevation of the Mass. This change had entailed various alterations of doors and windows, most interesting to follow in detail as given in an excellent paper read by Mr. Gregory of Darlington. The old columbarium or dove-cote was also largely in view.

The return journey, by kind permission of the owner of Cliffe Hall, was made through the fields on the south side of the river, where another of life's tragedies was seen in the shape of a trap, set in a passage through a small wall, which had successively caught a rat and a hedgehog, poachers both, and of all unlikely things a robin just fledged, which was still warm. The usual birds were well in evidence throughout the day, especially the swallows, which at times skimmed the water so closely as to make quite a considerable spash.

The entomologists of the party found the first mile or two of the journey so productive that they decided to go no farther, and spent the rest of the time by the river banks, discovering several species of Thrips, etc., not recorded before in the district and identified by Mr. Bagnall.

The party met for tea at the George Hotel, Piercebridge, after which a hearty vote of thanks to Mr. Stanley Smith, M.Sc., was passed for his kindness in making the arrangements, and the hope was expressed that other meetings of the united societies might take place, a hearty invitation being given to the Darlington friends for the meetings at Wooler and the Northumbrian Lakes.

The Fourth Field Meeting took the form of a three days' visit to the Cheviots, the only one of the season from which the President was absent, and curiously enough the only time when the fates were unpropitious so far as the weather was concerned. This, however, failed to damp the spirits of the party, as judging from the individual reports the meeting was one of the pleasantest of the season. The Cottage Hotel, Wooler, was chosen for head-quarters, and the evening of the arrival was spent in a visit to the lake on Weetwood Moor.

The party started next morning from Kirknewton Station, via the College Burn and Heathpool to the Henhole on the western shoulder of Cheviot, obtaining a magnificent view from the summit and descending by way of Langleeford. Next day, notwithstanding the heavy rain, the party ascended Yeavering Bell, and during a temporary lull beheld the plain of Flodden and the valley of the Till spread out to view, then descending over the edge of Tom Tallon's Cliff by way of Gleascleugh and Akeld to Wooler. One day was to have been devoted to climbing Hedgehope, but the rain prevented this; and another visit was made to the College Burn and the Bizzle, another of Cheviots' gorges, returning by the Lambden and Carey Burns now swollen by two days' rain. Another day was spent, by the courtesy of Mr. G. P. Hughes, at Middleton Hall, in examining his varied collection of coniferous trees, and of horns and antlers discovered in draining the neighbouring bog. A list of the flora and fauna observed during a most interesting outing is subjoined :—

July 21st.—Weetwood Moor :—

Grasshopper warbler.

Wooler : Great celandine.

July 22nd.—College Burn and Cheviot :—

Wood geranium, musk mallow, dove's-foot cranesbill, great mullein, foxglove (red and white), annual knawel, bog asphodel, mossy saxifrage (not in bloom), starry saxifrage, wild thyme, maiden pink, cloudberry (in fruit), scorpion-grass, bilberry, crowberry, white heather, ling, fine-leafed heath, cross-leafed heath, dyer's rocket, mimulus.

Raven (not hatched young this year, two pairs Henhole), carrion crow, heron, golden plover, curlew, sandpiper, dipper, ring ousel, wheatear, whinchat, blackcock, peregrine (hatched in Bizzle).

July 23rd.—Yeavering Bell and Akeld :—

Heron, kestrel, stonechat, whinchat.

Pennycress (in fruit), white stonecrop, yellow stonecrop.

July 24th.—Beaumont Water and Yetholm :—
Water-hen, goldfinch.
Willow-leaved spiræa, mimulus (in great quantity).

The Fifth Field Meeting for 1910 was held on Wednesday, the 7th September, as an excursion to the Northumbrian Lakes, walking from Bardon Mill Station on the line to Carlisle. The sky was overcast, and a cold north-easterly wind blowing, but the weather improved as the day went on, and there was an entire absence of rain. The lakes were reached by a winding road gradually ascending from the Tyne valley past the hill of Barcombe, on which is an ancient British camp and several quarries from which the Romans obtained much of the stone to build the Wall; and lower still the green-clad slope on which may still be seen the ancient station of Vindolana, now known as Chesterholm. Then, still ascending, the military road constructed by General Wade was crossed, and finally the bold crest topped by the Roman Wall was reached. During this climb of some four miles the usual autumn roadside flowers were noticed in profusion, such as knapweed, ragwort, sheep's scabious, and devil's-bit scabious; the latter being especially noticeable for the number of abnormal growths or sports obtained. Eyebright was found in quantity and of large size, and the members interested in fungi collected many specimens, including an umbrella-full of the horse-mushroom.

The excursion was not devoid of interest to the ornithologists of the party, as curlews, wheatears and lapwings were seen in some number, also a whinchat or two, with some of the herring gulls which are said to breed at the lakes, and a stray visitor in the shape of a heron.

After inspecting the magnificent example of a Roman camp at Borcovicus or Housesteads, the party proceeded along the top of the Wall westward, having a grand view of the Brownlee, Greenlee and Crag Loughs, with Simonside and the Cheviots in the far distance. These lakes are said to be full of trout, with large pike and eels, the latter of which are preyed upon by the otters which are still found in the neighbourhood and long ago gave its name to Otterburn. These lakes are gradually diminishing in size by the growth of vegetation round tbe edges, which, however, affords fine shelter to the moorhen and coot, and also to wild duck, of which some fifteen were flushed in one flight. The swamps at the foot afforded many specimens of the beautiful Grass of Parnassus, red rattle and valerian, but the sundew, though carefully sought for, was not found.

After partaking of a bountiful tea at Hot Bank, subsequent to which a letter was read from Mr. R. Adamson, recording the discovery of *Orobanche minor*, the lesser broom-rape, at Blaydon Burn, and a vote of thanks to Sir Hugh Blackett and Mrs. Clayton for their permission to visit the lakes, the party returned by way of the burn to Bardon Mill.

The Sixth Field Meeting was held on Wednesday, the 5th October, in the shape of an excursion to the coast between Dunstanborough and Alnmouth, and was favoured with fine weather and brilliant sunshine. Leaving the train at Christon Bank the party passed through the village of Embleton, with its interesting church with battlemented tower, and vicarage whose nucleus is an old pele tower, dating back to the days of the church militant, and once the residence of the late Bishop Creighton during his vicarate from 1874 to 1884. In the winding lane from the village to the sea shore a flock of newly washed sheep of snow-like whiteness was met, and a chat with their custodian elicited the interesting fact that a few days of the sea breezes would cause their fleeces to return to a sombre dull brown hue. The tide being out afforded a welcome opportunity of examining at leisure the rock pools and their imprisoned inhabitants, notably several species of the marine bristle-worms; and many of the sea-weeds were in full fructification. Owing to the rocks being bared, the geologists of the party were able to observe to the best advantage the junction of the igneous rock forming the castle plateau with the various sandstones, limestones and shales underlying this formation, and the way in which they had been altered by contact.

On the sandhills were still in flower the burnet rose, whose stem is covered with densely set prickles, and whose white petals far exceed in size the leaves; also the bloody cranesbill, showing clearly the reason of its name, which is derived, not from the colour of its petals, which are lighter in hue than many of its congeners, but from that of its leaves, whose colour is changed by the approaching autumn.

After lunching among the romantic ruins of the Castle, and viewing therefrom the flight of many species of sea birds—so numerous at this part of the coast owing to the proximity of their nesting places at the Farne Islands, gulls, cormorants, eider ducks being observed in considerable numbers—the party proceeded by way of Craster to Cullernose Point, where the geologists obtained many interesting specimens of trilobites and molluscs from the shales underlying the projection of volcanic rock which forms the Point.

On the way to Boulmer, where tea was procured, a wounded brent goose was observed. The migrants from the Baltic did not yet seem to have put in an appearance.

After a brisk walk Alnmouth junction was reached just in time to catch the last train to Newcastle, thus concluding the last of a series of highly interesting and enjoyable field meetings for 1910.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE.

REPORT OF THE COUNCIL

FOR 1910–1911.

A satisfactory feature in the past year of the Society has been a decided increase in the membership. No fewer than 46 new members have joined the Society during the year, so that even with the loss of 25 by death and resignation there has been a nett gain of 21. This brings the total membership up to 416 at the close of the year. As has been the case in the past, the increase has been brought about by special efforts on the part of certain officers and members of the Council, who have found that a number of their friends were willing to become supporters of the Society when its claims were laid before them. The Council desire to commend this example to the members generally. With so many organizations competing for public support it is difficult to keep membership rolls from falling, and for a society such as this, which has little in the way of personal return to offer for subscriptions, it is a particularly hard task unless the existing members are doing what they can to induce others to join. There is some reason to believe that support would be forthcoming more readily if the purely voluntary nature of the Natural History Society's work were more generally appreciated. The Society not only encourages in many ways the local study of natural history; it maintains a museum which is a valuable educational asset to the district, and a piece of property which adds much to the attractiveness of the finest approach to the town; and all this without the cost of a single penny to the rates.

A valuable, though necessarily an occasional method of stimulating interest in the Society and the Museum is the holding of special gatherings of a social character, and in this direction also the past year has been noteworthy. A very successful and enjoyable conversazione was given in the Museum by the President and the late Lady Joicey on the evening of the 16th of February. Loan exhibits covering a wide range of interests were shown on temporary tables down the centre of the zoology room; in the geology room two large collections of objects were arranged by the museum staff to illustrate the history of the Museum and some recent work and acquisitions; the bird room was used for the reception and for music, and the east corridor for refreshments; and tasteful decorations gave the rooms a festive air without obscuring the collections. The Society is much indebted to the President for this conversazione, as also to those who contributed to its success by the loan of exhibits.

The pleasure given by the conversazione has been somewhat marred in retrospect by the lamented death of Lady Joicey. This was, in fact, the last public function at which she appeared in the North, and she had taken the greatest interest in all the preparations for it. Your Council, on behalf of the Society, have given expression to their sense of the loss they have suffered and of their sympathy with those who are personally bereaved.

Mr. N. H. Martin felt himself obliged by pressure of other duties to resign the secretaryship at the beginning of the year. His seven years' tenure of the office has seen a striking improvement in the general position and activities of the Society, and for this Mr. Martin's own energy and enthusiasm have been largely responsible. The Council feel themselves fortunate that they are able to retain him as a vice-president and so continue to profit by his advice and experience. Mr. J. Alaric Richardson has joined Mr. C. E. Robson as co-secretary.

Death has removed during the year the oldest servant of the Society, the late Mr. Joseph Wright. At his retirement in

1904 he had been in the Society's service as caretaker and keeper of the Museum for over fifty-one years. By his devotion to his duties and by his fine personal qualities he had earned the respect and friendship of a long succession of local naturalists, and his recollections of the distinguished men with whom he had been associated, and indeed of everything concerning the history of the Society, were always of interest and frequently of much value. When illness forced him to relinquish his duties, the Council, as some mark of their esteem, made him honorary keeper of the Museum. He died on his eighty-eighth birthday, and to the last his mind was mainly occupied with the past or present of the institution he had served so faithfully.

No Transactions have been actually issued during the year, though the concluding part of Volume III., New Series, will be in the hands of members before this report is read. Further papers have been accepted and are being printed to form the first part of Volume IV. These particular papers were of such high scientific value and so much local interest that your Council, in spite of financial obstacles, could not see their way to refuse them a place in the Transactions; nevertheless it is a fact, as the Treasurer has felt obliged to point out, that the Society is not really in a position to undertake even such publishing as it does. It is only because the publication of original work on local natural history is such an essential function of the Society that the Council have so far hesitated to suspend or abandon it. This is one of the directions in which the need of further support is most acutely felt.

The cost of the general repair and redecoration of the Museum building, referred to in the report for last year, appears in this year's accounts. The work in question has been completed in a thoroughly satisfactory manner, and has resulted in a marked improvement in the condition and appearance of the building. It is a great satisfaction to the Council to have been enabled to carry out these repairs, which had long been badly needed.

Of the various meetings held by the Society little need be said here. The field meetings are reported separately by the chairman of the Field Meetings Committee, and lists of the meetings held at the Museum will be fouud at the end of this report. The average attendance at the ordinary evening meetings was 84, at the two children's lectures 160. These figures are practically identical with those of the previous year. The average for the "museum talks" shows a rise from 53 to 71, but this is exactly accounted for by a record audience of 180 at the first "talk" of the session. The total attendance of visitors to the Museum during the last two years has shown a decided falling off. The figures for the past five years are as follows: 1906–7, 17,947; 1907–8, 18,840; 1908–9, 19,552 (increase due to special forestry exhibition); 1909–10, 16,510; 1910–11, 15,854. This unwelcome decline is undoubtedly to be accounted for in part by the unusual proportion of fine weather at recent public holiday times; but that there is some more general cause behind it is suggested by the fact that many kindred institutions in this country have of late experienced a similar falling off in their attendances.

The Hancock Prize was again keenly competed for last winter, the examiners reporting that of the thirteen essays submitted at least half reached so high a level of excellence as to make it difficult to place them in order. Eventually the prize was divided between Mr. Harold Jeffreys and Mr. John Baxter, both of Birtley.

The best thanks of the Society are due to the gentlemen who kindly prepared and delivered lectures, as also to the donors whose valuable gifts to the Museum and library are acknowledged in an appendix to this report; and the Council again wish to express their appreciation of the continued good work done in the Museum by the curator and his assistants. A list of members is printed with the report this year, and the honorary secretaries will be glad to be informed of any corrections in addresses, or other alterations that may be necessary in it.

NEW MEMBERS ELECTED

FROM JULY, 1910, TO JUNE, 1911.

Right Hon. Lord Allendale, Bywell Hall, Northumberland.

F. Buddle Atkinson, J.P., Gallowhill, Morpeth.

Robt. J. Atkinson, 3, Shakespeare Terrace, Sunderland.

Mrs. J. R. Baumgartner, 10, Eldon Square, Newcastle-upon-Tyne.

J. H. Beckingham, 32, Percy Gardens, Tynemouth.

W. J. Bellerby, 4, Kensington Terrace, Newcastle-upon-Tyne.

B. C. Browne, Fawdon Park, Fawdon.

Reginald Bryant, The Hayes, Corbridge.

R. G. A. Bullerwell, M.Sc., Balgonie House, Maddison Street, Blyth.

Miss Winifred E. Burnup, 2, Wentworth Place, Newcastle-upon-Tyne.

W. S. Burton, 2, Elmfield Villas, Gosforth.

A. H. J. Cochrane, Jesmond Dene House, Newcastle-upon-Tyne.

Mrs. Alfred Cochrane, ,, ,, ,,

R. W. Cooper, 2, Sydenham Terrace, Newcastle-upon-Tyne.

Walter S. Corder, J.P., Rosella Place, North Shields.

Percy Corder, Collingwood Terrace, Newcastle-upon-Tyne.

Dr. Otto V. Darbishire, Armstrong College, Newcastle-upon-Tyne.

Robert Dickinson, Underwood, Riding Mill-on-Tyne.

Jas. Dixon, 10, Granville Road, Newcastle-upon-Tyne.

Dr. Thos. Gowans, 4, Abbotsford Terrace, Newcastle-upon-Tyne.

T. S. Herd, 24, St. Mary's Place, Newcastle-upon-Tyne.

Tom Herdman, The Grove, Alston.

Ellwood Holmes, Wyncote, Jesmond Park East, Newcastle-upon-Tyne.

J. H. Holmes, Wellburn, Jesmond.

Miss Holmes, ,, ,,

Hon. Hugh Edward Joicey, Ford Castle, Cornhill, Northumberland.

Hon. Sydney James Joicey, ,, ,, ,,

Hon. Drever Joicey, ,, ,, ,,

Charles E. Merz, The Ems, Gosforth.

Lady Noble, Jesmond Dene House, Newcastle-upon-Tyne

Noel Parmeter, Bowland Lodge, Grainger Park Road, Newcastle-upon-Tyne.

Henry Peile, Duke's House, Hexham.

Francis Priestman, J.P., Shotley Park, Shotley Bridge.

J. H. Proctor, 8, Kensington Terrace, Newcastle-upon-Tyne.

Joseph Pumphrey, Hindley Hall, Stocksfield.

Miss Laura Richardson, South Ashfield, Newcastle-upon-Tyne.

Ralph Spencer, Netherwitton Hall, Morpeth.

R. W. Taylor, 9, Collingwood Terrace, Newcastle-upon-Tyne.

Rev. W. M. Teape, M.A., B.D., The Vicarage, Hylton, Sunderland.

James Thomson, 22, Wentworth Place, Newcastle-upon-Tyne.

Jas. B. Waggott, 94, St. George's Terrace, Newcastle-upon-Tyne.

Richard Welford, M.A., F.R.A.S., J.P., Thornfield, Gosforth.

ASSOCIATE MEMBERS

Miss Beddows, Newcastle High School, Newcastle-upon-Tyne.

W. Coyle, 36, Stanton Street, Newcastle-upon-Tyne.

A. D. Peacock, B.Sc., Armstrong College, Newcastle-upon-Tyne.

W. Leonard Turner, Derwenthaugh, Swalwell.

CURATOR'S REPORT ON MUSEUM WORK.

1910–1911.

The three most important pieces of museum work I have to report upon this year are those on the fishes, on the large beetle collection, and on a transitory but desirable object, an exhibit of living wild flowers.

Apart from a certain amount of labelling, the work on the fishes has consisted chiefly in the preparation of casts. We have succeeded, after a good deal of experiment, in making a considerable advance on the ordinary methods of taking plaster casts of fishes, and though it is too soon to boast, I hope we shall be able before long to put up a series of casts which will carry still further the already great improvement in the fish collection, and make it more nearly what such a collection ought to be in a museum so close to a great fishing centre. I may mention here also that the cast of a white-beaked dolphin, referred to in the last report, has been finished and placed in position. The colouring of it was extremely well done by Mr. Fletcher.

The large beetle collection spoken of above is the one we are forming by a combination of the three fine collections made respectively by the late T. J. Bold, Mr. John Gardner, of Hartlepool, and Mr. Bagnall. Its installation demands an immense amount of minute work. So far we have been carrying it on under Mr. Bagnall's supervision at his house at Penshaw, where Mr. Fletcher and I have as far as possible been spending one evening a week upon it. The completed collection promises to be remarkably full—certainly one of the most valuable reference collections of Coleoptera in the country.

An exhibit of fresh wild flowers, such as many museums maintain in the summer, is a thing we have long had in mind. This year we have found it possible to make a beginning with it, and during the greater part of the summer we have had a representative, and often a very large series of flowering plants on show. They appear to have greatly interested many of our visitors. We have been much indebted to several members, and above all to Mr. B. Amsden, for supplies of fresh blossoms; Mr. Amsden's kind and constant help, indeed, has been one of the chief factors in making the exhibit a possibility.

Among the minor pieces of work that are worth mentioning is the stuffing of the condor. This celebrated bird was presented to the Society twenty-five years ago, as a nestling fresh from Chile, by the late Dr. H. Salvin Pattinson and Mr. W. C. Tripler. It had developed into a fine adult female, a very healthy bird, and it was a surprise as well as a grief to us when it succumbed last June to an unusually heavy moult. We have mounted it in its most characteristic attitude of repose. Happily, too, we shall be able to show it to advantage, for Mr. John Pattinson is very kindly providing us with a good pedestal case for it.

We have set up half-a-dozen other birds during the year, all good additions to the Hancock collection. A number of spirit preparations have been mounted, a fine series of marine invertebrates from Naples and Plymouth constituting the majority of them, and these have greatly improved the section of the museum to which they belong. We have had the central upright portions of the invertebrate cases altered so that they can be opened on both sides all along; this enables us to put in a median partition wherever we wish, and so to make fuller use of the space. A considerable amount of labelling has been done in different departments during the year, and additional specimens have been installed in nearly all sections of the museum. Preparations for the conversazione occupied the whole staff pretty fully for three weeks or more.

Some alterations to the heating apparatus were reported last year, and after the test of the winter's use we are able to say that the result is very satisfactory. The circulation of the hot water is now good and uniform. There is therefore no need for the additional main flow-pipe which it was feared might still be necessary.

Important and interesting acquisitions to the museum have been made during the year in, if anything, greater numbers than usual. Perhaps the most striking of all is a specimen of a gigantic species of squid, *Sthenoteuthis pteropus*, presented by Mr. Hugh V. Charlton, who found it early in January thrown up on the shore near Whitley Bay. The animal measures 5ft. 6½in. in total length, and its longest tentacles are 3ft. long. There appear to be only six recorded occurences of this formidable cephalopod on the coast of Britain, and in only two instances has the animal itself been preserved. The building of a tank in which to mount our specimen in an upright position is a problem that has cost us a great deal of time and trouble, and a considerable sum of money as well; nor are we yet by any means sure that we have succeeded.

Fishes that we required for casting have been obtained for us by Mr. Charlton, Miss D. Richardson, Mr. Newbey Green, and Mr. W. E. Beck; and Messrs. F. H. Phillips and Co. have very kindly lent us choice fishes from their shops for the same purpose. Mr. Abel Chapman has shown me through his large collection of bird skins, British, Arctic and Spanish, and has generously presented to the museum any that I thought would be of service. From two residents in Africa, through whom our collections have largely benefited already, we have received further gifts during the year: from the Rev. R. Stewart Wright some ethnological and natural history objects, the latter including two examples of *Glossina palpalis*, the fly which conveys sleeping sickness; and from Mr. Alex. Girdwood another consignment of useful specimens from the Gold Coast, including some young crocodiles of a rare species and an example of the electric catfish *Malopterurus*. Other valuable material from foreign countries has been obtained, both by donation and exchange, from Capt. D. H. Nash of South Shields, a keen naturalist who has made large collections in many parts of the world; and Mr. P. G. Spence has given us good examples of the celebrated phosphate deposits of Christmas Island and Ocean Island. Particulars of these and other donations will be found in an appendix.

One other donation must be mentioned, that of a living chough—already a great favourite with all who know it—presented by Messrs. Jos. G. and Hugh P. Angus. An acquisition of great value has also been made by exchange, namely a set of sea fans and other Alcyonarians in spirit, sent us by Prof. J. Arthur Thomson of Aberdeen; and a few specially important local birds, including an ivory gull and a bluethroat, have been acquired by purchase.

Our thanks are due to several gentlemen, in addition to those mentioned already, for special help in the work of the museum: to Mr. Bagnall for his supervision and the use of his private rooms in connexion with the beetle collection; to Mr. Robt. Kidston, F.R.S., for the identification of a number of our Coal Measure plant remains; and to Mr. P. Walther for the trouble he has taken in identifying some of our minerals and in helping me to sort out some duplicates.

E. Leonard Gill.

MUSEUM STAFF

Curator....................................E. Leonard Gill, M.Sc.

Assistant ....Herbert Fletcher.

Lady Assistant and Secretary.....Miss E. Welford.

Attendant..................................William Voutt.

Gardener ....Albert Spencer.

EVENING MEETINGS HELD DURING THE WINTER SESSION, 1910–1911.

Oct. 13.—Mr. Frank Elgee: "The Moorlands of East Yorkshire"; chair taken by Ald. Geo. Harkus.

Nov. 8.—Prof. A. C. Dixon, M.A., B.Sc.: "Ceylon: its Peoples, Religions and Products"; chair taken by Prof. M. C. Potter, M.A., Sc.D.

Dec. 7.—Dr. Otto V. Darbishire: "Sand Dunes"; chair taken by Mr. Jos. G. Angus.

Jan. 18.—Mr. R. A. H. Gray, M.A., M.Sc.: "The Immediate Ancestors of the Domestic Animals"; chair taken by Mr. N. H. Martin, F.R.S.E., J.P.

Feb. 8.—Mr. A. T. Gillanders, F.E.S.: The Aphidæ, or Plant Lice"; chair taken by Mr. Edwin Burnup.

March 8.—Mr. Geo. W. Temperley: "The Wading Birds of the Northumbrian Coast, and how to identify them"; chair taken by Mr. Edwin Burnup.

March 23.—Private Evening Meeting of the Society: Report on Field Meetings of 1910, by Mr. B. Amsden, B.A., B.Sc., Chairman of the Field Meetings Committee. Reading of extracts from the two prize essays in the Hancock Competition (see page 213).

AFTERNOON LECTURES TO CHILDREN.

Dec. 29.—Dr. Robt. Anderson: "Pond Life"; chair taken by Sir Geo. Hare Philipson, D.C.L., F.R.C.P.

Jan. 5.—Rev. W. McLean Brown: "Some Plants of the Bible"; chair taken by Prof. Sir Thos. Oliver, M.D., F.R.C.P.

CURATOR'S "MUSEUM TALKS."

Oct. 28.—Birds of the Town Moor.
Nov. 30.—Sea-Urchins and Starfishes.
Dec. 21.—Shells.
Jan. 25.—Changes of Plumage.
Feb. 22.—Recent Acquisitions.
Mar. 29.—Our Native Quadrupeds.
Apr. 28.—Some Rare Local Plants (by the Rev. W. McLean Brown).

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 26th, 1910

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Ridley.
Lord Barnard.
Lord Ravensworth.
The Bishop of Durham.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Andrew Noble, Bart., F.R.S.
Sir G. H. Philipson, M.D., D.C.L.
Sir John Swinburne, Bart.
Sir Lindsay Wood, Bart.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Col. C. W. Napier-Clavering
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
E. J. J. Browell.
R. Coltman Clephan, F.S.A.
Clive Cookson.
W. D. Cruddas.
Samuel Graham.
N. H. Martin, J.P., F.R.S.E., F.L.S., F.C.S.
H. N. Middleton.
John Pattinson, F.I.C.
Prof. M. C. Potter, M.A., Sc.D.

COUNCIL

G. A. Atkinson.
R. S. Bagnall, F.E.S., F.L.S.
W. E. Beck.
H. I. Brackenbury.
Rev. W. McLean Brown.
Edwin Burnup.
Wilfred Hall.
Prof. H. J. Hutchens, M.A., M.R.C.S., D.S.O.
Hon. J. Arthur Joicey.
Prof. Alex. Meek, M.Sc., F.Z.S.
Ernest Scott.
George Sisson.

HON. SECRETARIES

C. E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1911.

COL. C. H. E. ADAMSON, C.I.E.—Some insect boxes and setting boards. Freshwater shells from Burma. A large South American beetle, *Macrodontia cervicornis.* Volume vii. of *Lepidoptera Indica*, in 12 parts.

ALFRED ALLHUSEN.—Lesser redpole, male in full plumage, picked up at Beadnell.

JOS. G. AND HUGH P. ANGUS.—A living chough from the west coast of Ireland.

RICHARD S. BAGNALL, F.E.S., F.L.S.—Reprints of many of the donor's papers, including the Thysanoptera section of the *Fauna Hawaiiensis*, and papers published in Belgian, Hungarian and South African scientific annals, in the *Ann. and Mag. Nat. Hist.*, *Jour. Linn. Soc.*, *Ento. Mo. Mag.*, these *Transactions*, etc.

SEYMOUR BELL.—Clay ironstone nodule containing a good frond of *Neuropteris*.

H. I. BRACKENBURY.—Little auk found alive at Chillingham on Jan. 3rd.

DR. G. S. BRADY, F.R.S.—Reprints of papers by the donor on West African Entomostraca, on the British Ostracoda of the sub-families Candoninæ and Herpetocypridinæ, and on the zoology of the Sheffield district.

CHRIS. C. CADMAN.—Yearling trout and freshly hatched fry of several varieties, from the North of England Fish Hatchery, Barrasford.

JAS. CAYGILL.—Small concretion from the intestine of a pony.

J. D. CHALLONER.—Pair of horns of a prong-horned antelope, killed by the donor in Nebraska, U.S.A.

ABEL CHAPMAN.—Twenty-two bird skins (see Curator's Report) : including pairs of lesser kestrel and great spotted cuckoo, an azure-winged magpie, a little bustard (male) in full plumage, and various ducks, waders. etc., in special states of plumage.

HUGH V. CHARLTON.—Fine specimen of the large squid *Sthenoteuthis pteropus* Verr., found by the donor on Jan. 8th thrown up on the sands near Whitley Bay. A pike and two chubs for casting. Two young lesser black-backed gulls in different stages of nest plumage

ERNEST CHEAL.—Two hawfinches, female and young, from Surrey.

W. D. Clague.—Young hedgehog about a fortnight after birth.

Isaac Clark.—Two fine South American butterflies mounted on plaster blocks : *Haliconius erato* and *Callithea sapphira*.

Mrs. Cooch (Bulawayo).—Skin of python and tooth of wart hog from near Bulawayo. Kaffir wire bracelets and examples of dress of Kaffir boys, from Rhodesia.

W. Coyle.—A roach for casting.

Dr. O. V. Darbishire.—"Haslemere Museum Gazette," vol. i.

The Misses Dixon (Ramshawe, Corbridge).—Model of a ship made by French prisoners in Newcastle.

Master C. J. Dixon.—Four shells of *Anomia ephippium* from the South Coast.

Alexr. Girdwood.—Many natural history specimens from the West African Gold Coast, including scorpions and centipedes, dragonflies, butterflies, two goliath beetles, an electric catfish *(Malopterurus electricus)*, snakes, a chameleon, and five young of the stumpy crocodile, *Osteolæmus tetraspis*.

J. A. Goldberg (Kimberley).—A pod of "lucky beans" from Rhodesia. Gold quartz from the Brian Boru gold mine, and pyrites crystals (regarded as an index for diamonds) from the De Beers diamond mines.

Prof. Dr. F. Goppelsroeder.—Reprint of paper by the donor on the phenomena of capillarity and absorption.

Newbey S. Green.—Some grayling from the River Till.

India Office (Secretary of State for India in Council).—Further volumes of the *Fauna of British India* : Coleoptera (Lamellicornia) ; Rhynchota, vol. v.

Dr. A. Randell Jackson.—Reprints of papers by the donor : "Notes on Arachnids observed during 1910"; "On a Spider new to science recently found in Ireland."

Charles Janet (Paris).—Reprints of four papers by the donor on the phylogeny and ontogeny of insects.

S. T. King.—Living sea-cucumber *(Cucumaria)* from off the Yorkshire coast.

John Laurence.—Abnormal eggs of a white Leghorn fowl ; a large and a small egg, soft shelled, connected together.

Arthur Loveridge.—Beetle *(Carabus)* with the parts labelled, mounted in a glass box.

Miss M. Ridley Makepeace.—Some ethnological and other objects on loan, including two heads carved out of cocoa-nut husks from the Andaman Islands, a Kaffir cup, and a South African weaver-bird's nest.

J. Ford Maling.—Remarkable flint concretion from the chalk.

R. D. Maughan.—Large saddle (cow-boy's) from North-West America.

Henry T. Mennell.—Copy of Bacon's engraving of the portrait of Thomas Bewick by Ramsay. Current additions to the set of the Linnean Society's *Journals* presented the year before.

Capt. D. H. Nash.—Partly by exchange: natural history objects collected by the donor in various parts of the world: some good shells; South American Lepidoptera; twenty skins of South American sea birds, including some rare terns, a rare cormorant, and two species of the southern auk-like petrels *Pelecanoides*.

Walter Nelson.—Chicken monstrosity—a rather interesting case of dichotomy.

Major Geo. J. W. Noble.—Five recent parts of the *Proceedings* and *Transactions* of the Zoological Society, and vol. 45 of the *Zoological Record*.

J. J. Oxley.—Samples of wild cotton and various mineral deposits (asbestos, bitumen, etc.) from Newfoundland.

John Pattinson.—Small fossils—crinoids and *Actinoceras*—from local limestones.

W. Mark Pybus.—Collections of shells, chiefly British land shells.

E. O. Reid (the late).—Young hawfinch from near Newcastle.

Wm. Reid (Bulawayo).—Good examples of gold quartz and chrome iron from Rhodesia.

Miss Dorothea Richardson.—Char netted in Windermere; weight just under ¾lb.

J. Alaric Richardson.—Young swift that fell from a nest in the donor's house.

Messrs. Robson and Sons.—Two large shells, *Bulimus* sp. and *Carocolla* sp., found embedded in a log of walnut from the Mississippi.

H. Minton-Senhouse.—Piece of Lepidodendron stem.

Laurence Smith.—Fresh comb from the nest of a wild bee, *Bombus venustus*, from the Shetlands.

P. G. Spence.—Samples of the phosphate deposits and coral sands ot Christmas Island and Ocean Island, in the South Pacific.

W. Sutherland (Hull).—Bottle brought up by the trawl, encrusted with Serpula, hydroids, etc.

Clifford Temperley.—Small five-bearded rockling *(Motella mustela)* rom a rock pool at Alnmouth.

Prof. J. A. Thomson, F.R.S.—By exchange with Zoological Department of Aberdeen University : a collection of sea fans and other Alcyonarians in spirit.

C. T. Trechmann.—Nest of meadow pipit containing two eggs of cuckoo, found by the donor near Castle Eden, June 10, 1909: described and figured in the *Naturalist* for April, 1910.

J. D. Walker.—Two black-winged stilts, stuffed by R. Duncan, sen.

P. Walther.—Various minerals, including lignite from West Germany, zinc blande in a septaria from near Whitby ; a fossil plant from the Keuper of Windsheim ; petrified moss from Fallowfield. A number of other minerals by exchange.

J. Henry Watson.—Batch of eggs (for rearing) of the Arrindi silk moth, *Philosamia ricini.*

Rev. R. Stewart Wright.—Objects from Lake Tanganyika: a native hippopotamus spear ; a primitive telephone made from cord, small gourds and lizard skin by a native boy. Also, from the same locality, a queen white ant and two specimens of the sleeping-sickness fly, *Glossina palpalis.*

ADDITIONS TO THE LIBRARY

BY EXCHANGE AND DONATION

From JULY 1st, 1909, to JUNE 30th, 1910

BRITISH SOCIETIES AND INSTITUTIONS

Berwick-upon-Tweed:—Berwickshire Naturalists' Club.
History of the Club, vol. 20, part 2.

Cambridge University:—Philosophical Society.
Proceedings, vol. 15, parts 3–5.
Report for 1908–9.

Cardiff:—Museum and Art Gallery.
Report of the Welsh Museum for 1908–9.

Cardiff:—National Museum of Wales.
1st and 2nd Annual Reports.

Dublin:—Royal Dublin Society.
Scientific Transactions, N.S., vol. 12, nos. 14–29.
Scientific Proceedings, vol. 1, no. 16 and index; vol. 2, no. 1.

Edinburgh:—Botanical Society.
Transactions and Proceedings, vol. 24, part 1.

Edinburgh:—Geological Society.
Transactions, vol. 9, parts 3-4 and special part.

Glasgow;—Natural History Society.
"The Glasgow Naturalist," vol. 1, parts 1–4

Glasgow:—Geological Society.
History from 1858–1908.
Transactions, vol. 13, parts 1–3.

Greenwich:—Royal Observatory.
Results of the Magnetical and Meteorological Observations for 1907.

Hull:—Municipal Museum.
Museum Publications, 64-65.

Leeds :—Yorkshire Naturalists' Union.

"The Flora of West Yorkshire," by F. A. Lees.

"The Alga Flora of Yorkshire," by West and West.

"North Yorkshire," by J. G. Baker.

Botanical Transactions, vol. 1.

"The Fungus-Flora of Yorkshire" (2 parts), by C Crossland and G. Massee.

"The Yorkshire Carboniferous Flora," by R. Kidston.

London :—British Association for the Advancement of Science.

Report of 79th Meeting, Winnipeg, 1909.

London :—British Museum (Natural History), South Kensington.

Hand-list of Birds, vol. 5.

Catalogue of Lepidoptera Phalænæ, vol. 8, text and plates.

,, Cretaceous Bryozoa, vol. 2.

Special Guide—No. 4—Memorials of Darwin.

London :—Royal Society of Arts.

Directory for 1909.

London :—Quekett Microscopical Club.

Journal, ser. 2, vol. 10, no. 65 ; vol. 11, no. 66.

London :—Zoological Society.

Proceedings, 1909, parts 2–4.

Transactions, vol. 19, parts 1–5.

Manchester :—Literary and Philosophical Society.

Memoirs and Proceedings, vol. 53, part 3 ; vol. 54, parts 1–2.

Manchester :—Manchester Museum, The University.

Annual Report for 1908–9.

Notes, no. 22.

Museum Handbook, no. 64.

Museum Lecture List.

Newcastle-upon-Tyne :—North of England Institute of Mining and Mechanical Engineers.

Transactions, vol. 59, parts 3–8 ; vol. 60, parts 1–3.

Annual Report, 1908–9.

Newcastle-upon-Tyne :—University of Durham Philosophical Society.

Proceedings, vol. 3, part 4.

Newcastle-upon-Tyne:—Northumberland Sea Fisheries Committee.

Report on the Scientific Investigations for 1908–9.

Northampton:—Northamptonshire Natural History Society and Field Club.

Journal, vol. 15, nos. 117-120

Norwich:—Norfolk and Norwich Naturalists' Society.

Transactions, vol. 8, part 5.

Norwich:—Castle Museum.

Report for 1909.

Plymouth:—Marine Biological Association of the United Kingdom.

"Journal," vol. 2.
,, New Series, vol. 1, nos. 1–4; vol. 2, nos. 1–3; vol. 3, nos. 1–4 and special number.
,, ,, vol. 4, nos. 1–4; vol. 5, nos. 1–4; vol. 6, nos. 1–4; vol. 7, nos. 1–5.
,, ,, vol. 8, nos. 1–5.

Oxford:—Ashmolean Natural History Society.

Rules of the Society.
Transactions, vol. 1, title page and contents, nos. 3, 4, 7, 9, 10 11 12, 13, 14, 16, 18–25,
Reports, 1872–7, 1900-1907.
Journal, nos. 3-4.
List of Members 1866, 1872, 1880.
Lecture Lists 1893-4; 1896–7; 1897, 1898.
Lectures and Members 1895–6; 1896–7.
Balance Sheet 1897.
Christmas Lectures 1903–4; 1904–5; 1905–6. 1907–8.
Engraving of the Ashmolean Museum.
Papers by:—Prestwick — Mineral Water.
Bosanquet — New Form of Polariscope.
Whiteaves — Land and Fresh Water Mollusca.
Masters — Flowering Plants and Ferns.
Bellamy — Positions of Nova Persei.
,, — Permanent Records.
,, — Phenology.
White — Main Drainage of Oxford.
Proceedings and Report for 1909.

Stone, Staffs.:—North Staffordshire Field Club.
Annual Report and Transactions, vol. 43.

Stratford, Essex:—Essex Field Club.
"The Essex Naturalist," vol. 15, parts 7–8: vol. 16, parts 1–2.

Worcester:—Public Library, Museum, and Art Gallery.
Report of Committee, 1908–9.

York:—Yorkshire Philosophical Society.
Annual Report for 1908.

COLONIAL SOCIETIES AND INSTITUTIONS.

Cape Town:—South African Museum.
Report for 1908.
Annals, vol. 5, part 7; vol. 6, part 3.

Ottawa:—Geological Survey of Canada.
Maps nos. 39, 41, 51–4, 592, 624, 634, 826, 903, 985, 1005, 1019, 1025, 1026, 1036, 1037, 1041, 1043–9.
Catalogue of publications revised to January, 1909.
Publications, no. 980, 1081, 1035, 1050, 1059, 1085.
Catalogue of Canadian Birds.
Annual Report on the Mineral Production of Canada during 1906.

Sydney, N.S.W.:—Australian Museum.
Report of Trustees for 1908–9.
Records, vol. 7, nos. 4–5.

Sydney, N.S.W.:—Royal Society of New South Wales.
Journal and Proceedings, vol. 42; vol. 43, part 1.

Western Australia:—Geological Survey.
Bulletins 35 and 37.
Report on Mining in Leonora and Wiluna Districts.
" " Waverley or Siberia Districts.

AMERICAN SOCIETIES AND INSTITUTIONS

UNITED STATES OF AMERICA

Berkeley:—University of California.
Publications in Zoology, vol. 4, index; vol. 5, nos. 2-4; vol. 6, nos. 2-5.
" Geology, vol. 5, nos. 16, 18–22.
" Botany, vol. 3, nos. 6–8.
Bulletin (3rd series), vol. 2, no. 9.

Boston :—Society of Natural History.

Proceedings, vol. 34, nos. 6–8.

Occasional Papers, no. 7.

Boston :—American Academy of Arts and Sciences.

Proceedings, vol. 44, nos. 18–26; vol. 45, nos. 1–15.

Brooklyn, N. Y. :—Institute of Arts and Sciences.

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Bulletin, vol. 9, no. 3.

Cambridge :—Museum of Comparative Zoology, Harvard College.

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Memoirs, vol. 27, no. 3; vol. 34, no. 3; vol. 38, no. 1; vol. 39, no. 1.

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Chicago :—Academy of Sciences.

Bulletin, vol. 3, nos, 1–3.

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Report Series, vol. 3, no. 4.

Columbus :—Ohio State University.

Bulletin, vol. 13, nos. 16, 22.

Michigan :—Academy of Science.

11th Annual Report.

New York :—Academy of Sciences.

Annals, vol. 18, part 3; vol. 19, part 1.

New Orleans :—Louisiana State Museum.

2nd Biennial Report.

Philadelphia :—Academy of Natural Sciences.

Proceedings, vol. 61, parts 1–2.

Philadelphia :—American Philosophical Society.

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List of Members, 1910.

Portland :—Society of Natural History.

Proceedings, vol. 2, part 8.

Springfield:—Museum of Natural History.

An Historical Sketch of the Museum, 1859–1909.

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St. Louis:—Missouri Botanical Gardens.

20th Annual Report.

Tufts College, Mass.:—Tufts College Studies.

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Washington:—Smithsonian Institution.

Annual Report for 1907–8.

Miscellaneous Collections, vol. 54, parts 1, 7; vol. 56, part 2; Quarterly Issue, vol. 5, parts 3–4.

Publications 1922, 1924–6.

Washington:—Smithsonian Institution, U.S. National Museum.

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Bulletin, nos. 63–69; 72.

Proceedings, vols. 35, 36.

Publication no. 1738.

Contributions from the U.S. National Herbarium, vol. 12, parts 7–10; vol. 13, parts 1–2.

Washington:—United States Geological Survey.

30th Annual Report, 1908–9.

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Bulletins, 341, 356, 360, 368, 370–80, 382–97, 399, 400–405, 408–14, 416, 418, 421, 423–4.

Professional Papers, 59, 64, 66–67.

Water-supply Papers, nos. 223–5, 227–36, 238, 242.

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SOUTH AMERICAN STATES, ETC.

Mexico:—Instituto Geologico.

Parergones, tomo 2, no. 10; tomo 3, nos. 1–2

Montevideo, Uruguay:—Museo Nacional.

Anales, vol. 7, tomo 4, ent. 1–2.

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Bergen:—Bergens Museum.

Aarbog, 1909, hefte 1, 2, 3.

Aarsberetning for 1909.

Crustacea of Norway (G. O. Sars), vol. 5, parts 25–28.

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Brussels:—Société Royale Zoologique et Malacologique.
Annales, vol. 43.

Christiania:—Videnskabs-Selskabet.
Forhandlinger, 1908.

Copenhagen:—Naturhistoriske Forening.
Videnskabelige Meddelelser, 1909.

Dresden:—Naturwissenschaftliche Gesellschaft "Isis."
Sitzungsberichte und Abhandlungen, 1906 in 2 parts; 1907 in 2 parts; 1908 in 2 parts; 1909 in 4 parts.

Frankfurt-am-Main:—Senckenbergische Naturforschende Gesellschaft.
Bericht, 1909.

Hamburg:—Naturwissenschaftlicher Verein.
Verhandlungen, dritte Folge, 16, 1909.

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Acta, vols. 24 and 32.
Meddelanden, part 35.

Kiew, Russia:—Société des Naturalistes.
Memoirs, tome 20, part 4; tome 21, part 1.

Lisbon:—Société Portugaise des Sciences Naturelles.
Bulletin, vol. 2, fasc. 3.

Paris:—Muséum d'Histoire Naturelle.
Bulletin, 1909, nos. 1-6.

Portici:—Laboratorio di Zoologia Generale e Agraria.
Bollettino, vol. 3.

Stockholm:—Kongliga Svenska Vetenskaps-Akademien.
Les Prix Nobel en 1906 and 1907.
Handlingar, vol. 43, nos. 7-12; vol. 44, nos. 1-4; vol. 45, nos. 1-4.
Arsbok, 1909.
Arkiv for Botanik, vol. 8, nos. 1-4; vol. 9, nos. 1-2.
,, Zoologi, vol. 5, nos. 1-4; vol. 6, no. 1.
,, Matematik, Astronomi och Fysik, vol. 5, nos. 1-4; vol. 6, no. 1.
,, Kemi, Mineralogi och Geologi, vol. 3, no. 3.
Meddelanden, vol. 1, nos. 12-15.
Lefnadstechningar, vol. 4, part 4.

Upsala:—Geological Institution, University of Upsala.

Correspondence of Linneus, part 3.

Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901, part 3.

Vienna:—K. k. zoologisch-botanische Gesellschaft.

Verhandlungen, Bd. 59.

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Museums Association Annual Reports, 1890-9.

Museums Journal, 1901-1908.

Presented by N. H. Martin, Esq., J.P., F.R.S.E., &c.

Bibliography of the North of England, 1902-8.

Presented by the Yorkshire Naturalists' Union.

Fauna of British India Series—Dermaptera.

Presented by the Secretary of State for India in Council.

Linnean Society of London:—

Journal of Botany, vols. 7-12, 14-39, and Index 1838-86.

Journal of Zoology, vols. 9, 10, 12-30, and Index 1838-90.

Proceedings, 1896-1908.

Presented by Henry T. Mennell, Esq., F.L.S.

Reprint of a paper by Sir William Turner, K.C.B., F.R.S.:—

"The Skeleton of a Sowerby's Whale (Mesoploden bidens) stranded at St. Andrews." *Presented by the Author.*

Copy of a paper by Mary Hallock-Greenwalt:—

"Time Eternal." *Presented by the Author.*

Reprint of an address by Canon A. M. Norman, M.A., F.R.S.:—

"The Celtic Province: its Extent and its Marine Fauna."

Presented by the Author.

Cash.—"British Freshwater Rhizopoda and Heliozoa," vol. 88, part 2.

From the Ray Society (by subscription).

"Museums Journal," July, 1909, to June, 1910.

From the Museums Association (by subscription).

"Nature," July 1st, 1909, to June 30th, 1910

Presented by the Publishers.

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM 1ST JULY, 1910, TO 30TH JUNE, 1911

RECEIPTS	£	s.	d.
Balance in hand, 30th June, 1910	17	14	4
Members' Subscriptions	396	14	0
Museum Admission Fees	131	3	5
Sale of Guide Books, etc.	6	1	5
Interest on Investments	370	16	9
Deficit	70	13	11
	£993	3	10

PAYMENTS	£	s.	d.
Salaries	601	0	2
Advertising	12	8	4
Fuel, Lighting, and Water	72	9	3
Insurance	26	18	1
Materials and Fittings	40	3	10
Postage and Carriage	12	16	4
Printing	21	5	10
Property Tax	10	11	1
Building Repair Fund	40	0	0
Stationery	1	11	0
Publication Account	105	14	11
Sundries	48	5	0
	£993	3	10

BUILDING REPAIR FUND

	£	s.	d.
Transfer from General Account	40	0	0
Deficit, 30th June, 1911	30	11	11
	£70	11	11

	£	s.	d.
Deficit, 30th June, 1910	43	3	8
Sundry Repairs	27	8	3
	£70	11	11

SAML. GRAHAM }
W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

CRAWHALL LEGACY ACCOUNT

	£	s.	d.
Balance in Bank, 30th June, 1910	805	19	10
Per Executors of the late G. E. Crawhall	300	0	0
Bank Interest on Account	6	2	3
	£1,112	2	1

	£	s.	d.
G. G. Laidler (cleaning and decorating Museum)	338	11	7
J. C. Hope—repairs to Museum building	50	0	0
Dinning and Cooke—new hot water return pipe	34	2	6
Purchase of Specimens	20	8	11
Sundry extraordinary expenditure	15	6	10
Placed on deposit with Crown Permanent Benefit Building Society	300	0	0
Placed on deposit with Crown Benefit Building Society	300	0	0
Balance in Bank, 30th June, 1911	53	12	3
	£1,112	2	1

PUBLICATION ACCOUNT

	£	s.	d.
Transferred from "Special Publication Fund" Account	37	6	9
Balance to General Account	105	14	11
	£143	1	8

	£	s.	d.
J. Bell & Co.—printing of Transactions (vol. iii., part 2)	97	9	9
Philipson and Skilleter: block	0	3	11
W. West: Lithographing	3	2	0
J. Bell & Co.—printing of Transactions (vol. iii., part 3)	42	6	0
	£143	1	8

SAML. GRAHAM }
W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1911 :—

£	s.	d.	Investment		Taken at cost. £	s.	d.
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock (Coppin Bequest).............		2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt		500	0	0
2,000	0	0	Tyne Commissioners' Consolidated Fund at 4 per cent.		2,000	0	0
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock	Crawhall Bequest	6,000	0	0
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock				
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock.				
					£10,500	0	0

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors

A. H. DICKINSON, Hon. Treasurer.

ADDITIONS TO THE LIBRARY

BY EXCHANGE AND DONATION

FROM JULY 1ST, 1910, TO JUNE 30TH, 1911.

BRITISH SOCIETIES AND INSTITUTIONS

Berwick-upon-Tweed:—Berwickshire Naturalists' Club.
History of the Club, vol. 20 (1906–8).

Cambridge University:—Philosophical Society.
Proceedings, vol. 15, part 6; vol. 16, parts 1–2.

Cardiff:—Museum and Art Gallery.
Report of the Welsh Museum for 1909 and 1910.

Cardiff:—Naturalists' Society.
Transactions, vol. 42.

Cullercoats:—Dove Marine Laboratory.
"An Account of the Dove Marine Laboratory," 1910.

Dublin:—Royal Dublin Society.
Scientific Proceedings, vol. 12, nos. 30-36, and general index 1898–1909.
Economic Proceedings, vol. 2, no. 2.

Edinburgh:—Botanical Society.
Transactions and Proceedings, vol. 25.

Edinburgh:—Geological Society.
Transactions, vol. 9, part 5.

Greenwich:—Royal Observatory.
Results of the Magnetical and Meteorological Observations, 1908 and 1909.

Hastings:—Corporation Museum.
Hastings and East Sussex Naturalist, vol. 1, nos. 4-5.
Occasional Publications, nos. 3–4.
Notes on Sussex Pottery.

London:—British Museum (Natural History), South Kensington

"A Descriptive Catalogue of the Marine Reptiles of the Oxford Clay," part 1, by C. W. Andrews, D.Sc., F.R.S.

"Guide to Mr. Worthington Smith's drawings of Field and Cultivated Mushrooms and Poisonous or Worthless Fungi often mistaken for Mushrooms."

London:—Quekett Microscopical Club.

Journal, ser. 2, vol. 11, nos. 67–68.

London:—Zoological Society.

Proceedings, 1910, parts 1–4; 1911, part 1.

Transactions, vol. 18, part 4.

List of Fellows for 1910.

Manchester:—Literary and Philosophical Society.

Memoirs and Proceedings, vol. 54, part 3; vol. 55, parts 1-2.

Manchester:—Manchester Museum, The University.

Report for 1909-10.

Museum Handbooks, nos. 67, 68, 70, 71.

Newcastle-upon-Tyne:—Armstrong College.

Reprint:—"Observations on the Large Larch Sawfly," by J. F. Annand.

Calendar for 1910–11.

Newcastle-upon-Tyne:—North of England Institute of Mining and Mechanical Engineers.

Transactions, vol. 57, part 8; vol. 60, parts 4-9; vol. 61, parts 1-3.

Annual Report, 1909-10.

An Account of the Strata of Northumberland and Durham, 1910.

Newcastle-upon-Tyne: — Northumberland Sea Fisheries Committee.

Report on the Scientific Investigations for 1909–10.

Newcastle-upon-Tyne:—University of Durham Philosophical Society.

Proceedings, vol. 3, part 5; vol. 4, part 1.

Northampton:—Northamptonshire Natural History Society and Field Club.

Journal, vol. 15, nos. 121–124.

Norwich:—Norfolk and Norwich Naturalists' Society.

Transactions, vol. 9, part 1.

Norwich:—Castle Museum.
Museum Report for 1910.
3rd Annual Report of the Norwich Museum Association.

Oxford:—Ashmolean Natural History Society.
Proceedings and Report for 1910.

Plymouth:—Marine Biological Association.
Journal, N.S., vol. 9, no. 1.

Sheffield:—Naturalists' Club.
Proceedings, vol. 1.
Annual Report for 1910.

Sheffield:—Museum and Art Gallery.
Report, 1908–10.
Reprint—"Museums and Art Galleries," by E. Howarth.
,, —"Meteorology," by E. Howarth.

Stone, Staffs:—North Staffordshire Field Club.
Annual Report and Transactions, vol. 45.

Stratford, Essex:—Essex Field Club.
"The Essex Naturalist," vol. 16, parts 3–6.

York:—Yorkshire Philosophical Society.
Annual Report for 1909.

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Cape Town:—South African Museum.
Report for 1909.
Annals, vol. 5, parts 8–9; vol. 6, part 4; vol. 9, part 1.

Halifax, Nova Scotia:—Nova Scotian Institute of Science.
Proceedings and Transactions, vol. 12, part 2.

Melbourne:—National Museum.
Memoirs, no. 3.

Ottawa:—Geological Survey of Canada.
Summary Report, no. 26.
Geological Survey Map, no. 9A.
Publications, nos. 1979 and 1080.
Memoirs, 1, 2, 3, 5, 6, 7, 8, 12 and 14.

Perth, Western Australia:—Geological Survey.
Bulletin, nos. 33, 38 and 39.

Sydney, N.S.W.:—Australian Museum.

Report of Trustees for 1909-10.

Records, vol. 8, nos. 1-2.

Sydney, N.S.W.:—Technological Museum.

Annual Report for 1909.

Australasian Society for the Advancement of Science.

12th Annual Report—Brisbane Meeting. 1909.

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UNITED STATES OF AMERICA

Ann Arbor:—Michigan Academy of Science.

12th Annual Report.

Berkeley:— University of California.

Geological Bulletin, vol. 5, nos. 23-30; vol. 6, nos. 1-4.

Botanical Bulletin, vol. 4, nos. 1-10.

Zoological Publications, vol. 5, nos. 5-12, also title page and index; vol. 6, nos. 6-14; vol. 7, nos. 1-6.

Boston:—American Academy of Arts and Sciences.

Proceedings, vol. 45, nos. 16-21, vol. 46, nos. 1-17.

Brooklyn, N.Y.:—Institute of Arts and Sciences.

Science Bulletin, vol. 1, no. 17; also index and title page.

Cambridge:—Museum of Comparative Zoology, Harvard College.

Bulletin, vol. 52, nos. 16-17; vol. 54, nos. 2-5

Memoirs, vol. 26, no. 7; vol. 40, nos. 1-2; vol. 41, nos. 1-2.

Annual Report of the Curator, 1909-10.

Chicago:—Field Museum of Natural History.

Report Series, vol. 4, no. 1.

Cincinnati:—Lloyd Library.

Bibliographical Contributions, nos. 1-2.

Columbus:—Ohio State University.

Bulletin, vol. 13, nos. 4, 15, 28; vol. 14, nos. 6, 7, 18, 25.

New Haven:—Connecticut Academy of Arts and Sciences.

Memoirs, vol. 2.

New Haven:—Yale University.

Transactions, vol. 16, pp. 1-116.

,, vol. 16, pp. 247-382.

New Orleans:—Louisiana State Museum.
Bulletin, no. 1.

New York:—Academy of Sciences.
Annals, vol. 19, parts 2–3; vol. 20, part 2.

Orono:—Maine Agricultural Experiment Station.
Bulletins, 180, 181, 182, 187.
List of Entomological Papers (1880–1909).

Philadelphia:—Academy of Natural Sciences.
Proceedings, vol 62, parts 1–3.

Philadelphia:—American Philosophical Society.
Proceedings, vol. 49, nos. 194–7; vol. 50, no. 198.

St. Louis:—Academy of Science.
Transactions, vol. 18, nos. 2–6; vol. 19, nos. 1–10.

St. Louis:—Missouri Botanical Garden.
21st Annual Report.

Washington:—Bureau of Fisheries.
5 reprints from Bulletin, vol. 28, 1908.

Washington:—Smithsonian Institution.
Annual Report for 1909.
Miscellaneous Collections, vol. 51, no. 4, title page and cover; vol. 53, nos. 6 7; vol. 54, no. 3, title page and cover; vol. 55; vol. 56, nos. 1, 3, 4–11, 13–15, 17; vol. 57, no. 1.
Publications, nos. 1938 and 1989.

Washington:—Smithsonian Institution, U.S. National Museum.
Bulletin, nos. 71, 73, 74, 75; and title page to vol. 39.
Proceedings, vol. 37.
Publication no. 1821.
Contributions from the U.S. National Herbarium, vol. 13, parts 3-9; vol, 14, parts 1–2; vol. 15.
Reprint:—"A Revision of the Fossil Plants of the Genera Acrostichopteris, Tæniopteris, Nilsonia, and Sapindopsis, from the Potomac group."

Washington:—United States Geological Survey.
31st Annual Report, 1909-10.
Bulletins, 381, 398, 406–7, 415, 417, 419–20, 422, 425–30, 432–5, 437, 440, 442, 444.
Professional Papers, 68.
Water-supply Papers, nos. 237, 239, 240–1, 243–7, 248–52, 253, 255, 260, 262, 264.

Washington:—Library of Congress.
Classification—Class N—Fine Arts.

SOUTH AMERICAN STATES, ETC.

Mexico:—Instituto Geologico.
Boletin, num. 25 and 27.
Parergones, tomo 3, num. 3-6.

Monte Video:—Museo Nacional.
Anales, serie 2, tomo 1.

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Bergen:—Bergens Museum.
Aarbog, 1910, hefte 1-2.
Aarsberetning for 1910.
Crustacea of Norway (G. O. Sars), vol. 5, parts 29-32.

Brussels:—Société Royale Zoologique et Malacologique.
Annales, tome 44-45.

Christiania:—Videnskabs-Selskabet.
Forhandlinger, 1909.

Copenhagen:—Naturhistoriske Forening.
Videnskabelige Meddelelser, 1910.

Dresden:—Naturwissenschaftliche Gesellschaft "Isis."
Sitzungsberichte und Abhandlungen, 1910 in 2 parts.

Frankfurt-am-Main:—Senckenbergische Naturforschende Gesellschaft.
Bericht, 1909-10.

Hamburg:—Naturwissenschaftlicher Verein.
Verhandlungen, vol. 17, 1909.
Abhandlungen, vol. 19, hefte 3-5.

Kiew, Russia:—Société des Naturalistes.
Mémoirs, tomo 21, part 2.

Lisbon:—Société Portugaise des Sciences Naturelles.
Bulletin, vol. 3, fasc. 1-4 and supplements; vol. 4, fasc. 1-2.

Paris:—Muséum d'Histoire Naturelle.
Bulletin, 1909, nos. 7-8; 1910, nos. 3-5.

Paris:—Institut Général Psychologique.
Mémoirs par Victor Cornetz. 1910.

Portici:—Laboratorio di Zoologia Generale e Agraria.
Bollettino, vol. 4.

Rostock-i-M.:—Naturforschende Gesellschaft.
Sitzungberichte und Abhandlungen, 1910, Band 1–2.

Stockholm:—Kongliga Svenska Vetenskaps-Akademien.
Handlingar, vol. 45, nos. 5–12; vol 46, nos. 1–3.
Arsbök, 1910 in 3 parts.
Arkiv for Botanik, vol. 9, nos. 3–4; vol. 10, no. 1.
,, Zoologi, vol. 6, nos. 2–4; vol. 7, no. 1.
,, Matematik, Astronomi och Fysik, vol. 6, nos. 2–3.
,, Kemi, Mineralogi och Geologi, vol. 3, nos. 4–6; vol. 4, no. 1.
Les Prix Nobel en 1908.

Trencsen:—Naturwissenschaftlicher Verein.
Jahresheft, 1908–10.

Upsala:—Geological Institution, University of Upsala.
Bulletin, vol. 9, nos. 17–18; vol. 10, nos. 19–20; Index to vols. 1–10.
Bref och Shrifvelser af och till Carl von Linné.
Kungl.-Vetenskaps-Societeten, 1910.

Vienna:—K. k. zoologisch-botanische Gesellschaft.
Verhandlungen, Bd. 60.

MISCELLANEOUS.

"Fauna of British India," Coleoptera (Lamellicornia).
,, ,, Rhynchota, vol. 5.
Presented by the Secretary of State for India in Council (India Office).

Reprints of Papers:—
"A Description of some Gold Coast Entomostraca," by Dr. W. M. Graham, B.A.
"Notes on Dr. Graham's Collection of Cyclopidae from the African Gold Coast," by Dr. G. S. Brady.
"On Some Species of Cyclops and other Entomostraca collected by Dr. Dalziel in Northern Nigeria," by Dr. G. S. Brady.
'A Revision of the British Species of Ostracod Crustacea belonging to the sub-families Candoninæ and Herpetocypridinæ," by Dr. G. S. Brady.
'Zoology of the Sheffield District," from the British Association 'Handbook and Guide.'
Presented by Prof. G. S. Brady, M.D., D.Sc., F.R.S.

Reprints of papers by R. S. Bagnall, F.E.S., F.L.S. :—

Extracts from "Fauna Hawaiiensis," vol. 3, part 6, Thysanoptera.
,, "Annales de la Société Entomologique de Belgique," tome 53, 1909.
,, "Annales Musei Nationalis Hungarici," vol. 7, 1909; vol. 8, 1910.
,, "Annals of the South African Museum," vol. 5, part 8.
,, "Linnean Society's Journal," Zoology—vol. 30, Dec., 1909, and June, 1910.
,, "Entomologist's Monthly Magazine," second series, vol. 21.
,, "Annals and Magazine of Natural History," series 8, vol. 1.
,, "Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne," Transactions, N.S., parts 1–3.
,, "Journal of Economic Biology," vol. 4, part 2; vol. 6, part 1.

Presented by the Author.

"Lepidoptera Indica," vol. 7 in 12 parts complete.

Presented by Lt.-Col. C. H. E. Adamson, C.I.E.

"The Hazlemere Museum Gazette," vol. 1 complete.

Presented by Dr. Otto V. Darbishire.

"Kapillaranalyse beruhend auf Kapillaritäts- und Adsorptionserscheinungen," by Prof. Dr. Friedr. Goppelsroeder.

Presented by the Author.

Reprints of papers by A. Randell Jackson, M.D., D.Sc. :—
"Notes on Arachnids observed during 1910."
"On a Spider new to Science recently found in Ireland."

Presented by the Author.

Reprints of papers by M. Charles Janet (Paris) :—
"Sur la Morphologie de l'Insecte."
"Note sur la Phylogénèse de l'Insecte."
"Sur l'Ontogénèse de l'Insecte."
Three extracts from Mémoires de la Société Académique de l'Oise, 1909. *Presented by the Author.*

Journal of the Linnean Society—Botany, vol. 39, no. 272.
,, ,, —Zoology, vol. 30, nos. 201-2; vol. 31, no. 207. *Presented by Henry T. Mennell, F.L.S.*

Zoological Society of London—Zoological Record, vol. 45, 1908.
,, ,, —Proceedings, 1909, part 4.
,, ,, —Transactions, vol. 19, parts 2–5.
Presented by Major Geo. Noble.

Sir Chas. Eliot, D.C.L., C.B., &c. :—"British Nudibranchiate Mollusca," part 8 and Supplement.

Prof. W. C. McIntosh, M.D., LL.D., &c. :—"British Annelids," vol. 2, part 2. *From the Ray Society (by subscription).*

"Museums Journal," July, 1910, to June, 1911.
From the Museums Association (by subscription).

"Nature," July 1st, 1910, to June 30th, 1911.
Presented by the Publishers.

MISCELLANEA.

Charadriiformes

Bird Notes.

Little Auks in 1912.—The "rush" of Little Auks, which attracted so much attention in the early weeks of 1912, was strongly marked on our local coast. Mr. John Crisp, of St. Mary's Island, writing on February 3rd, 1912, said, "During the past three weeks the Little Auk has been very numerous along the coast—flock after flock of them, all making south. Large numbers of them have foundered: they could be picked up all over the beach. I have never seen so many, and they certainly have confirmed the common opinion that we are in for bad weather when they are seen."

Mr. Hugh V. Charlton, of Cullercoats, has supplied me with some interesting notes on the same visitation, and the following are quoted from them. "The first Little Auk recorded was shot on January 7th off Cullercoats. On the night of January 8th a severe blizzard swept over from the south-east. On the 9th Mr. Crisp saw "dozens" swimming round St. Mary's Island; one was brought alive to us, but would not feed and died next morning . . . . . January 18th. South-east wind; flock of six seen passing St. Mary's Island by H. V. C. We were told that many had been seen, and the fishermen amused themselves by throwing stones at them as they passed along by the shore. We were also informed that one flock had about fifty birds in it . . . . January 21st. One was picked up alive in the fields half a mile behind Cullercoats . . . . . January 23rd. J. M. C. saw one swimming off Cullercoats. The swimming birds apparently used their wings when on the surface as an aid to their feet, flapping them in the water beside them in their hurry to escape. January 24th . . . . . I also saw four to-day; one was quite at home riding over the great breakers off St. Mary's Island."

Many Little Auks were brought to the Museum, some of them picked up far inland. One was brought alive by Mr. R.

Wailes Cooke; it had been found in his garden at Wylam. Another was seen to flutter down during a snowstorm on February 2nd in Grey Street, Newcastle, and was picked up by Mr. R. J. Dewar and brought to us by Mr. G. G. Laidler, jun. We kept this bird alive for rather more than a day, but though it pecked and squawked vigorously when handled, it would not take food. We forced bits of shrimp down its throat, but apparently to no purpose. While it lived we kept it in a large sink partly filled with water, and with rocks to climb out upon. The rotundity of its form was noticeable, as was the fact that it never sat up on its tail-end in the attitude in which Little Auks are always shown by taxidermists and artists. I have stuffed the bird in the position it invariably adopted when it left the water—supported on its breast and feet, with its head drawn well back and its little tail erect. It is of course possible that a Little Auk in normal condition is able to sit upright; this bird, like all that we examined, was extremely emaciated and evidently starving.—*E. Leonard Gill.*

Brent Geese at St. Mary's Island.—Mr. John Crisp, in the letter quoted above (dated Feb. 3, 1912), goes on to refer to another matter. He says, "There has been a great migration of Brent Geese, making north. Thousands of them have passed here in flocks of from ten to fifty for the past week. Several have been shot; Mr. Charlton, of Cullercoats, has shot three." It is many years since Brent Geese have been seen in any numbers, or shot, at St. Mary's Island.

White Variety of Woodpigeon.—While walking through the General's Wood at Fatfield, on Monday evening, August 28th, 1911, I noticed a white bird rise and fly away, which from its flight appeared to be a young one. Flying against a tree trunk it fell, and I was thus able to pick it up, and on examination found that it was a pure white variety of the Ring Dove, fully feathered, but as yet weak on the wing. The eyes were black, thus showing that it was not a true albino, and as it will be interesting to observe whether any change will take place after the first moult, I have given it to Mr. Gill who will attempt to rear it.—*William Hall, Fatfield House, Washington.*

[This young woodpigeon was successfully reared at the Museum by William Voutt, and lived for more than a year in the aviary. Its albinism was associated, as is often the case, with marked stupidity, and the bird would evidently have perished very soon in a state of nature. Eventually it developed a habit of pursuing and attacking the other birds; we were obliged to put it in a smaller cage by itself, and here it died in about a week, having apparently refused its food. It occasionally cooed like a wild woodpigeon, and though it remained pure white it acquired the characteristic patches of specialized feathers on the sides of the neck.—*E. L. G.*]

Ciconiiformes

The Heron in Northumberland.—From recent observations I am of opinion that, as a feeding ground, apart from its breeding haunts, the Heron frequents the neighbourhood of Alnmouth more than any other spot on the Northumberland coast. I have met with this bird from the Tyne to the Tweed, scarce in the south, more plentiful in the north, but nowhere in such numbers as on that stretch of coast lying between the river Aln and Howick Burn. Here the broad, far-stretching reefs offer a safe feeding place at low tide, and the winding Aln and neighbouring burns in the back country a suitable resort for high tide intervals. It is in these intervals on land that danger is most imminent for the Heron, and from the abundance of the birds near Alnmouth it would appear that some protection is afforded them on the Ducal estates adjoining.

The ordinary flight of the Heron is familiar to most people, but what is perhaps not so commonly noticed is that interesting exhibition they sometimes give when alighting from a great height. On these occasions—only rarely performed—instead of descending in a long incline, or planing round in lowering circles, they change their course suddenly, taking a series of violent twists and dropping vertically the while, until, reaching a convenient elevation they recover themselves with marvellous skill and glide gently to the spot chosen for alighting.

The birds frequent the same resorts time after time, and I know a burn by the sea where, in autumn, one might reckon with certainty on finding them waiting for a falling tide. Here I have on occasions disturbed as many as nine Herons within a radius of a quarter of a mile.

As soon as the tide is low enough to give foothold on the outlying reefs the Herons come down to the sea, not in groups, but singly, each bird taking up a position well removed from that of its neighbour. They are silent as a rule, but occasionally utter a peculiar honking croak. This cry I have heard only when a number of birds are about, and usually when one is on the point of rising or alighting.

As they are among the first birds to arrive on the uncovered rocks, so they are about the last to leave when the tide returns. Long after the gulls and small wading birds have left, the Herons are there, and if the sea is calm you see them standing on the submerged rocks, motionless, like so many sentinels, silhouetted against the waters of the incoming tide.—*J. J. Hill.*

Pelecaniformes

Cormorants in Tynemouth Haven.—A pair of Cormorants have this year (1912) taken up their winter quarters in Tynemouth Haven. They frequent the north shore in the vicinity of the Black Middens, and are particularly fond of perching upon the "Skeleton Beacon" near the outer margin of the rocks about a mile up river. Here one or both of the birds may be seen regularly, often in characteristic pose with raised bill and outspread wings. I saw them first in mid-November when a storm was raging, and on that occasion their position seemed well chosen, being somewhat sheltered behind the Battery Point from the north and north-east winds.

I am told that for the past three years two of these birds, presumably the same pair, have made this spot their headquarters during the winter months, leaving again in early spring for their nesting grounds.

The coastguard says that some little time ago a third Cormorant was found upon the rocks here in an exhausted condition and taken to the men's cabin and tended, where it soon became very tame. When given its liberty it returned again and again to the cabin, and it appears the men had the greatest difficulty in driving the bird away.

It is remarkable that Cormorants, which one usually associates with the Farnes or the wilder parts of the coast, should have chosen a haunt within the track of shipping and near such large and busy towns. The fish refuse borne down by the tide from Shields Quay, which is in near proximity, might possibly be the attraction.—*J. J. Hill.*

Galliformes

Brown Variety of Partridge.—On December 4th, 1911, I was shown a Partridge which had been shot at Cockle Park, near Morpeth, on November 24th, and which was being preserved for Mr. T. E. Parrington, of Carley Hill, Monkwearmouth. It was an adult of the well-known *montana* variety, examples of which are shot from time to time in this district, especially in central Northumberland. But it differed in some respects from the usual adult of this variety, and the difference is worth recording because the *montana* pattern is remarkably constant as a rule wherever it appears, even in such widely separated localities as Northumberland, Norfolk and Spain. The notes I made at the time on this bird from Cockle Park are as follows: Not same in colour as the usual *P. montana* variety; parts usually dark chocolate are much lighter brown, with a cinnamon shade; breast feathers spotted near tips with dull white; head and neck a less brilliant buff—softened in colour towards a brownish straw.—*E. L. G.*

Birds in Museum Grounds.—Interesting birds visit the Museum grounds from time to time; the visit of a Greater Spotted Woodpecker was recorded in a recent number of the

Transactions, and every autumn a few Redstarts and large numbers of Willow Wrens frequent the grounds for several weeks. A Willow Wren was singing there on September 17th, 1912, and a chiffchaff on the 23rd—the latter quite a scarce bird in the district. Cuckoos are not infrequently heard calling near the Museum in the early morning in May and June. A Tree Creeper spent the day about the grounds and the adjacent gardens on March 15th, 1912; and a week earlier we had a visit of a more surprising character—from a couple of Long-tailed Tits. They did not stay long, for they were vigorously pursued by the Blue Tits which are always about the grounds. On November 22nd of the same year a Tawny Owl was found to be roosting in a tree at the back of the Museum: our attention was called to it early in the day by the outcry among the mistle thrushes and blackbirds. Later it was disturbed and flew to a window-sill, where it was captured. We kept it for a week or two and then liberated it. The time when the owl appeared was perhaps a period of considerable migratory movement; at any rate it is suggestive that on the same day a Woodcock was brought to us by Mr. W. Swanston which had killed itself by flying against a window of his house in Sydenham Terrace, within a stone's-throw of the Museum grounds.—*E. L. G.*

Summer Migrants in 1912.—A few miscellaneous notes may be brought together under this heading. Mr. Isaac Clark reported that he watched a Willow Wren at the top of Rye Hill, in Newcastle, on the morning of January 27th, 1912. This is a remarkable occurrence, but such an experienced ornithologist as Mr. Clark is not likely to be mistaken. It may be recalled, too, that we have in the Museum a Chiffchaff which was shot in the neighbourhood seven winters previously on the 20th of December.

Swifts are to be seen in most years on odd days during the first half of September—presumably birds from further north appearing after our local stock has left. I noticed a Swift at Chimney Mills, Newcastle, on the evening of September 13th, 1912.

Much was said in the newspapers about the scarcity of Swallows in the summer of 1912. It is therefore worth while to put on record the fact that in this part of the country Swallows were noticeably more abundant than usual all through that summer. One day in September* a remarkable southward migration of swallows was taking place across Newcastle Town Moor. The swallows were flying low, in a straggling stream a hundred to two hundred yards wide, crossing the Recreation Ground, the south-east corner of the Moor, the houses in Claremont Place, and the Leazes. I saw them as I went home to lunch, and they were still passing in the same way when I came back again. Most of them were young birds.—*E. L. G.*

Ciconiiformes

Night Heron at Warkworth.—In March, 1913, a Night Heron *(Nycticorax griseus)* was shown to us at the Museum by Mr. Wallace, jun., of Churchill Villa, Warkworth, who had shot it by the Coquet just above Warkworth in the preceding month. It had been seen about the same place for at least a fortnight.

Gruiformes

Water Rail in Jesmond.—From the frequency with which Water Rails are picked up under telegraph wires or met with in various other casual ways it is evident that only their retiring habits make them seem scarce. A Water Rail which was brought alive to the Museum on October 1st, 1913, had made itself known in a particularly curious way. It was brought by Mr. P. O. Hare, who told us that it had that morning actually run in at the front door of his house, 9, Manor House Road, Jesmond. We kept this bird for some time in the aviary. At first it spent all the daytime roosting about five feet up in some brushwood in a dark corner, and always in the same posture, with its tail up and its head and bill pointing obliquely downwards. Later it became much tamer and showed itself freely. We fed it on worms, but to judge by the efforts needed to swallow them they were not a

* I made a note of the date somewhere, but unfortunately cannot now find it.

natural food, and to our disappointment it died after about a month. Several times I heard its croaking grunt in the evenings.—*E. L. G.*

Quails in the Northern Counties.—During the last fifty years Quails seem to have become much scarcer in England than they used to be. Lately, however, there have been signs that their numbers were increasing again, and in the early autumn of 1913 a good many were reported as seen or shot by partridge shooters in the North of England and the Border counties of Scotland. Mr. H. I. Brackenbury sends word of a Quail seen by Mr. Montagu Maclean and the reporter to the *Field* at the retriever trials at Harehope in the last week of September. Another Quail was brought to the Museum on September 23rd. It had been shot the previous day near the village of Bowsden, close to Lowick. This was a bird of the year, and though no others were seen it suggests the probability that Quails had bred in the district. It was sent by Mr. H. L. Pattinson, of Low Lynn, Beal, on whose shooting it was killed.

There appear to be no actual records of the nesting of Quails in our neighbourhood since the early 'seventies, when Mr. Hancock's catalogue was written. The gift to the Museum of a clutch of Quail's eggs from Ryton is therefore very welcome. They have been presented by Mr. Thomas Thompson, of Ashfield Terrace, Ryton, who took them himself "in a new-land hayfield off the Greenside road" about the year 1893. He knew the birds were there, and followed the hay-cutting machine until it uncovered the nest. The machine unfortunately broke two of the eggs: there were thirteen in the clutch, and eleven remain.—*E. L. G.*

Prestwick Car Field Meeting.

Some notes supplementing Mr. Amsden's report on the field meeting at Prestwick Car (see p. 202) have been supplied by Mr. G. Nicholson, who was collecting with Mr

D. Rosie. The following is quoted from Mr. Nicholson's letter :

"The only butterfly noted was the Small Copper, *P. phlœas*. The Common Heath Moth, *F. atomaria*, was flying freely on the heather. Specimens of the following were also taken : Poplar Hawk, *S. populi*; Water Carpet, *C. suffumata*, and its variety *piceata* ; Hebrew Character, *T. gothica*.

"Amongst various *larvæ* of the lepidoptera taken by searching and beating were the following :

Oak Eggar, *B. quercus*, var. *callunæ* Light Emerald, *M. margaritaria* Large Emerald, *G. papilionaria*	from birch.
Shaded Broad Bar, *T. variata* Pine Carpet, *T. firmata*	from pine.

Heath Rustic, *A. agathina*, from heather.

"We heard the Nightjar in the evening, and have seen the birds since."

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM, AND NEWCASTLE-UPON-TYNE

REPORT OF THE COUNCIL

FOR 1911–1912

THE Council are glad to report that the Society has had a successful year of work, chiefly, but not entirely, upon established lines; though as regards membership and general support there is less cause for satisfaction. The twelve months under review have seen a succession of strikes of railwaymen, colliers and dockers, crippling the industries of the district, and undoubtedly causing a withdrawal of support from societies depending upon voluntary subscriptions. By resignation the Natural History Society has lost 14 members, and by death 10, while 14 new members have joined, leaving a net loss of 10; the membership now standing at 406. It is hoped that each member will make the effort to introduce new subscribers to replace those unfortunately lost to the Society.

The Treasurer's accounts show a reduction of the deficit with which the year opened from £101 5s. 10d. to £66 4s. 10d., but in the present state of the Society's affairs a large debit balance is difficult to reduce materially.

One feature of the year's statistics, however, is more encouraging. The attendance of visitors to the Museum recorded in the last report was exceptionally low. In three years it had fallen by three thousand, and last year only 15,854 visitors passed the turnstile. This year there has been a marked recovery; and though the actual figure, 19,727, is swollen by the regular visits of school classes, yet even deducting the 2,305 due to this cause, the remainder shows something approaching a return to the normal attendance. With a few exceptions the lectures and "talks" have also been well attended. The average attendance at the lectures given at the ordinary evening meetings was 71, at the children's lectures 147, and at the Curator's "museum talks" 60. The field meetings of the summer months have been carried out with the usual measure of success. The Council, on behalf of the Society, wish here to record their thanks to those who prepared and delivered the lectures for their kind and much valued services.

This year has brought an extension of the use of the Museum upon lines which have been contemplated for some time by some of the members of the Council and officers of the Society. By an arrangement with the Newcastle Education Committee, certain classes in the elementary schools are now visiting the Museum on one afternoon in the week, and are being given a course of six lessons dealing chiefly with the vertebrate fauna of Britain—mammals, birds, reptiles, amphibians and fishes. The lessons were planned out in the first instance by the Curator, and were then rehearsed by him with the teachers who were to take the actual classes. So far as can be judged up to the present the experiment has been a very decided success. The classes have been conducted with excellent discipline, and there has been every appearance of keen interest among the children. In lieu of the entrance fees of children and teachers the Education Committee is paying the Natural History Society £10 for the year. Apart from the use of the collections by specialists, there is certainly no better purpose to which they could be put than that of interesting school children in natural history.

A further pleasing evidence that the educational value of the Museum is appreciated is that afforded by a recent resolution of the Council of Armstrong College, voting an annual subscription of £5 to the Natural History Society in recognition of its work in this and other directions.

The Museum building has not required any extensive repairs in the course of the year, but some costly alterations have been necessary in the electric lighting installation. The fusing of one of the main wires in the basement was very nearly the cause of a serious fire; and a thorough examination of the installation throughout the building showed that much of the wiring was unsuitable for carrying the voltage it now has to bear, and that in certain other respects the arrangements were none too safe. These defects have now been remedied. The best thanks of the Society are due to Mr. Wilfred Hall, who went to a great deal of trouble in examining the installation and advising the Council in regard to it.

Of the Society's Transactions, one part, forming the conclusion of Volume III., New Series, has been issued during the year, and another part is now almost ready. The Council fear that unless there is a substantial improvement in the financial outlook it may be necessary to suspend the publication of Transactions altogether for a time, though such a step would be taken with much regret, and would have an unfortunate effect upon the standing of the Society in the scientific world. With what success that standing has hitherto been maintained by means of the Transactions may be judged from a recent and most gratifying notice in *Nature*,* the leading general scientific review.

The Hancock Prize for 1911–12 was divided between Mr. Wm. Eltringham, of West Wylam, and Mr. John Baxter, of Birtley. Both prize-winners are excellent self-taught field naturalists, precisely such as the competition was founded to encourage, and it is a gratifying result of the annual offer of the Hancock Prize that it has brought into notice such a number of men of similar type who are doing really good work in various branches of local natural history.

The work done in the Museum during the year is described by the Curator in a later section of the report, but the Council wish here to express their thanks to the donors of the numerous gifts to the Museum, and to the gentlemen, of whom Mr. P. Walther must be mentioned specially, who have

* Vol. 88, p. 158, Nov. 30, 1911.

given valuable help in the work. The Council also record their appreciation of the excellent work done by the Curator and staff, particularly in modelling fishes, and of the enterprise shown by them in dealing with the whale stranded on the coast in the winter. The Museum was used on the evening of January 4th for a civic reception given by the Lord Mayor to the North of England Education Conference.

Among the members lost by death during the year was Mr. John Pattinson, who as a member of Council and as a vice-president has long been of much service to the Society. One of his last acts was to present to the Museum the oak pedestal case in which the condor is now exhibited. Mr. C. E. Stuart, who served as a member of Council, and lectured for the Society, has also passed away.

NEW MEMBERS ELECTED

FROM JULY, 1911, TO JUNE, 1912.

George B. Bainbridge, Espley Hall, Morpeth.

Frederick Beavan, Dene Brow, Jesmond Park West.

Edward J. Dove, J.P., Causey House, Gosforth.

T. Burdon Frazer, Woodside, Lindisfarne Road, Newcastle-upon-Tyne.

John Gardner, F.E.S., Laurel Lodge, Hart, West Hartlepool.

J. P. Maxwell Heron, 65, Eldon Street, Newcastle-upon-Tyne.

Sidney Reid, 26, Claremont Place, Newcastle-upon-Tyne.

Edmund R. Richardson, Monkton Lodge, Jarrow.

Frank Richardson, Clifton Cottage, Clifton Road, Newcastle-upon-Tyne.

Right Hon. Walter Runciman, M.P., Doxford Hall, Chathill.

John Smith, F.L.S., Shire Hall, Durham.

Gerald G. Stoney, Oakley, Heaton Road North, Newcastle.

Hon. W. Watson-Armstrong, Cragside, Rothbury.

Joseph Wright, 7, St. Mary's Place, Newcastle-upon-Tyne.

CURATOR'S REPORT ON MUSEUM WORK

1911–1912

To a considerable extent the work of the museum during the past year has been a continuation of that which chiefly occupied us in the year preceding it. Making casts of fishes, for example, has again been one of our principal lines of work. We have still further improved our methods, and our results with all kinds of fishes now show a practically uniform level of success. The majority of the casts that we have made are those of marketable marine fishes, but we have cast a number of other interesting fishes as well. We have also taken casts of a few animals other than fishes, including one or two snakes and a dolphin. Snakes proved very easy to deal with in comparison with fishes. The dolphin was an example of the rather uncommon white-sided species, *Lagenorhynchus acutus*; it was caught off the mouth of the Tyne, and measured nearly eight feet in length. As usual in the case of such a large cast as this, we are making the model in paper.

We have made fair progress with the large combined reference collection of beetles. The cabinets are now at the museum—previously we were working upon them at Mr. Bagnall's house at Penshaw—and this saves a good deal of time. We are now also in a position to make a beginning upon the new exhibited collection of insects. A range of desk-cases surmounted by a central row of upright cases has been adapted for its reception, and some of the material, chiefly exotic beetles and butterflies, is practically ready to be installed. A rather elaborate and somewhat costly system of shutters has had to be fitted to the cases to keep the light from the specimens when they are not actually being examined; without some such protection most insects are quickly spoilt.

Another matter which was referred to in the last report was the making of a tank in which to exhibit the giant squid presented by Mr. H. V. Charlton. To our great regret we were eventually obliged to abandon the upright tank which had cost us so much time and labour, and to content ourselves with showing the animal lying horizontally. For showing it in this position we were able to get a satisfactory tank made in teak, with plate-glass sides and top.

The experiment was tried last year of maintaining all through the summer an exhibition of fresh wild flowers. By the kindness of the members and others who collected for us we were able to carry it out successfully, and it was so much appreciated by visitors that we decided if possible to repeat it. This we have happily been able to do. From the latter part of April onwards there has been a continuous exhibit of wild flowers arranged along the counter in the entrance hall, and again the public have made much use of it. The amount of time which has to be spent upon the flowers is considerable, but the result seems to be distinctly worth it, and if the effort is as kindly supported in future as it has been during these two summers we hope to make the wild flower exhibition an annual feature of our work.

A large amount of excellent work has been done during the year upon the collection of minerals, in this case carried out almost entirely by one of the honorary curators, Mr. P. Walther. It is difficult to give an adequate idea of the extent and value of Mr. Walther's labours. He has examined an immense quantity of stored material, showing us what could be thrown away, what reserved for exchange, and what should be added to the collection. In the collection itself he has relieved much of the overcrowding by taking out unimportant specimens, and in a large number of doubtful cases he has settled the identity of minerals by analysis. The exhibited collection has been rendered much more reliable by the elimination of mistakes in identification and labelling, and among the specimens brought to light by Mr. Walther in the storeroom and elsewhere were many that were of very considerable value. At present Mr. Walther has plans in hand for further systematizing the arrangement and labelling of the collections. One of the greatest needs of the mineral section of the museum is a set of upright centre-cases for large show-specimens, and we hope it may before long be possible to have these made and fitted.

A piece of work which was far from the ordinary museum routine fell to our lot in February. A whale 45 feet long (a Rudolphi's Rorqual, *Balænoptera borealis*) was cast ashore to the south of Amble, and after a good deal of trouble we obtained leave to cut out the skeleton. This proved to be a heavy and extremely unsavoury job, with many unforeseen difficulties to be overcome. It involved the removal of fifteen tons of flesh, much of which, either because of its toughness or its putridity, was very difficult to deal with. The bones, too, were very hard to extract from their sheaths, and the skull alone weighed half-a-ton. The actual work on the shore occupied us for about ten days. In spite of its disagreeable nature and the discomforts it entailed it was well worth doing, for a really complete whale's skeleton is very hard to obtain, and in this case we were able to secure all the parts that are usually lost, such as the ear bones, cheek bones, hyoids, chevron bones, and the rudimentary hip bones. Most of the skeleton is being cleaned by burial in a sand pit which we made for the purpose in the museum grounds, but some of the smaller bones are macerating in the usual way in water. We still have before us the very considerable task of mounting the skeleton and suspending it.

Some minor matters may be briefly mentioned. A few birds have been set up, including an African coly presented by Mr. H. B. Wilson, and a little auk picked up alive during a snowstorm in Grey Street. The pedestal case containing the condor is now in position by the door of the committee room; the condor's cage in the grounds has been wired in and converted into an aviary for small birds. Apart from the regular school classes on Thursday afternoons, we have had visits from various parties of school children and other people, to whom I have usually given a short talk on some section of the collections.

Our thanks are due to a number of members and others, in addition to Mr. Walther, for help in the work of the museum. Mr. George Sisson has helped us in installing the reference collection of beetles and in elucidating the chemistry of some processes we employ in plaster casting. He is also doing valuable work in checking and editing the general index to the last series of Transactions. There have been many contributors to the wild flower exhibition; Mr. Randal B. Cooke's weekly supplies have been particularly useful, and we are much indebted to Miss Joyce Amsden for her regular help in arranging and attending to the flowers.

Of the many donations made to the museum during the year only very few can be referred to here. Living birds for the aviary have been given to us by Mrs. W. F. Henderson, Mr. H. B. Wilson, Mr. C. G. Petterson, Mr. P. Webster and others. Fishes for casting, in some cases obtained at considerable trouble, have been provided by Messrs. J. Alaric Richardson, Newbey S. Green, Hugh P. Angus, J. Simpson and Andrew Thomson; whilst Messrs. F. H. Phillips and Co. have again very kindly lent us some particularly fine fishes from their shops. A set of good ethnological specimens from Labrador has been presented by Mr. E. A. Payne. Mr. Henry T. Mennell, a former secretary of the Society, has sent us a most interesting collection of photographs of the distinguished local naturalists of the 'seventies, together with some letters of Joshua Alder and Albany Hancock. A full list of the donations will be found on a later page.

E. LEONARD GILL.

MUSEUM STAFF

CURATOR..E. LEONARD GILL, M.Sc.

ASSISTANT ....HERBERT FLETCHER.

LADY ASSISTANT AND SECRETARY.....MISS E. WELFORD.

ATTENDANT...................................WILLIAM VOUTT.

GARDENER ....ALBERT SPENCER.

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 26th, 1911

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Ridley.
Lord Barnard.
Lord Ravensworth.
The Bishop of Durham.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Andrew Noble, Bart., F.R.S.
Sir G. H. Philipson, M.D., D.C.L.
Sir John Swinburne, Bart.
Sir Lindsay Wood, Bart.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
E. J. J. Browell.
R. Coltman Clephan, F.S.A.
Clive Cookson.
Samuel Graham.
Principal W. H. Hadow, M.A., Mus. Doc.
N. H. Martin, F.R.S.E., F.L.S., F.C.S.
H. N. Middleton.
Col. C. W. Napier-Clavering.
Prof. M. C. Potter, M.A., Sc.D.

COUNCIL

G. A. Atkinson.
Hugh P. Angus.
R. S. Bagnall, F.E.S., F.L.S.
W. E. Beck.
H. I. Brackenbury.
J. L. Gracie.
Wilfred Hall.
T. E. Hodgkin, M.A.
Prof. H. J. Hutchens, M.A., M.R.C.S., D.S.O.
Prof. Alex. Meek, M.Sc., F.Z.S.
George Sisson.
J. D. Walker.

HON. SECRETARIES

C. E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

EVENING MEETINGS HELD DURING THE WINTER SESSION, 1911–1912.

Oct. 11.—Mr. F. Martin Duncan, F.R.M.S. : "The Romance of Marine Biology"; chair taken by Prof. Alex. Meek, M.Sc., F.Z.S.

Nov. 8.—Mr. S. Rennie Haselhurst, M.Sc. : "When Tynemouth was a Desert"; chair taken by Mr. Edwin Burnup.

Dec. 15.—Mr. John Smith, F.L.S. : "British Ferns"; chair taken by Mr. W. Mark Pybus.

Jan. 10.—Mr. Sydney Mangham, M.A. : "Types of British Vegetation"; chair taken by Mr. H. I. Brackenbury.

Feb. 14.—Mr. W. Buckley : "Starfishes"; chair taken by Mr. George Sisson.

Mar. 13.—Dr. A. Randell Jackson, M.D., D.Sc. : "Animal Partnerships"; chair taken by Mr. C. E. Robson.

Mar. 23.—Private Evening Meeting of the Society : Report on Field Meetings of 1911 by Mr. R. S. Bagnall, F.E.S., F.L.S., Chairman of the Field Meetings Committee. Reading of extracts from the two prize essays in the Hancock Competition by Mr. J. Baxter and Mr. W. Eltringham.

AFTERNOON LECTURES TO CHILDREN.

Dec. 28.—Mr. J. W. Nicholson, M.A., D.Sc. : "Mimicry in Butterflies and Moths"; chair taken by Mr. N. H. Martin, F.L.S., F.R.S.E.

Jan. 4.—Dr. R. Gordon Bell, F.R.C.S. : "Starch : a Romance of Plant Life"; chair taken by Principal W. H. Hadow, M.A., Mus. Doc.

CURATOR'S "MUSEUM TALKS."

Oct. 25.—The Structure of a Bird.
Nov. 29.—The Structure of a Fish.
Dec. 20.—Northumbrian Bird Life.
Jan. 31.—Corals.
Feb. 28.—The Reptiles.
Mar. 27.—The Summer Migrants.
Apr. 24.—Rock Pool Life.

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.
R. S. Bagnall, F.E.S., F.L.S.
Rev. W. McLean Brown.
Harry Eltringham, M.A., F.Z.S.
Samuel Graham.
Prof. G. A. Lebour, M.A., D.Sc.
Prof. Alex. Meek, M.Sc.
Prof. M. C. Potter, M.A., Sc.D.
P. Walther.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1912.

COL. C. H. E. ADAMSON, C.I.E.—Nest of goldfinch from which a brood was hatched in the donor's garden at North Jesmond in the summer of 1911. A further volume (vol. viii.) of "Lepidoptera Indica."

HUGH P. ANGUS.—Graylings from the river Till. A living example of the rare slug *Testacella haliotoidea* from a local greenhouse.

JOS. G. ANGUS.—A Berlepsch nesting box (subsequently used by blue tits in museum grounds).

GEO. A. ATKINSON.—A turnstone shot by the donor at Holy Island.

R. S. BAGNALL, F.E.S.—Examples of twelve species of British fleas.

C. J. BAILES.—A number of natural history specimens from the neighbourhood of Port Elizabeth, South Africa; including house snake, baumslang, scarpstecker and other snakes.

MISS C. A. BELL.—Various snakes and other spirit specimens; including a cobra, a python, a grass snake caught in the Tyne at Bywell, some centipedes and scorpions.

SEYMOUR BELL.—Cocoa pod from Panama. Crude rubber as gathered in Brazil.

MRS. WM. BLAKEY.—A fine colony of madrepore coral.

MR. BLENKINSOP.—Heads of bull, cow and calf from the Haggerston herd of Indian humped cattle.

GEORGE BOLAM.—Two marsh tits, sent to illustrate the difference between the typical race and the "willow tit."

K. BRUCE.—Some natural history drawings and diagrams (mollusca, etc.) by the late G. F. Angas.

MRS. CATCHESIDE.—An emu's egg.

JAS. CAYGILL.—Pieces of a shale from the Lowlands of Scotland bearing crustacean carapaces (*Ceratiocaris?*). Geological specimens from the neighbourhood of Consett, including some Coal Measure plants and numerous samples of glacial boulders.

THOS. CHANDLER.—Fossils from the Lias and the Chalk.

HUGH V. CHARLTON.—Two little auks from the coast near Cullercoats.

ISAAC CLARK.—Young barn owl in the flesh, and young stone curlew set up by the donor; both from Hampshire.

R. COLTMAN CLEPHAN.—A piece of silicified wood from Egypt, showing galleries of boring insects.

WALTER S. CORDER.—Fresh stems and heads of Egyptian papyrus grown at North Shields.

R. J. DEWAR (per G. G. Laidler, Junr.)—A little auk picked up alive in Grey Street on Feb. 2nd; kept alive at the museum for a day.

A. H. DICKINSON.—Embryo nest of tree wasp, *Vespa norvegica*, found at Warkworth in a hole in a wall—a very unusual situation.

ALEX. DICKSON.—A very complete example of dichotomy in the chick.

MRS. DINNING.—Drawings in water colour by John Hancock, used at the Newcastle meeting of the British Association in 1838 to illustrate the distinctions between the Greenland and Iceland falcons.

WM. ELTRINGHAM.—Nodules from Crawcrook with fish scale, *Neuropteris tenuifolia*, *Cordaianthus*, etc.

MISS EMBLETON.—Oil painting of Barras Bridge early in the nineteenth century, by the donor's mother after T. M. Richardson, Senr.

GEO. A. EMERY.—Fine egg of razorbill.

ERIC FALLOWS.—Nest of tree wasp, *Vespa norvegica*, from heather.

MESSRS. W. FERGUSON AND SON.—A cast of one of the Elgin Marbles.

JOHN FORSTER.—Stuffed specimens of a Virginian owl and a long-eared owl.

THOS. GATISS.—A box of striking exotic beetles.

I. A. GOLDBERG (Kimberley).—Two Kaffir wire bracelets.

SAML. GRAHAM.—An adder killed near Bellingham. Nest and eggs of skylark. Necklace from native woman, Omdurman. A young cuckoo, alive. A primitive wrought-iron oil lamp, of the pattern known as the Scotch crusie.

NEWBEY S. GREEN.—A pike caught for the museum in Crag Lough by the donor. Gulls' and terns' eggs from the west coast of Ireland.

MISS L. F. HALEY.—Eggs and newly hatched young of a South-European stick insect. (Examples reared and still living at the museum).

WM. HALL.—A young albino woodpigeon, caught alive by the donor at Fatfield. (Still living in the aviary).

J. HARRIS.—A small lizard (a gecko) imported among bananas.

GEO. E. HENDERSON.—Two specimens of the kea parrot of New Zealand.

RICHD. JOHNSON.—Egg of kelp goose (*Cloëphaga magellanica*) laid in Brandling Park, Newcastle.

T. KING.—Small sting ray, *Trygon pastinaca*, caught 15 miles east of Hartlepool.

MRS. CHAS. LOW.—A living Greek tortoise.

PROF. ALEX. MEEK.—A large torpedo (electric ray) taken in the North Sea.

HENRY T. MENNELL.—Portraits (photographs) of a number of the distinguished naturalists connected with the Society about 1860-70. Some interesting letters from Joshua Alder and Albany Hancock.

C. G. PETTERSON.—A living male red bishop (a South African weaver-bird, *Pyromelana oryx*) for the aviary.

E. A. PAYNE.—Indian and Esquimo ethnological objects from Labrador, including a primitive Esquimo lamp, a dog whip, models of sledge and kajak, Indian snowshoes and caribou fur coats.

MISS PLOTNICKI.—Sinter from the hot springs of New Zealand.

EDWD. REED.—A human skull found exposed by a flood in the bank of the Tyne at Ryton.

J. ALARIC RICHARDSON.—A tench for casting. Fine tusk of narwhal.

J. D. ROBINSON —Photograph of a tree at Folkestone, the trunk of which has grown round some railings.

HENRY J. ROBSON.—Two Egyptian ushabti.

J. SIMPSON.—Various fishes, including a weever, a dragonet, a rockling, thornback skates, etc.

STANLEY SMITH, M.Sc.—Fossil bone (*Bos*?) from Pleistocene gravel, Newmarket; impregnated with silica.

DR. J. A. SMYTHE.—Specimen of the Crook-dene anorthite dyke.

CAPT. J. STRAKER.—Deposited on loan: cases of Indian and other foreign birds; heads and skulls of Indian game animals; some miscellaneous geological and other objects.

SUNDERLAND MUSEUM COMMITTEE.—Skull of an elephant seal.

W. SWANSTON.—A woodcock killed against a window in the donor's house in Sydenham Terrace, Newcastle, in November.

Arthur Tate (Amble).—Microscope slides prepared by the donor: foraminifera, etc., and sections of whalebone.

Nathan E. Thompson.—A little auk found near Broomhill.

Andrew Thomson.—A fine male example of the striped wrasse taken near the Pentland Skerries.

T. R. Wallace.—Three adders from Woodburn.

P. Walther.—Fine piece of crystalline brochantite from Chile. A Masai spear.

P. Webster.—Two young turtle doves or the aviary.

H. B. Wilson.—A pair of living violet doves for the aviary. A South African olive weaver bird. A pair of African colies or mouse-birds with two young.

Miss Wraith.—A collection of pressed plants.

Jos. Wright.—Photographs of the interior of the old museum. Portrait engraving of George Allan.

A. C. Young.—A partridge for the aviary.

W. H. Young, F.L.S.—Living male and female of the great black water beetle, *Hydrophilus piceus*.

ADDITIONS TO THE LIBRARY

BY EXCHANGE AND DONATION

FROM JULY 1ST, 1911, TO JUNE 30TH, 1912

BRITISH SOCIETIES AND INSTITUTIONS

Cambridge University:—Philosophical Society.
Proceedings, vol. 16, parts 3–6.
Report for 1910.

Cardiff:—Naturalists' Society.
Transactions, vol. 43.

Dublin:—Royal Dublin Society.
Scientific Proceedings, vol. 12, no. 37, title and index; vol. 13, nos. 1–11.
Economic Proceedings, vol. 2, nos. 3–4.

Edinburgh:—Botanical Society.
Proceedings, vol. 31, part 5; vol. 32, part 1.
Notes, nos. 22–24, 26–27.

Glasgow:—Geological Society.
Transactions, vol. 14, part 1.

London:—British Association for the Advancement of Science.
Report of 80th Meeting, Sheffield, 1910.
,, 81st ,, Portsmouth, 1911.

London:—British Museum (Natural History), South Kensington.
Catalogue of African Freshwater Fishes, vol. 2.
,, Moths, vol. 10 (text and plates).
Handbook of Tsetse-flies.

London:—Quekett Microscopical Club.
Journal, ser. 2, vol. 11, no. 69.

London:—Zoological Society.
Proceedings, 1911, parts 2–4; 1912, part 1.
Transactions, vol. 18, part 5; vol. 20, part 1.
Zoological Record, vol. 46, 1909; vol. 47, 1910.

Manchester:—Literary and Philosophical Society.

Memoirs and Proceedings, vol. 55, part 3; vol. 56, part 1.

Manchester:—Manchester Museum, The University.

Report, 1910–11.

Millport:—Marine Biological Association of the West of Scotland.

Annual Report for 1910.

Newcastle-on-Tyne:—North of England Institute of Mining and Mechanical Engineers.

Transactions, vol. 58, part 8; vol. 59, part 9; vol. 61, parts 4–8; vol. 62, parts 1–5.

Annual Report, 1910–11.

Newcastle-on-Tyne:—Northumberland Sea Fisheries Committee.

Report on the Scientific Investigations for 1910-11.

Newcastle-on-Tyne:—University of Durham Philosophical Society.

Proceedings, vol. 4, part 2.

Norwich:—Norfolk and Norwich Naturalists' Society.

Transactions, vol. 9, part 2.

Norwich:—Castle Museum.

Museum Report for 1911.

Catalogue of Loan Collections, 1911.

4th Annual Report of the Norwich Museum Association.

Oxford:—Ashmolean Natural History Society.

Proceedings and Report for 1911.

Plymouth:—Marine Biological Association.

Journal N.S., vol. 9, no. 2.

Southport:—Society of Natural Science.

15th Report, 1910-11.

Stratford, Essex:—Essex Field Club.

"The Essex Naturalist," vol. 16, parts 7–9.

York:—Yorkshire Philosophical Society.

Annual Report for 1910.

COLONIAL SOCIETIES AND INSTITUTIONS

Cape Town:—South African Museum.

Annals, vol. 2, part 2; vols. 5–6, title and index; vol. 7, part 4; vol. 8, part 1; vol. 10, parts 1, 2; vol. 11, part 1.

Colombo:—Ceylon Marine Biological Laboratory.

Ceylon Marine Biological Reports, part 6, nos. 20–22.

Ottawa:—Geological Survey of Canada.

Memoirs, nos. 4, 10, 11, 9-E, 15-P, 16-E, 27.
Report no. 1064.
Map no. 1066.
Summary Report for 1910 (1170).

Sydney, N.S.W.:—Australian Museum.

Report of Trustees for 1910–11.
Records, vol. 9, part 2.

Sydney, N.S.W.:—Royal Society of New South Wales.

Journal and Proceedings, vol. 43, parts 2–4; vol. 44, parts 1–4; vol. 45, parts 1–2.

Sydney, N.S.W.:—Technological Museum.

Annual Report, 1910.

Western Australia:—Geological Survey.

Bulletin 41.

AMERICAN SOCIETIES AND INSTITUTIONS

UNITED STATES OF AMERICA

Ann Arbor:—Michigan Academy of Science.

13th Annual Report.

Berkeley:—University of California.

Geological Bulletin, vol. 5, title page and index; vol. 6, nos 5–19.
Botanical Bulletin, vol. 4, no. 11.
Zoological Publications, vol. 6, no. 15; vol. 7, nos. 7–8; vol. 8, nos. 1–2, 4–7.

Boston:—American Academy of Arts and Sciences.

Proceedings, vol. 46, nos. 18–24; vol. 47, nos. 1–15.

Buffalo:—Society of Natural Sciences.

Bulletin, vol. 10, no. 1

Cambridge:—Museum of Comparative Zoology, Harvard College.

Bulletin, vol. 53, nos. 5–9; vol. 54, nos. 6–10; vol. 55, no. 1.

Memoirs, vol. 25, no. 3; vol. 28, no. 2; vol. 39, no. 2; vol. 40, no. 3; vol. 45, no. 1.

Annual Report of the Curator, 1910–11.

Cincinnati:—Lloyd Library.

Bibliographical Contributions, nos. 3–5.

Chicago:—Academy of Sciences.

Special Publication, no. 3.

Bulletin, vol. 3, nos, 4–5.

Chicago:—Field Columbian Museum.

Geological Series, vol. 3, no, 9 (publication 151).

New Haven:—Connecticut Academy of Arts and Sciences.

Transactions, vol. 16, pages 383–407.

New York:—Academy of Sciences.

Annals, vol. 20, no. 3; vol. 21, nos. 1–6; vol. 21, pp. 87–117, 119–156, 157–175.

Philadelphia:—Academy of Natural Sciences.

Proceedings, vol. 63, nos. 1–3.

Philadelphia:—American Philosophical Society.

Proceedings, vol. 50, parts 199–202.

Transactions, vol. 22, part 1 (new series).

Portland:—Portland Society of Natural History.

Proceedings, vol. 2, part 9.

St. Louis:—Missouri Botanical Gardens.

22nd Annual Report.

Washington:—Smithsonian Institution.

Annual Report, 1910.

Miscellaneous Collections, vol. 53; vol. 56, nos. 12, 16, 18-37; vol. 57, nos. 2–8; vol. 58, no. 1; vol. 59, nos. 2–5.

Smithsonian Contributions to Knowledge, vol. 27, part 3.

Publications, nos. 2013, 2060.

Washington:—Smithsonian Institution, U.S. National Museum.

Bulletin, no. 50, part 5; nos. 71, 76, 77.

Proceedings, vols. 38–40.

Publications, nos. 1862, 1873.

Contributions from the U.S. National Herbarium, vol. 13, parts 10–12 vol. 14, part 3; vol. 16, part 1.

Annual Report, 1909-10.

Washington:—United States Geological Survey.
Mineral Resources of the U.S., 1909, part 12.
Monograph 52.
Bulletins, 431, 436, 438, 439, 443, 445–447, 449–465, 467–469, 472–483, 486–490, 495.
Professional Papers, 70, 72, 73, 75.
Water-supply Papers, nos. 256–258, 261, 265–270, 272–277.

SOUTH AMERICAN STATES, ETC.

Mexico:—Instituto Geologico.
Boletin, num. 28.
Parergones, tomo 3, numero 7–10.

Montevideo:—Museo de Historia Natural.
Anales, vol. 7, tomo 4, ent. 3.

EUROPEAN SOCIETIES AND INSTITUTIONS

Barcelona:—Club Montanyenc.
Any 1, nos. 2-3.

Bergen:—Bergens Museum.
Aarbok, 1911, hefte 1–3.
Aarsberetning for 1911.
Crustacea of Norway (G. O. Sars), vol. 5, parts 33–36.

Brussels:—Royal Museum of Natural History.
Mémoires, vol. 2 (Papers read at 1st International Congress of Entomology).

Christiania:—Videnskabs-Selskabet.
Forhandlinger, 1910.

Copenhagen:—Naturhistoriske Forening.
Videnskabelige Meddelelser, bind 63.

Dresden:—Naturwissenschaftliche Gesellschaft "Isis."
Sitzunsberichte und Abhandlungen, 1911.

Frankfurt-am-Main:—Senckenbergische Naturforschende Gesellschaft.
Bericht, 42, 1911, hefte 1–4.

Hamburg:—Naturwissenschaftlicher Verein.
Verhandlungen, 1910, dritte Folge, 18.

Helsingfors:—Societas pro Fauna et Flora Fennica.

Acta 35.

Meddelanden, parts 36–37.

Kiew, Russia:—Société des Naturalistes.

Mémoires, tome 21, parts 3–4.

Lisbon:—Société Portugaise des Sciences Naturelles.

Bulletin, vol. 4, fasc. 3; vol. 5, fasc. 1.

Marseille:—Bibliothèque de la Faculté des Sciences.

Annales, tome 19.

Paris:—Muséum d'Histoire Naturelle.

Bulletin, 1910, nos. 6–7; 1911, nos. 1–4.

Portici:—Laboratorio di Zoologia Generale d' Agraria.

Bolletino, vol. 5.

Rostock:—Naturforschende Gesellschaft.

Sitzungberichte und Abhandlungen, Band 3.

Stockholm:—Kongliga Svenska Vetenskaps-Akademien.

Handlingar, vol. 46, nos. 4–11; vol. 47, no. 1.

Arsbök, 1911.

Arkiv for Botanik, vol. 10, parts 2–4.

,, Matematik, Astronomi och Fysik, vol. 6, part 4; vol. 7, parts 1–2.

,, Kemi, Mineralogi och Geologi, vol. 4, part 2.

Meddelanden, vol. 2, part 1.

Les Prix Nobel, 1909 and 1910.

Upsala:—Geological Institution, University of Upsala.

Bulletin, vol. 11.

Bref och Skrifvelser af och till Carl von Linné, del vi.

Results of the Swedish Zoological Expedition in 1901, part 4.

MISCELLANEOUS.

"Fauna of British India": Freshwater Sponges, Hydroids, and Polyzoa, by N. Annandale, D.Sc; Coleoptera (General Introduction Cicindelidae and Paussidae), by W. W. Fowler, M.A., D.Sc., F.L.S.

Presented by the Secretary of State for India in Council (India Office).

Reprint of Paper by Dr. G. S. Brady, D.Sc., F.R.S., C.M.Z.S.:—
"Notes on Marine Ostracoda from Madeira."

Presented by the Author.

Reprint of paper by Prof. A. Meek, M.Sc., F.Z.S., F.L.S., and R. A. H. Gray, M.Sc. :—

"Corstopitum : report on the excavations in 1910. Animal Remains."

Presented by Prof. Meek.

"British Desmidiaceæ," vol. 4, by W. and G. S. West.

"The British Tunicata," vol. 3, by Joshua Alder and Albany Hancock.

From the Ray Society (by subscription).

Linnean Society of London :—

Transactions, vol, 24, part 3.
,, 25, parts 1-3.
,, 26 ,, 1-4.
,, 27 ,, 1-4.
,, 28 ,, 1-4.
,, 29 ,, 1-3.
,, 30 ,, 1-3.

General Index for Vols. 1-25.

Transactions—2nd Series—Botany.
Vol. 1, parts 1-9.
,, 2, ,, 1-16.
,, 3, ,, 1-11.
,, 4, ,, 1-4.
,, 5, ,, 1-15.
,, 6, ,, 1-11.
,, 7, ,, 1-15.

Transactions—2nd Series - Zoology.
Vol. 1, parts 2-8.
,, 2, ,, 1-3 and 5-18.
,, 3, ,, 1-6.
,, 4, ,, 1-3.
,, 5, ,, 1-11.
,, 6, ,, 1-8.
,, 7, ,, 1-11.
,, 8, ,, 1-13.
,, 9, ,, 1-14.
,, 10, ,, 1-10.
,, 11, ,, 1-7.
,, 12, ,, 1-5.
,, 13, ,, 1-4.
,, 14, part 1.

Journal—Botany.
Vol. 39, nos. 273–274.
" 40, " 275–276.

Journal—Zoology.
Vol. 31, no. 208.
" 32, nos. 211, 212.

Proceedings—
122nd Session, 1909–1910.
120th " 1907–8.

List of Fellows—
1910–11.

Catalogue of Papers in the Transactions of the Linnean Society, 1791–1905.

Presented by Henry T. Mennell, Esq., F.L.S.

"Museums Journal," July, 1911, to June, 1912.

From the Museums Association (by subscription).

"Nature," July 1st, 1911, to June 30th, 1912.

Presented by the Publishers.

THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM 1ST JULY, 1911, TO 30TH JUNE, 1912

RECEIPTS		£	s.	d.
Members' Subscriptions		366	11	0
Museum Admission Fees		136	13	11
Sale of Guide Books, etc.		7	15	4
Interest on Investments		369	5	10
Sundries		15	15	9
Deficit, 30th June, 1912		66	4	10
		£962	6	8

PAYMENTS				£	s.	d.
Deficit, 30th June, 1911				70	13	11
Salaries				585	10	5
Advertising				8	19	10
Fuel, Lighting, and Water				66	15	6
Insurance				26	18	10
Materials and Fittings				34	11	0
Postage and Carriage				11	5	8
Printing				23	19	6
Property Tax				10	11	1
Building Repair Fund				40	0	0
Stationery				2	11	3
Publication Account				18	2	2
Subscriptions: Museums Association	1	1	0			
Dove Marine Laboratory	10	0	0			
Ray Society	1	1	0			
Entomological Congress	1	0	0			
Expenses re Whale	13	10	5			
Sundries	35	15	1			
				62	7	6
				£962	6	8

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

BUILDING REPAIR FUND

	£	s.	d.		£	s.	d.
Transfer from General Account	40	0	0	Deficit, 30th June, 1911	30	11	11
				Sundry Repairs	8	13	9
				Balance, 30th June, 1912	0	14	4
	£40	0	0		£40	0	0

CRAWHALL LEGACY ACCOUNT

	£	s.	d.		£	s.	d.
Balance in Bank, 30th June, 1911	53	12	3	Placed on deposit with Crown Permanent Benefit Building Society	300	0	0
Residue of Legacy	600	0	0	Placed on deposit with Crown Benefit Building Society	300	0	0
Balance of Legacy	25	0	1	Harry Brazenor—remounting panther	6	4	7
Interest on Investments	22	18	7	Dinning and Cook—new cisterns	7	8	6
Bank Interest on Account	1	15	10	Robson and Coleman—altering installation	21	15	9
				Gundlach und Müller—glass jars	5	7	2
				J. W. Bowes—tank for squid	3	16	10
				Balance in Bank, 30th June, 1912	58	13	11
	£703	6	9		£703	6	9

SAML. GRAHAM }
W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

PUBLICATION ACCOUNT

	£	s.	d.		£	s.	d.
Balance from No. 2 Account	1	12	0	Postage and Carriage	3	11	2
Sale of Transactions	0	19	6	Philipson and Son—blocks	3	1	6
Balance to General Account	18	2	2	W. West—lithographing	11	6	0
				J. Swain and Son, Ltd.—engraving	2	15	0
	£20	13	8		£20	13	8

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1912 :—

£	s.	d.			Taken at cost. £	s.	d.
£2,000	0	0	Newcastle Corporation $3\frac{1}{2}$ per cent. Irredeemable Stock (Coppin Bequest)		2,000	0	0
500	0	0	River Wear Commission $4\frac{1}{2}$ per cent. Funded Debt		500	0	0
2,000	0	0	Tyne Commissioners' Consolidated Fund at 4 per cent.		2,000	0	0
2,946	18	1	Midland Railway Company's Consolidated $2\frac{1}{2}$ per cent. Preference Stock	Crawhall Bequest	6,000	0	0
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock				
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock.				
					£10,500	0	0

SAML. GRAHAM }
W. J. BELLERBY } Hon. Auditors

A. H. DICKINSON, Hon. Treasurer.

NATURAL HISTORY SOCIETY

OF

NORTHUMBERLAND, DURHAM AND NEWCASTLE-UPON-TYNE.

REPORT OF THE COUNCIL

FOR 1912–1913.

Though there has been no such augmentation of support for the Natural History Society as is needed for a fuller development of its work, it is at least a satisfaction to the Council this year to have no falling-off to record. The membership shows a slight gain: the number lost by death (13) and resignation (15) is rather more than counterbalanced by the accession of 33 new members, and the membership now stands at 410.

The turnstile figures, showing the year's attendance of visitors to the Museum, are less satisfactory. The actual total, 19,566, includes the school classes which now visit the Museum regularly; excluding the figures for these classes the year's total would be only 15,382, which would represent a considerable decrease as compared with the records of four or five years ago. The Education Committee of Newcastle have renewed the arrangement made last year, by which classes from their elementary schools visit the Museum on Thursday afternoons in term time. It is much to be regretted, however, that they have abandoned the definite course of lessons which was planned by the Curator and followed during most of last year. The difficulty appears to have been to find sufficient time in the curriculum for repeated visits by the same class.

No extraordinary expenditure has been incurred during the past year, but as will be seen from the balance sheet, a deficit has again arisen on the year's working, due to the cost of publication of the Society's Transactions. It would be a matter of great regret to the Council if the printing of the Transactions had to be suspended for lack of funds.

As usual, a syllabus of lectures and "museum talks" was arranged for the winter months, and the best thanks of the Society are due to those who prepared and delivered the six ordinary lectures and the two lectures for young people. The average attendance may be considered distinctly good: for the ordinary lectures it was 74 and for the children's lectures 105. The attendance at the Curator's "museum talks" shows a falling off—it is to be hoped merely temporary—to an average of 44. At the suggestion of some of the members who regularly attend the field meetings, the experiment was tried during the winter of holding a few informal meetings at the Museum for the discussion and illustration of practical work in different branches. This was tried only in a tentative way, but with results that were distinctly encouraging.

One part of the Society's Transactions has been published during the year. It forms the much-delayed conclusion of the old series, and also completes the catalogue of local Lepidoptera by the late John E. Robson. The author's death occurred just as the first sheet of this concluding part was going through the press, and Mr. Eustace R. Bankes, the well-known entomologist who kindly undertook to edit the remainder, was eventually obliged by ill-health to abandon it. Finally Mr. John Gardner was persuaded to take it in hand, which he was well qualified to do, as he has studied the local Micro-lepidoptera more thoroughly than anyone else and was himself responsible for a large part of the records. He was assisted by Mr. C. O. Trechmann, who also prepared the index. The indebtedness of the Society to both of these gentlemen has been expressed to them by the Council. A very useful piece of work, the preparation of a general index to the whole of the last series of Transactions, has now also been brought to a conclusion. The separate indexes for the volumes were prepared by various members, and the work of combining them into a general index has been carried out almost entirely by Mr. George Sisson. He has also very kindly had a copy typed and bound for immediate use.

A beginning has been made with an index of another and much more extensive kind, a card catalogue of the fauna and flora of Northumberland and Durham. This was first advocated by Mr. R. S. Bagnall, and he, the Rev. J. E. Hull, Mr. W. H. Young and others have already made themselves responsible for considerable sections of it. The catalogue is intended to form a permanent record of what is known of each species in the two counties, and as it will be in the form of cards, one for each species, it will be easy to make any additions to it that may be required. Such a catalogue will be of the greatest possible use to future workers.

The Hancock Prize Competition again produced some good essays. The judging was undertaken by the Rev. J. E. Hull and Mr. George W. Temperley, who had no hesitation in awarding the prize to Mr. J. Horsley for an essay describing the birds seen during a walk along the coast near Bamburgh. For the forthcoming competition additional prizes are offered by the President. Lord Joicey is providing a second prize of the value of £2, and two junior prizes, of the value of 25s. and 15s. respectively, for competitors under sixteen years of age. The Council particularly welcome this encouragement to juvenile naturalists, and would be glad if it could be made an annual adjunct to the main competition.

A few other matters which have been before the Council during the year may be briefly alluded to. Mr. J. D. Challoner was appointed a member of the Council during the year, to fill the place of Mr. George A. Atkinson, who had gone abroad. Col. C. H. E. Adamson succeeds the late Mr. R. R. Dees as the representative of the Natural History Society on the Board of Governors of Armstrong College. The Museum grounds have received a good deal of attention and various improvements have been carried out, notably in the condition of the grass and the groups of shrubs. As usual, the Society has been indebted to a number of members and others for gifts of museum specimens; these are acknowledged in a later section of the report. Of gifts of other kinds, one which calls for special mention is that of a first-class camera. The need of a camera has often been felt at the Museum, and it is chiefly owing to the kindness of Mr. W. E. Beck that it has at length been supplied. Mr. Beck gave £10 towards the purchase, and other members have contributed most of the remaining cost of the camera and the apparatus connected with it. Further sums for this purpose will be gladly accepted, as the original contributors did not wish any of the cost to come upon the general funds.

A great loss to the Society and to north-country natural history has been suffered in the death of the Rev. W. J. Wingate. He was best known as an authority on the Diptera or two-winged flies, and his modestly named "Catalogue of Durham Diptera," published as the second volume of the new series of Transactions, has had a large sale as being the only real introduction to the study of the Diptera in the English language. His large collection of local flies he presented to the Museum some years ago. But Mr. Wingate's knowledge of nature was by no means confined to this group of insects; he was a good botanist and a good geologist as well, and by his energy as an organiser and lecturer he did great service to the local scientific societies of the county of Durham.

Several active and useful members have unfortunately been lost during the year by removal to other parts of the country. Among them are Mr. B. Amsden, the Rev. J. M. Hick and Mr. George W. Temperley. Mr. R. S. Bagnall, though retaining his connexion with the Society, has gone to Oxford as assistant to Prof. Poulton in the Hope Department of the University Museum; and while much regretting his loss to this district, we congratulate him on his appointment to such an important and congenial post. In view of the difficulties under which he has worked hitherto, his rise within a few years to a position of such prominence as an entomologist is remarkable. To help forward a gifted naturalist like Mr. Bagnall in the earlier stages of his career is one of the happiest functions which such a body as the Natural History Society can have the opportunity to discharge.

NEW MEMBERS ELECTED

FROM JULY, 1912, TO JUNE, 1913.

Thomas Anderson, M.A., B.Sc., Armstrong College, Newcastle-upon-Tyne.

T. Lindsay Bainbridge, Holmwood, Clayton Road, Newcastle-upon-Tyne.

Francis A. Beane, Lloyds' Bank, Collingwood Street, Newcastle-upon-Tyne.

G. F. Bell, 4, Tankerville Terrace, Newcastle-upon-Tyne.

J. T. Boocock, 80, Falmouth Road, Heaton.

Mrs. A. Brewis, East Ellesmere, Granville Road, Newcastle-upon-Tyne.

Chas. F. Charlton, 21, Claremont Place, ,, ,,

J. P. Cornett, Ford Paper Works, Hylton, Sunderland.

Mrs. Coulson, 2, Framlington Place, Newcastle-upon-Tyne.

Ivan East, Greenhill, Jesmond Park, ,, ,,

F. W. Gardner, B.A., 12, Roxburgh Place, Heaton.

G. H. Glendenning, Eslington Terrace, Newcastle-upon-Tyne.

Percy Gordon, 64, Osborne Road, ,, ,,

Miss H. M. Gurney, M.B., B.S., The White House, Grainger Park Road, Newcastle-upon-Tyne.

W. J. Hardie, Backworth Coal Co., Ltd., Milburn House, Newcastle-upon-Tyne.

J. D. Hodgson, Linton Villa, Grainger Park Road, Newcastle-upon-Tyne.

Wm. F. Horsley, St. Helen's Terrace, Low Fell.

Jas. Logan, 10, Eskdale Terrace, Newcastle-upon-Tyne.

Coun. George Lunn, Moorfield, Gosforth.

J. J. Maguire, Edgmere, Adderstone Crescent, Newcastle-upon-Tyne.

W. Maughan, 13, Mosley Street, Newcastle-upon-Tyne.

N. F. Ramsay, 131, Osborne Road, ,, ,,

Dr. J. A. Smythe, 10, Queen's Gardens, Benton.

Philip Spence, Mellbreak, Elmfield Park, Gosforth.

Chas. E. Straker, High Warden, Hexham.

E. W. Swan, The Pele Tower, Corbridge.

John Talbot, M.A., B.Sc., 4, Brandling Park, Newcastle-upon-Tyne.

Thomas Wallace, 42, Mosley Street, Newcastle-upon-Tyne.

H. S. Wallace, F.E.S., 17, Kingsley Place, Heaton (from Associate).

W. Walther, Eastfield House, Granville Road, Newcastle-upon-Tyne.

Geo. Welsh, 4, Devonshire Terrace, Newcastle-upon-Tyne.

ASSOCIATE MEMBERS.

C. W. Coyle, 36, Stanton Street, Newcastle-upon-Tyne.

John Jeffrey, B.Sc., 71, Malvern Street, Newcastle-upon-Tyne.

CURATOR'S REPORT ON MUSEUM WORK

1912–1913.

The past year has produced no such exciting or strenuous incidents as were provided the year before by the whale whose skeleton we cut out on the coast near Amble. A considerable amount of solid work has been accomplished, however, in addition to the incidental duties which necessarily take up a great deal of our time. In the main our work has followed the lines of the preceding year or two. The chief deviation, in fact, has been the preparation of the whale's bones. Nearly all of them we had buried in a sand pit made for the purpose in the museum grounds, and on opening it early this summer we were pleased to find that many of the bones were ready for the final cleaning and preparation for mounting. This we accordingly took in hand, and we now have the ribs, shoulder blades, various smaller bones and most of the vertebrae finished and brought indoors. The cervical vertebrae and the smaller caudals we had put to macerate in the usual way in water, and we were surprised at the little progress they had made compared with the bones in the sand. We have transferred them all to sand to finish the process. The skull and jaws have also had to be put back in sand for a few months longer, though all but small portions of them are finished.

We have taken casts of a certain number of fishes during the year. The most important are a set which nearly complete our representation of the life history of the salmon; we now have the stages known as parr, smolt, grilse, fresh-run salmon, and kelt. We have also made casts of a few things other than fishes, the largest being a full-grown porpoise. A particularly elaborate and difficult cast was that of a squid: the animal was too large to mount in any but a very expensive jar, and we obtained a perfect cast of it by means of a waste-mould in wax.

It has been suggested to us that we should make and supply casts of certain of our unique local fossils, and we have tried some experiments in that direction, but the difficulties to be overcome are great. The fossils, especially the amphibian skulls in Coal Measure shale, are far too fragile for ordinary methods. We have not yet found a means of taking moulds that we can safely employ on the most valuable specimens, most of which have been extensively broken and mended in cleaning them from the matrix; though where the fossils are sound enough we can reproduce them very perfectly.

We are gradually getting on with the work we have had in hand for some time on the insects. The beetles are the section we have chiefly been engaged upon, and we are working at two different sets of beetles, the general set for public exhibition and the large British reference collection. The set for exhibition is nearing completion. Its preparation has involved a great deal of detailed work—selecting the specimens, getting them named and labelled, relaxed, set and classified; and we are anxious to get it finished in order to start upon the butterflies and moths. The reference collection of British beetles, which we are forming by combining the fine private collections of Mr. John Gardner, Mr. R. S. Bagnall and the late T. J. Bold, is gradually taking shape. But it is an enormous undertaking, and it is only by working at it in the evenings that we have been able so far to make any progress with it at all. For the exhibition series of butterflies we now have a large amount of material in hand. Our stock was weakest in South American species, and much has been done to remedy that defect by the purchase of the late Capt. D. H. Nash's collection, in which the South American lepidoptera are well represented. One special set of lepidoptera is already on view in the new insect cases. It is a collection of the wild silk-moths of the world which we obtained by exchange with Mr. J. H. Watson, of Manchester, and includes not only the wild species whose silk is already in use, such as the Shantung, Tussore and Eria silk-moths, but also many others which appear to be more or less adapted for commercial exploitation. We have to thank Col. C. H. E. Adamson for the help he has given us in this department by naming for us a number of Asiatic butterflies.

Mr. P. Walther has continued his work on the minerals with unabated vigour, and we cannot speak too highly of the service he is rendering in this department of the museum. He has continued the testing of doubtful specimens, especially among the metallic ores, has sorted through further batches of unidentified minerals, made out a very large number of new labels, and is taking various steps for more completely systematizing the collection. For some time we gave one evening a week to writing labels for the specimens he had been working upon. During the year Mr. Walther has also negotiated for us a very useful exchange with a dealer in Austria, whereby for some of our duplicates we have obtained a large series of models of crystals, a number of cut precious stones and some fine examples of utensils made from agate. Few museums are fortunate enough to meet with an honorary curator who will place at their disposal so much zeal, knowledge and practical ability.

The exhibition of fresh wild flowers has again been successfully kept up, though the dryness of the present summer has been rather against it. Mr. Randal B. Cooke's regular supplies of flowers from Corbridge have been the mainstay of the exhibition, as they were last year. To Mr. Cooke we were also indebted for an interesting series of twigs and branches in bud which occupied the flower counter during the winter and early spring.

A considerable number of spirit and formalin specimens have been mounted in flat-sided jars and placed in the cases. In several sections of the museum the cases have been turned out and cleaned. The mammal cases have been not only cleaned but repainted throughout with distemper, and their general appearance has been much improved.

The collections, especially those of local fossils, have been studied during the year by several specialists, among them two of the leading authorities in palæobotany, Dr. Jongmans, of Leiden, and Dr. Robert Kidston of Stirling. Dr. Jongmans did us a good service in looking through our large stock of calamites and pointing out which were the more important specimens and which could safely be thrown away. Dr. Kidston has been examining some of the type specimens of Lindley and Hutton's "Fossil Flora," and has returned them with valuable notes on their modern nomenclature. Mr. D. M. S. Watson, of London, has continued the work he began last year upon the local Coal Measure amphibians. Few people in Newcastle, even among members of the Society, are aware of the scientific value of parts of our collections, and it may therefore be worth while to repeat Mr. Watson's statement that our series of these Coal Measure amphibian remains, which are of the highest interest from the light they throw on the evolution of the vertebrates, is the most valuable and extensive possessed by any museum in the world.

The low average attendance at my "museum talks" is probably due in part to the choice of subjects and the fact that in several cases talks with the same titles had been given before. The largest audiences are always drawn by subjects connected with birds. I am thinking of giving the talks in future rather more of the character of a series. Another somewhat disappointing feature of the year has been the abandonment of the regular system on which the school classes were receiving lessons in the museum last year. No doubt it was difficult to fit the lessons into an overcrowded curriculum, but I am afraid the visits as they are being conducted now, with very large classes straying round the museum as they like and without the possibility of a definite lesson, are not of much educational value to the children. Perhaps one of the best ways in which a museum can serve the schools is to send out travelling cases of selected objects accompanied by leaflets for the teachers' use, and if our time and means would allow of it we should be very glad to prepare such cases for the council schools of Newcastle; but with our present resources anything of the kind is out of the question.

Some of the donations received during the year call for special mention. Mrs. Wingate has handed over to the museum a large proportion of the natural history collections left by the late Rev. W. J. Wingate. They included a large number of diptera, from which we have selected all that were of value as additions to the fine collection presented by Mr. Wingate some years ago, and incorporated them in it. Fishes which we specially wanted for casting have been obtained for us by Mr. Abel Chapman, Mr. Newbey S. Green, Mr. Samuel Graham and the late Mrs. James Richardson. Some particularly interesting chicks and nestlings of British birds have been presented by Mr. Isaac Clark, who had stuffed them excellently himself. Mr. A. M. Oliver has given us some rare British land shells, and Mr. R. Standen, of the Manchester Museum, a series of Whitstable oysters, showing the stages of growth from the young or "spat" to the marketable size and beyond. From Mr. George A. Atkinson, who is at present in Japan, we have received an interesting set of Japanese butterflies and moths and a few bird skins; from Dr. W. M. Tattersall an example of one of the rare flexible-shelled sea urchins dredged off the west coast of Ireland. The chief acquisition in the geological department is a large set of fossils collected in various parts of England and Ireland by Major C. F. Bishop and presented by him to the museum. They include some good sections of Devonian corals, some fine specimens of rare fossils from the Irish Carboniferous Limestone, and some particularly good fossils from the Chalk. An interesting addition to the ethnology department is a collection of objects representing Chinese arts and customs, presented by Miss E. Livens. The camera given us by Mr. Beck and other members of the Council is a most welcome acquisition and has already proved very useful.

This annual survey of our work in the museum is always a somewhat disappointing document to prepare. There are such extensive pieces of work in nearly every section waiting year after year to be taken in hand, and the impression we are able to make upon them in any one year seems so insignificant. On the other hand, in view of the smallness of the staff and income in proportion to the size of the museum, and in view, too, of the extent to which our average day is inevitably occupied with incidental matters unconnected with our real progressive work, I am always rather surprised that the year's record amounts after all to as much as it does. But I feel bound to point out from time to time that while our resources in staff and income are so much inferior to those of other museums of the same standing, it is impossible for us to reach the same level in methods of displaying collections or to follow out modern educational developments in the same way as these more fortunate institutions.

E. Leonard Gill.

MUSEUM STAFF

Curator..E. Leonard Gill, M.Sc.
Assistant ....Herbert Fletcher.
Lady Assistant and Secretary.....Miss E. Welford.
Attendant......... ....William Voutt.
Gardener ....Albert Spencer.

HONORARY CURATORS

Col. C. H. E. Adamson, C.I.E.
R. S. Bagnall, F.E.S., F.L.S.
Rev. W. McLean Brown.
Harry Eltringham, M.A., F.Z.S.
Samuel Graham.
Prof. G. A. Lebour, M.A., D.Sc.
Prof. Alex. Meek, M.Sc.
Prof. M. C. Potter, M.A., Sc.D.
P. Walther.

HONORARY OFFICERS OF THE SOCIETY

Elected at the Annual Meeting, October 29th, 1912

PATRON

The Right Hon. Lord Armstrong, M.A., D.C.L.

PRESIDENT

The Right Hon. Lord Joicey

VICE-PRESIDENTS

The Duke of Northumberland.
Viscount Ridley.
Lord Barnard.
Lord Ravensworth.
The Bishop of Durham.
The Bishop of Newcastle.
Sir Hugh Bell, Bart.
Sir Arthur Middleton, Bart.
Sir Andrew Noble, Bart., F.R.S.
Sir G. H. Philipson, M.D., D.C.L.
Sir John Swinburne, Bart.
Sir Lindsay Wood, Bart.
Prof. Sir Thos. Oliver, M.D.
The Lord Mayor of Newcastle.
Lt.-Col. C. H. E. Adamson, C.I.E.
Lt.-Col. W. M. Angus, C.B.
Prof. G. S. Brady, M.D., F.R.S.
E. J. J. Browell.
R. Coltman Clephan, F.S.A.
Clive Cookson.
Samuel Graham.
Principal W. H. Hadow, M.A., Mus. Doc.
N. H. Martin, F.R.S.E., F.L.S., F.C.S.
H. N. Middleton.
Col. C. W. Napier-Clavering.
Prof. M. C. Potter, M.A., Sc.D.

COUNCIL

Hugh P. Angus.
R. S. Bagnall F.E.S., F.L.S.
H. I. Brackenbury.
Rev. W. McLean Brown.
Reginald Bryant.
John D. Challoner.
J. L. Gracie.
T. E. Hodgkin, M.A.
Prof. H. J. Hutchens, M.A., M.R.C.S., D.S.O.
Hon. J. Arthur Joicey.
Ernest Scott.
J. D. Walker, J.P.

HON. SECRETARIES

C. E. Robson.
J. Alaric Richardson.

HON. TREASURER

A. H. Dickinson.

HON. AUDITORS

Samuel Graham.
W. J. Bellerby.

EVENING MEETINGS HELD DURING THE WINTER SESSION, 1912–1913.

Oct. 18.—Mr. H. J. Chapman, F.R.H.S. : "A Talk about Orchids" ; chair taken by Mr. W. Mark Pybus.

Nov. 20.—Mr. George Sisson : "The North Sea : Ocean Investigation" ; chair taken by Mr. Jos. G. Angus.

Dec. 11.—Dr. J. A. Smythe, D.Sc., Ph.D. : "Crystals and their place in Nature" ; chair taken by Mr. B. Amsden, B.A., B.Sc., LL.B.

Jan. 15.—Miss E. Hollis : "The Northumbrian Coast" ; chair taken by Mr. George Sisson.

Feb. 12.—Prof. H. J. Hutchens, M.A., M.R.C.S., D.S.O. : "Tuberculosis" ; chair taken by Prof. Alex. Meek, M.Sc.

Mar. 12.—Mr. S. Mangham, M.A. : "Plant Life of the Woodlands" ; chair taken by Mr. J. Talbot, M.A.

Mar. 19.—Private Evening Meeting of the Society : Report on Field Meetings of 1912, by the Rev. J. M. Hick, M.A., Chairman of the Field Meetings Committee. Reading of the Hancock Prize Essay by the author, Mr. J. Horsley.

AFTERNOON LECTURES TO YOUNG PEOPLE.

Dec. 27.—Mr. Hugh Richardson, M.A. : "The Microscope" ; chair taken by Mr. W. E. Beck.

Jan. 3.—Rev. Arthur Watts, F.C.S. : "Flower-dust or Pollen" ; chair taken by Mr. N. H. Martin, F.R.S.E., F.L.S.

CURATOR'S "MUSEUM TALKS."

Oct. 30.—Succulent Plants.*
Nov. 27.—The Giant Squid.
Dec. 18.—Skulls.
Jan. 29.—Wildfowl of the Coast.
Feb. 26.—Elephants and Ivory.
Mar. 26.—Living Fossils.
Apr. 30.—Animals of South America.

* Kindly given by Mr. S. Mangham, M.A.

LIST OF DONATIONS

FOR THE YEAR ENDING JUNE 30TH, 1913.

HUGH P. ANGUS.—Three living examples of the rare slug *Testacella* from Gosforth.

GEO. A. ATKINSON.—A collection of butterflies and moths sent by the donor from Japan—about 70 species and 300 specimens. Skins of four wading birds from Japan.

RICHARD S. BAGNALL, F.E.S.—Specimens of three rare coleoptera from Oxford.

MAJOR C. F. BISHOP, R.A.—British fossils collected by the donor: sections of Devonian corals from Plymouth; Carboniferous Limestone fossils from Cahir, Ireland; a few Lias fossils; Cretaceous fossils from the south-east of England—Kentish Rag, Greensand, Gault and Chalk. Among the Chalk fossils a good series of *Micraster* and some unusually well preserved shells.

ALFRED BOOCOCK.—Pale blue egg of partridge.

MISS BUCKLAND (Fourstones).—Apical rosette of a crinoid from limestone at Fourstones.

JAMES CAYGILL.—Boulders from glacial deposits in the Consett district. Rocks and minerals from Upper Teesdale.

ABEL CHAPMAN.—Fishes representing stages in the life history of the salmon.

HUGH V. CHARLTON.—A squirrel from Cumberland.

P. CHARLTON (Chopwell).—A fine slab of *Asterophyllites* foliage from Chopwell Colliery.

ISAAC CLARK.—Nestling gannet in the 'squab' stage, and a young chick of the little grebe: both stuffed by the donor.

HELEN AND JOHN COULSON.—Valves of the boring shells *Pholas crispata* and *P. candida*.

MISS DIXON (Corbridge).—John Hancock's group of "Young Leopards Asleep," from which one of his published drawings was made.

WM. ELTRINGHAM (West Wylam).—Coal Measure plant remains, including part of an inflorescence of Cordaianthus.

G. A. Emery.—Three guillemots' eggs; two being eggs of the "ringed" guillemot from Shetland, the third an abnormally small egg from Bempton.

Jno. Gardner, F.E.S.—A further section of the donor's collection of British coleoptera for incorporation in the large reference collection.

H. A. Gill.—A number of living stag beetles *(Lucanus cervus)* from the donor's garden at Chiswick.

Samuel Graham.—Three birds' skins (starling, little owl, jacamar); a peewit's nest with two normal and two very abnormal eggs; a hen's egg with a partial subsidiary shell inside; chaffinches and a common tern from Bellingham; a dace from the North Tyne.

Newbey S. Green.—Roach and large pike from the Till.

Max Holzapfel.—Seven skins of small eagles from the highlands of British East Africa.

George Jennings (Backworth).—Two Indian stag beetles.

H. A. Kersey.—Large Orthoceras on a piece of limestone from a wall near Matfen.

T. King (Hartlepool).—A ballan wrasse, *Labrus maculatus*, caught in the trawl off Hartlepool.

Miss Ethel Livens.—Characteristic objects from China: including an illustrated native newspaper, a letter, a book; pictorial sheets, one of them a New Year "kitchen-god"; models of insects, etc.; combs, scissors, thimble, and a silver shield for an elongated finger nail.

Manchester Museum (per Dr. W. M. Tattersall).—An example of one of the rare flexible-shelled sea-urchins, *Asthenosoma hystrix*, dredged from ooze off the west of Ireland in 492 fathoms.

Sir Arthur E. Middleton, Bart.—Branches and cones of Araucaria from a tree at Belsay Castle; the first known to have produced cones there.

A. M. Oliver.—Shells of *Helix terrestris* from Dover.

J. J. Oxley.—A piece of shale from Newfoundland with remains of minute ostracods.

Miss Audrey Pease.—A number of specimens of the freshwater fish-louse, *Argulus foliaceus*, collected from small trout in the Otterburn district.

Rev. H. Proctor.—Three alligators' eggs from Southern Nigeria.

ROBT. REID.—A stump-tailed lizard, *Egernia stokesii*, which came inv cargo of wheat from Western Australia.

MRS. FRANK RICHARDSON.—A char caught in Windermere towards the end of September; turning silvery.

THE LATE MRS. JAS. RICHARDSON.—A Windermere char in full coloration, caught in July.

J. ALARIC RICHARDSON.—The skin of a harp seal, *Phoca grœnlandica*. A claw-toed frog and a spider imported in skins.

HON. JASPER RIDLEY.—Three very fine antelopes' heads from Bechuanaland, viz., a gemsbok *(Oryx gazella)* and two hartebeests *(Bubalis cama)*, on loan.

J. D. ROBINSON.—Engravings of two pictures.

ERNEST SCOTT.—On loan: two large cases of Egyptian birds collected by Mr. Scott and his brother.

MRS. T. W. SHARP.—A living pair of South American cardinal finches *(Paroaria cucullata)*.

STANLEY SMITH, M.SC.—Three sections of the fossil coral *Aulophyllum fungites*.

R. STANDEN (Manchester).—A series of Whitstable oysters in all stages from the young ("spat") to the marketable size ("ware") and beyond.

B. STORROW.—Two specimens of a marine tube-making worm, *Pectinaria (Amphitrite) auricoma*, found living in a tank at the Dove Laboratory, Cullercoats.

ANDREW THOMSON.—A large specimen of the monkfish *(Rhina squatina)*.

P. WALTHER.—Colour microphotographs of rock sections under polarized light. Sections of minerals, fossil corals, ammonites.

JOS. WATERS.—Very large claw of a lobster, from Dunbar.

J. WEBSTER (Madras).—Cobras from Madras; scorpions from Madras and Raniput.

MRS. WINGATE.—A large part of the collections left by the late Rev. W. J. Wingate: a large quantity of diptera in store-boxes; some other insects; snakes, etc., in spirit; diagrams and geological maps; card catalogues of natural history records.

ADDITIONS TO THE LIBRARY

BY EXCHANGE AND DONATION

From JULY 1st, 1912, to JUNE 30th, 1913.

BRITISH SOCIETIES AND INSTITUTIONS

Berwick-upon-Tweed:—Berwickshire Naturalists' Club.
History of the Club, vol. 21, parts 1–2.

Cambridge University:—Philosophical Society.
Proceedings, vol. 16, part 7; vol. 17, parts 1–2.

Cardiff:—Naturalists' Society.
Transactions, vol. 44.

Cardiff:—National Museum of Wales.
5th Annual Report, 1911–12.

Dublin:—Royal Dublin Society.
Scientific Proceedings, vol. 13, nos. 12-37.
Economic Proceedings, vol. 2, no. 5.

Edinburgh:—Geological Society.
Transactions, vol. 10, part 1.

Edinburgh:—Royal Society.
Proceedings, vol. 32, parts 2–5; vol. 33, parts 1–2.
Transactions, vol. 48, part 2.

Edinburgh:—Botanical Society.
Transactions and Proceedings, vol. 24, parts 2–3, title and index.

Edinburgh:—Royal Botanic Garden.
Notes nos. 25, 31–34, 36.

Glasgow:—Geological Society.
Transactions, vol. 14, parts 2–3.

Greenwich:—Royal Observatory.
Magnetical and Meteorological Observations, 1910.

London:—British Association for the Advancement of Science.
Report of 82nd Meeting, Dundee, 1912.

London:—British Museum (Natural History), South Kensington
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"Notes on Dr. Graham's Collection of Cyclopidæ from the African Gold Coast."

"On some Species of Cyclops and other Entomostraca collected by Dr. J. M. Dalziel in Northern Nigeria."

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THE HONORARY TREASURER IN ACCOUNT WITH THE NATURAL HISTORY SOCIETY

CURRENT ACCOUNT FROM 1ST JULY, 1912, TO 30TH JUNE, 1913

RECEIPTS	£	s.	d.	£	s.	d.
Members' Subscriptions				374	5	0
Museum Admission Fees	134	5	9			
Education Committee Grant	10	0	0			
				144	5	9
Sale of Guide Books, etc.				5	7	6
Interest on Investments				418	13	8
Sundries	10	1	6			
Grant from Armstrong College	5	5	0			
				15	6	6
Deficit, 30th June, 1913				84	8	1
				£1,042	6	6

PAYMENTS	£	s.	d.	£	s.	d.
Deficit, 30th June, 1912				66	4	10
Salaries				583	11	9
Advertising				9	0	0
Fuel, Lighting, and Water				76	9	5
Insurance				30	8	2
Materials and Fittings				31	3	4
Postage and Carriage	£13	7	2			
Carriage on Mr. Scott's Egyptian birds	5	7	3			
				18	14	5
Printing				41	2	7
Property Tax				10	11	1
Building Repair Fund				40	0	0
Stationery				2	7	9
Publication Account				60	5	3
Camera Account				6	7	8
Subscriptions: Museums Association	1	1	0			
Dove Marine Laboratory	10	0	0			
Ray Society	1	1	0			
Sundries	35	5	6			
Bank Interest on overdraft	18	12	9			
				66	0	3
				£1,042	6	6

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

A. H. DICKINSON, Hon. Treasurer.

BUILDING REPAIR FUND

	£	s.	d.
Balance in hand, 30th June, 1912	0	14	4
Transfer from General Account	40	0	0
	£40	14	4

	£	s.	d.
Sundry repairs	10	8	2
Balance in hand, 30th June, 1913	30	6	2
	£40	14	4

CRAWHALL LEGACY ACCOUNT

	£	s.	d.
Balance in hand, 30th June, 1912	58	13	11
Interest on Investments	24	0	0
Bank Interest on Account	1	0	2
	£83	14	1

	£	s.	d.
John W. Bowes: Altering museum cases	21	10	0
Mrs. Nash: Purchase of butterflies	10	0	0
Balance in Bank, 30th June, 1913	52	4	1
	£83	14	1

PUBLICATION ACCOUNT

	£	s.	d.
Sale of Transactions	2	6	9
Transferred from General Account	60	5	3
	£62	12	0

	£	s.	d.
J. Swain and Sons: engraving blocks	2	12	10
Philipson and Son: engraving blocks	0	3	0
Postage on vol. 15, part 2	2	16	8
J. Bell & Co.: Printing of vol. 15, part 2	56	19	6
	£62	12	0

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors.

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CAMERA ACCOUNT

	£	s.	d.		£	s.	d.
Donations	17	3	0	Brady and Martin: Camera and Fittings	23	10	8
Transferred from General Account	6	7	8				
	£23	10	8		£23	10	8

INVESTMENTS

The following is a list of the Investments held by the Society, June 30th, 1913:—

£	s.	d.	Investment		Taken at cost. £	s.	d.
£2,000	0	0	Newcastle Corporation 3½ per cent. Irredeemable Stock (Coppin Bequest)		2,000	0	0
500	0	0	River Wear Commission 4½ per cent. Funded Debt		500	0	0
2,946	18	1	Midland Railway Company's Consolidated 2½ per cent. Preference Stock	Crawhall Bequest	6,000	0	0
1,900	0	0	North-Eastern Railway Company's 4 per cent. Preference Stock				
1,400	0	0	Newcastle and Gateshead Water Company's Consolidated 5 per cent. Preference Stock.				
400	0	0	Armstrong, Whitworth & Co., Ld., 4 per cent. Debenture Stock		*2,000	0	0
485	0	0	Newcastle and Gateshead Water Company's Ordinary Stock				
80	0	0	Weardale and Consett Water Company's 10 per cent. Maximum Ordinary Stock				
350	0	0	" " 7 " " "				
					£10,500	0	0

* This was formerly invested in the Tyne Commissioners' Consolidated Fund.

SAML. GRAHAM, W. J. BELLERBY } Hon. Auditors

A. H. DICKINSON, Hon. Treasurer.

Megalichthys : a Study incorporating the Results of Work on previously undescribed Material.

By the REV. S. GRAHAM BIRKS, M.Sc. (Victoria University of Manchester).

Part I.

DESCRIPTION OF SOME NEW MATERIAL FOR A STUDY OF THE GENUS.

Professor Miall in his "Description of the Remains of Megalichthys in the Leeds Museum" gave some historical account of the genus, together with a condensed translation of the remarks of Agassiz with emendations. The examination of additional material enables the author of the present paper to place some additional facts on record.

In the Museum of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne (the Hancock Museum, Barras Bridge) is to be found the Atthey Collection, presented by Lady Armstrong. This splendid collection includes a large number of fossil fish remains found in the Black Shale above the Low Main Seam at Newsham Colliery. The remains of *Megalichthys* in this collection are important and numerous.

(* The numbers in this paper followed by asterisks refer to specimens from Newsham.)

Megalichthys pygmæus : B17*. (Plate XII., fig. 1).

A very interesting specimen in the Atthey collection is numbered B17*. This is labelled as *Megalichthys hibberti* and shews a large part of the fish and so gives a general idea of its size and shape. The pectoral fins are indistinctly indicated, and one of the pelvic fins, possibly both, are even less distinctly seen. The punctation of the scales is undoubtedly relatively coarse, and the fish therefore belongs to the species *M. pygmæus*. It seems quite possible that this species may eventually be shewn to be the young of *M. hibberti*.

B9*, B10*, and B19*.

There is a wealth of associated head bones in the Hancock Museum. One specimen, B9*, shews the general outline of the parietal region of the skull of the fish, and the decorticated layer of bones forms a striking contrast with the usual ganoid layer. B10* is part of a smaller skull and shews similar characters. B19* is a similar skull to B10*.

Megalichthys hibberti (Ag.) : skull. B1*. (Plate XIII).

The most interesting skull of *Megalichthys* in this collection seen in dorsal aspect, however, is one of *M. hibberti*.

Certain parts of the skull are well preserved, and the sutures can there be clearly made out. The whole skull, as is usual with remains from the roof shale of the Low Main, Newsham, has been very much crushed, and the specimen before us, while exhibiting both dorsal and ventral surfaces of the skull, is little more than a plate, its thickness being about one centimetre. The central parts of the dorsal surface of the skull are specially well preserved and are of exceptional interest, while the general proportions of the skull in plan can be made out clearly. The skull is much smaller than that of the type-specimen in the Leeds Museum, but it represents a slightly greater proportion of the body surface than the anterior portion of the type-specimen, as it includes some part of the pectoral fin of the right side.

The parietals are well preserved, and unlike those in the type-specimen, do not end in a slender and jagged process anteriorly. As in the type-specimen, the right bone overlaps the left; each bone is incised by a T-shaped canal, and a short canal seems to run forward from the posterior edge of the right one.

The bones corresponding to the post-frontals and squamosals of the type-specimen are two, not four in number. These bones are well preserved, and on the inner side each exhibits a suture which begins at about the same point as the division in the type-specimen; but this suture dies away about half way across the bone, so that there are but two "compound squamosals" (post-frontal + squamosal) present, one on either side of the parietals. On the right side the suture and a crack give the appearance at first sight of a dividing suture, but on the left there is only the interrupted suture. The left squamosal element shews a transverse canal, and there are indications of the same feature in the right bone. There is a small process of the right "compound squamosal" corresponding to the portion of the skull which Agassiz took to be the nasal. This process, together with three small bones, fills the space which intervenes between the "compound squamosals" and parietals and the frontals. One of the three small bones corresponds in position, on the left side, with the process of the right "compound squamosal," while in close juxtaposition, and between this small bone and the process, is the smallest of the three bones. The third small bone is placed in a median and anterior position.

The frontals are well preserved, and each exhibits a canal with a curved course, as in the type-specimen. The "compound ethmoid" is much cracked, and it is consequently difficult to determine whether or not it is single. There is a large oval depression on either side of the shield near its border; and a little nearer its anterior end, and slightly more median in position, there is a small raised area on either side of the skull which appears to have been caused during the crushing of the fossil. These areas were perhaps raised by the crushing up of two laniary teeth into the roof of the buccal cavity. On the left anterior border of the "compound ethmoid" is a small notch, perhaps corresponding to the nasal opening noticed in the type-specimen.

Much displacement has taken place in the sub-orbital and more posterior regions, and it is difficult to determine the exact relations of the bones in these areas; it seems probable, however, that parts of two sub-orbitals are represented by the bones lying in the space between the right maxilla and the frontals, while suggestions regarding the others are shewn in the key to the photograph of the dorsal aspect of the skull.

Other bones are probably as follows: Still more towards the posterior end on the right side lies the operculum, whose posterior border is obscured by the displaced right supra-temporal. The large operculum on the left side is covered by the left supra-temporal, which is almost in its natural position. If this determination of the supra-temporals be correct it will be noted that there are two.

Traces of a sub-operculum are perhaps to be seen on the left posterior border of the specimen.

In a median posterior position a few scales can be made out, while the right posterior portion of the fossil exhibits part of a large fulcral scale of the right pectoral fin, of which parts of some of the fin-rays are seen in position. On the right of this portion of the specimen is to be seen a series of scales associated with the fin-lobe. A fulcral scale of the left pectoral fin is perhaps represented by a fragment on the left posterior margin of the specimen.

The under surface of the fossil exhibits no new features except the limited number of lateral jugular plates which are present.

Megalichthys coccolepis: B2*, portion of skull. (Plate XII., fig. 2.)

Among other interesting representatives of the genus is B2*. The bones of this specimen, part of the skull of *M. coccolepis*, are similar in size to those of the skull of *M. hibberti* previously described from the same museum. The left parietal is well preserved, while the posterior portion of its fellow is broken off. The post-frontal and squamosal are clearly separated by suture from one another. One small isolated bone is seen in a median position in front of the parietals. Each parietal is incised with two canals, which differ slightly from those of *M. hibberti* in disposition in that they are not set at right angles to one another. The left squamosal is also incised with a transverse canal, and the posterior border of the left parietal has a slight incision running forwards. Small depressions occur irregularly on all the bones, while the whole of the surface is furnished with the tuberculation characteristic of the species *M. coccolepis.*

Megalichthys coccolepis: B3*, portion of skull.

We pass on to B3*. This specimen of *M. coccolepis* shews parts of the parietals and neighbouring bones, and although the skull is not in such good condition as B2*, several points of interest can be made out. The parietals shew the central canals disposed in the same way as in B2*, and the transverse canal appears on the right squamosal. The suture between the post-frontal and the squamosal is clearly defined on the right side, and the characteristic tuberculation of the species is seen on the ganoin. Here and there the bony layer is exposed, and the canals can be traced across parts of this in the right parietal and squamosal.

Megalichthys hibberti: B4*, portion of skull.

B4*, a portion of a skull of the species *M. hibberti*, is of interest because here the left "compound squamosal" perhaps has an incomplete suture between the two elements. As the specimen is not in a very good state, the surface of the bone being covered with a thin coating of shale, it is possible that the left suture may be present. There appears to be a complete suture in the corresponding position on the right side. The "nasal" of Agassiz is here median in position, and is the termination of a process of the left post-frontal element. At points where sutures might have been expected there is a slight depression on the surface of the bone.

Megalichthys (hibberti?): B11* and B12*, portions of skulls (decorticated). (Plate XIV., fig. 1.)

Mention may also be made of two decorticated specimens B11* and B12*.

B11*: Some of the sutures can be traced in this decorticated parietal region of a skull. The path of some of the mucus canals can also be made out. It seems clear that the left squamosal is a separate bone. The reverse side (ventral) of the specimen is much crushed.

B12* shews the sutures which separate the right squamosal from the parietal of the same side.

From a number of examples of the anterior portion of the skull it is clear that, whereas in some specimens the so-called "compound-ethmoid," or snout, is divided up by suture into its constituent parts, a complete series shewing every phase from this divided state to a completely fused-up shield can be obtained. In specimens described in this paper and in other examples, as noted, the course of fusion may be indicated thus:—

B6*. M. hibberti.
B5*. M. coccolepis.
B20*. M. hibberti.
B7*. M. hibberti.
B13*. M. hibberti; and Dr. Traquair's fig. 3, Proc. Roy. Soc. Edin., viii., 1883-4, p. 67.

The change is probably ontogenetic, as the examples of *M. hibberti* exhibiting it would seem to indicate.

Megalichthys coccolepis: B5*, anterior portion of skull. (Plate XIV., fig. 2.)

This exceptionally interesting fossil represents the anterior portion of the skull of *M. coccolepis.* There is some indication that the bones are at a stage where there is a tendency to fusion.

The specimen exhibits the usual tuberculation characteristic of *M. coccolepis*. It is difficult to determine some of the apparent sutures in this portion of skull fragment. The skull has been flattened so as to tend to close the sutures between the elements. The following interpretation may be suggested: Unlike the anterior portion of the skull of *M. hibberti* B7* (*infra*) the example before us has the compound ethmoidal shield divided by sutures into its constituent bones. The pre-maxillæ are seen to meet in a somewhat curved median suture. The median ethmoid (*vide* B6* *infra*) seems to have become fused with the right nasal, and, as in other cases, there seems to be a tendency for the bones on the left side to be at a more advanced stage of fusion than those on the right.

Megalichthys hibberti: B6*, anterior portion of skull. (Plate XV., fig. 1).

This represents a *less* advanced stage in the course of fusion of the head bones than is the case in B5* (*ante*). The bones have been much flattened out. Near the centre of each pre-maxilla is a small depressed area.

Megalichthys hibberti: B7*, anterior portion of skull.

B7* shews a *more* advanced stage in the fusion of head bones than does B5*. The depressions seen in many specimens are here very marked, and in the case of the right depression there is an opening into the buccal cavity from the dorsal surface of the skull. The anterior portion of the dorsal surface of the skull, although cracked, is well preserved. The hinder portion is less well preserved, and is decorticated.

Megalichthys hibberti: B13*, anterior portion of skull.

This exhibits part of the "compound ethmoid" of *M. hibberti*. No sutures are visible, and there are the two usual large depressions near the lateral borders of the shield. The specimen is fairly well preserved.

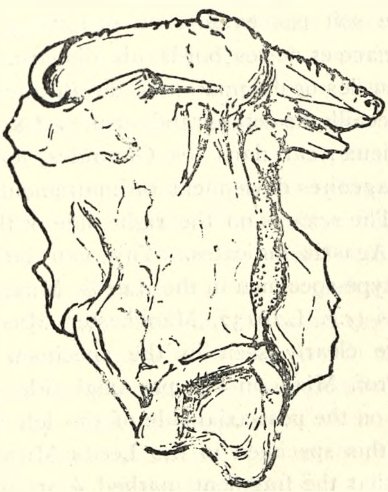
Anterior portion of skull of Megalichthys hibberti (Wild Collection, Manchester Museum, W.850.)

Not least in interest among the specimens of *Megalichthys* in the Manchester Museum is this anterior portion of a skull from the Thin Bed, Fulledge, Burnley. The label indicates that this beautiful example was described by J. Ward, but as I have found no such description a word here may not be out of place. The bone is very well preserved, and though cracked in many places, illustrates, beyond doubt, the fact that the fusion of the bones in this region was complete, and that a compound ethmoidal shield resulted. The punctate nature of the surface of the bone is clearly to be seen, and the small openings probably connected with the mucus system are present in large numbers; four larger openings arranged in the form of a square appear to have been present, and there are two small depressed areas, one on either posterior lateral border of the bone.

Palate of Megalichthys, B7* and B8*. (Plate XV., fig. 2, and text-fig. 1.)

B7*: The inferior aspect of this fossil, previously referred to in this paper, shews some of the bones of the palate, and though further examination may amplify or amend the account given below of this and of the next-mentioned specimen (B8* *infra*), the following will give some indication of the general disposition of some of the bones of the palate in the genus. B7* is much broken up anteriorly, where the teeth-bearing pre-maxillæ can be made out. In a median position, posterior to the pre-maxillæ, there appears to be a bone occupying about one-fifth of the width of the roof of the buccal cavity. Posteriorly this bone articulates with the expanded edge of a triangular bony plate which underlies a median tooth-bearing ridge of bone. This ridge tapers towards its anterior end and is somewhat rounded posteriorly. Apparently a broad median bone, of which the anterior margin underlies both the triangular plate and the dentiferous ridge, is present. The posterior portion of this bone, however, projects behind the other bones, and is expanded into a concave posterior portion. Near each lateral edge of the roof of the cavity is a relatively large perforation opening on to the dorsal surface of the head. Each opening is surrounded by a slight elevation of the bone.

B8* is a smaller skull of *Megalichthys hibberti* exhibiting the ventral aspect of the buccal cavity, and perhaps represents



Text-figure 1. *Megalichthys hibberti.* Part of skull; inferior aspect. Low Main, Newsham. Hancock Museum, B8. Natural size. (E. L. Gill del.)

a younger stage than B7* (*ante*). The posterior expansion of the hindmost bone described in B7* is clearly seen. The median dentiferous ridge appears to be more slender than in the specimen previously described, and shews less differentiation in width between its anterior and posterior portions.

Perhaps the most important of the specimens of *Megalichthys* in the Manchester Museum is that of a small portion of the ventral surface of the body which shews the pectoral fins very clearly and probably approximately in their natural positions.

On the pre-axial border of the right pectoral fin-lobe there appears a large scale which differs in size and shape from its neighbours. This type of scale has been termed the basal scale or fulcrum, but it is a feature which has apparently received but little attention. In the generic type-specimen in the Leeds Museum there is a large basal scale to be seen in a position posterior to the two inferior opercular bones. Of this scale Agassiz says :—" Il est fâcheux que la grande écaille du côté gauche ne soit pas entière, et surtout qu'une grande partie de sa surface et de ses bords ait disparu. Cette pièce expliquerait bien des os énigmatiques de Burdie-House. La présence d'une écaille de cette grandeur près des ventrales est un fait très-curieux ; car dans les Ganoïdes, les écailles qui avoisinent les nageoires deviennent ordinairement de plus en plus petites." The scale is on the right side of the body, not on the left as Agassiz indicates. This can be ascertained either from the type-specimen in the Leeds Museum or from the plaster casts (*e.g.* L.10132, Manchester Museum.) The basal scales are clearly seen in the specimen from Idle described by Prof. Miall on the pre-axial side of the right pectoral fin and on the post-axial side of the left pectoral. I have examined this specimen in the Leeds Museum, and I feel little doubt that the fragment marked *b* at the *bottom* of Prof. Miall's figure 5 was originally part of the same scale as two fragments not illustrated in this figure, but shewn, in a position anterior to the large fragment, in Prof. Miall's figure 1. This seems to indicate fairly conclusively that this species has large basal scales or fulcra on either side of the fin-lobes. The specimen (L.10124) in the Manchester Museum further exhibits very clearly the fin fringes and their relation to the lobe of the fin, a feature which the splendid specimen in the Leeds Museum fails to illustrate adequately. A description of the specimen follows :—

Portion of the body of Megalichthys hibberti in the Manchester Museum (L.10124.)

The specimen represents a part of the ventral surface of the fish, and its greatest length is about forty centimetres, while it measures about twenty centimetres at the widest part. In some places the original material has been replaced by pyrites, and the part of the fish which has been collected and forms the specimen is broken in several directions.

The anterior portion of the fossil clearly shews a considerable part of the pectoral fins, which seem to be nearly in their natural positions. Further back the arrangement of the body scales is well shewn. Both pectoral fins illustrate very well the obtuse lobate character of the anterior paired appendages of *Megalichthys*. In the case of the left pectoral the scales of the lobe are well preserved, and their arrangement and relation to the fin rays can be clearly made out. There are traces of the underlying bones in the region anterior to this fin, but they are hardly sufficiently clear to admit of description. There is an acutely lobate scale imperfectly shewn in a central anterior position; this is perhaps a displaced basal scale or fulcrum, belonging to the left pectoral fin. The dichotomy of the fin-rays is to be clearly seen in both the fin-fringes preserved in the specimen, but particularly in that of the right pectoral; here too the punctate surface of the ganoin is particularly well illustrated by some of the proximal elements. In places where the fin-rays are broken away the underlying body scales are exposed to view. A considerable expanse of the fringe of each fin forms a very interesting feature of the specimen, but even more interesting is a large scale lying on the pre-axial side of the lobe of the right pectoral fin. Its basal (anterior) portion is missing, as the edge of the specimen cuts the scale, but that part of it now seen is 3·3 cms. in length and 2·2 cms. in width at the widest exposed part. The bright surface is the same as that which characterises all the neighbouring scales, and the punctate appearance of the scale is similar to, though not so marked as, that of some of the scales of the fin-lobe. This scale differs, however, from the other scales in both size and shape; its dimensions have already been given. In shape it is acutely lobate like the large imperfectly shewn scale already referred to as a possible fulcrum of the left pectoral fin. Superimposed upon the more anterior portion of the basal scale here described is a smaller and very much rounded scale identical in surface and punctation with the basal scale. Whether this is approximately the natural position of the smaller scale or not it is not for us to say now, but on the face of things it does not seem likely that this is its natural position. The fish in the Leeds Museum described by Prof. Miall does not appear to exhibit the same character.

A series of scales in the region of the mid-ventral line can be traced posteriorly from a point between the fins to the border of the specimen. From the mid-ventral region some half-dozen series of scales extending diagonally and posteriorly to the right are admirably seen. The shining surface, punctate appearance, and characteristic shape of the scales are well illustrated.

The specimen is from the Kay-Shuttleworth collection and is labelled : " Burnley, Lancashire, Middle Coal Measures."

Part of a fin of Megalichthys (L.8328.)

It may be noted that in part of a fin of *M. hibberti* in the Manchester Museum from the Knowles Ironstone, Fenton, (Ward collection), there is a large scale, probably a fulcrum, near the base of the fin-lobe. Some convex scales are also present in this specimen, and they form a feature of considerable interest, which is shared by some of the scales registered under :—

W.817 (Manchester Museum) Wild Collection, Thin Bed, Middle Coal Measures, Fulledge Colliery, Burnley, Lancashire.

W.817 is a collection of scales and other parts of *M. hibberti*, and the well known punctate "ganoid" surface is seen in all the scales. Some of them are very convex, and a crack extends down the long axis in at least two cases. The convexity seems to be related to the position of the scales, either in the median line in the caudal region or in other places where the natural curvature of the body was markedly acute, and very convex scales were of use as a protection.

The use of these scales is admirably seen in the whole fish, preserved in the Leeds Museum, in which such scales occur in relation to the left pectoral fin, and in the ventral caudal region. That the convexity is natural is seen where the scales have been subjected to pressure; in such cases a median fracture is a common feature. Among the Manchester Museum specimens, in addition to L.8328 and W.817, which both shew convex scales, L.10114 ("Cannel, Middle Coal Measures, Wigan (?), Scales of Megalichthys hibberti") is also of interest since one of the scales exhibits the median fracture.

Part II.

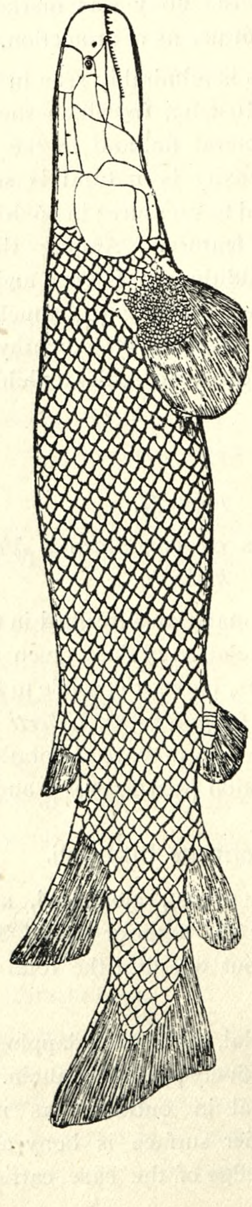
A New Description of the Species *Megalichthys hibberti.*

A consideration of the material described in the earlier part of this paper, and a correlation of data given there with the results arrived at by others, make it possible to suggest a more complete description of *Megalichthys hibberti* than has previously been presented, and to prepare restorations of the fish to accompany the description (text-figures 2 and 3).

Megalichthys hibberti.

The body is fusiform, robust, elongated, and somewhat depressed, especially near the anterior end. The head and opercular fold occupy about one-fifth the total length of the fish.

The scales are rhomboidal, slightly overlapping, and covered externally with a layer of finely punctate ganoin. The exposed surface, while rhomboidal in outline, has more or less rounded angles; the under surface is bony and serves for attachment. The upper edge of the base carries an oblique

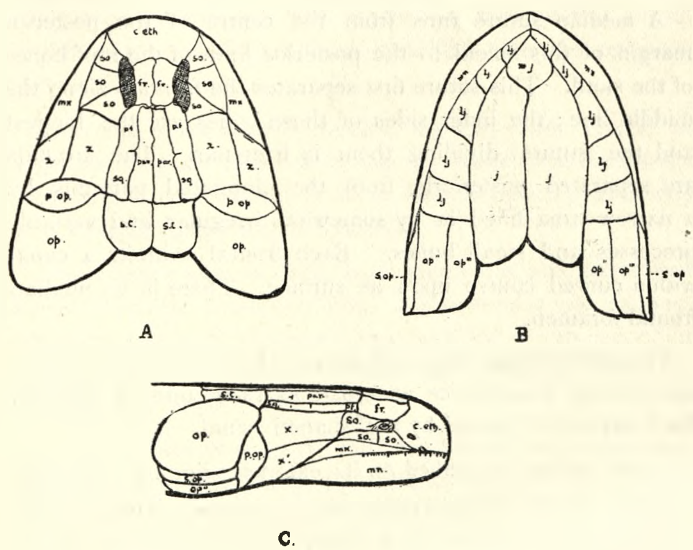


B.

Text-figure 2. *Megalichthys hibberti*. Outline restoration of the whole fish. (S. Graham Birks del.)

sloping margin, which is overlapped by another scale; the fore edge was sunk in the skin, and also overlapped. The scale is thickest at its centre.

The skull is long, broad, and depressed. The orbits are far forward. The nasal apertures are in front of them at the sides of the rostrum. The top of the brain case is protected



Text-figure 3. *Megalichthys hibberti.* Restorations of the head. (S. Graham Birks del.) A. Superior aspect. B. Inferior aspect. C. Side view.

C. eth., compound ethmoidal shield; *so.*, sub-orbitals; *fr.*, rontals; *mx.*, maxillæ; *x* and *x'*, cheek-plates; *par.*, parietals; *p.f.*, post-frontal element; *sq.*, squamosal element; *p.op.*, pre-operculum; *op.*, operculum *s.t.*, supra-temporals, or nuchal-plates; *mn.*, mandible: *j.*, principal jugulars; *m.j.*, median jugulars; *l.j.*, lateral jugulars; *s.op.*, sub-operculum; *op.*", *op.*'", inferior operculars. The orbit is shaded.

by a parietal shield which is often defined on the sides as well as behind by an irregular sunk space, which indicates subsidence and a weak condition of the underlying parts, a feature which accounts for the frequent loss or crushing of the dermal bones of the disturbed regions. The parietal region of the cranium is longer than the fronto-ethmoidal. The thick membrane bones or dermal plates with their punctate layer of ganoin exhibit a bilateral symmetry except towards the end of the rostrum. In the anterior region the bones about the median line are fused together in the adult to form the compound ethmoidal shield.

A median suture runs from the centre of the posterior margin of this shield to the posterior limit of the roof bones of the skull. This suture first separates the frontals along the middle line; the inner sides of these bones are the longest and the suture dividing them is irregular. The frontals are separated posteriorly from the elongated parietals by a narrow area filled in by somewhat irregular and variable processes and small bones. Each frontal exhibits a canal with a curved course upon its surface. There is no median frontal foramen.

The parietals are long and narrow bones whose posterior margins are about twice as broad as their anterior borders. Each parietal is incised by a T-shaped canal.

Either parietal is flanked on its external edge by two bony elements which tend to fuse in the adult. The anterior or post-frontal element is a narrow strip of bone which is either partially fused with the posterior or squamosal element or completely separated from it by an irregular curved suture. The squamosal element is furnished with a transverse canal.

Posterior to the parietals and to the squamosal elements of their flanking bones is a pair of broad nuchal plates or supra-temporals, one on either side, meeting in a median suture and interposed between the large principal operculars.

The sub-orbitals are three in number on either side of the head; they form the lower border of the anteriorly placed orbits, of which the compound ethmoidal shield and the frontals are the other investing elements.

The maxilla is of an elongate triangular shape, the alveolar border being the longest and the posterior the shortest. The length is a little more than twice the height. The anterior angle is somewhat pointed, the other two are blunt.

The anterior portion of the head consists, in the adult, of a compound ethmoidal shield or rostrum formed by the synosteosis of the dermal bones of the region. There is a large oval depression or perforation on either side of the shield near its border. The notches in the anterior lateral borders of the shield have been identified with the openings of the external nares.

Each side of the head is invested by two cheek plates, the larger flanking the post-frontal and squamosal, and the smaller occupying a more lateral position and articulating anteriorly by a straight suture with the maxilla.

The anterior edge of each large operculum articulates with a much rounded pre-operculum. The opercular fold was very extensive and well protected, and included a sub-operculum and two inferior operculars placed longitudinally and overlapping each other.

The mandible is elongate and slender, its long sides being parallel; what seems to be the articular process has been recorded as projecting from the middle of the hinder end; the rami are usually separated in front. Dentary, angular and splenial elements are said to exist in their usual relation to each other.

The space between the sides of the mandibular rami is occupied by two great elongate plates, the principal jugulars, and a numerous series of lateral pieces, the lateral jugulars. Between the truncated anterior ends of the principal jugulars and the mandibular symphysis is a large azygous rhombic plate, the median jugular. Each of the principal jugulars is about two and a half times as long as broad, and abruptly truncated posteriorly.

The teeth are conical and pointed, being rounded in transverse section. They are folded and striate at the base and smooth above. The maxillary and pre-maxillary teeth are of two sizes, the larger ones being internal to the smaller and occurring at intervals of about seven teeth.

Oval patches of vomerine teeth have been recorded as present close to the middle line on each side of the fore part of the palate. A large patch of minute clustered teeth is disposed in a long, narrow and posterior median strip. The dentition is that of a predatory fish.

The paired fins are obtusely lobate and are accompanied by basal scales or fulcra. Between the ventrals several large pelvic scales are interposed. Possibly they vary according to sex. There are two dorsals, the first nearly opposite the ventrals, the second nearly opposite the anal fin. The anal fin is close to the root of the tail. The caudal fin is intermediate between the heterocercal and diphycercal types; it is rhomboidal and oblique, projecting further above than below. Rays arise from both the upper and the lower margins of the body-continuation, but those of the lower side commence in advance of those of the upper. All the fins are composed of numerous closely set rays, divided by very close transverse articulations, except quite at their proximal extremities, which are covered by the scales of the body; they dichotomise towards their extremities, and their free surfaces are brilliantly ganoid and punctated like the scales.

The centra and the neural and hæmal arches of the vertebræ are all thoroughly ossified; the centra are in the form of rings. They are relatively broad in this species.

The length of a large member of this species may have amounted to four or five feet.

It seems probable that the so-called *M. pygmæus* is the young of *M. hibberti.*

Part III.

The Systematic Position and the Relationships of the Genus.

A comparison of *Megalichthys* with other members of the Rhipidistia is almost sufficient in itself to convince one that the classification of these genera into groups of family rank is premature; it is evident that much must be added to our knowledge of some of the genera before the data be adequate to enable us to work out their exact relationships to other members of the group.

In many respects the similarities between *Megalichthys* of the family Osteolepidæ and *Rhizodopsis* of the family Rhizodontidæ are greater than those which unite *Megalichthys* to *Osteolepis*, the type genus of its family. This is sufficient to shew the insecurity of the position which *Megalichthys* holds among the Osteolepidæ. In all three genera the shape of the body is very much the same, and the features which are stressed in the distinction between the two families are the scales and the folding of the walls of the teeth. The latter character is, in this case, one of much less than family significance, since it concerns merely the *degree* of folding. In the Rhizodontidæ there are vertical infoldings, but they are comparatively few and simple, and in *Rhizodopsis* itself the teeth are described as round in section, and smooth. In *Megalichthys hibberti* the teeth have fine superficial vertical striæ at the base, where they are folded, and they are smooth above. *Megalichthys* agrees with *Rhizodopsis* in having the parietal region longer than the fronto-ethmoidal. In *Osteolepis* the length of the parietal shield of the type species is only two-thirds that of the fronto-ethmoidal region.

Megalichthys differs from both *Rhizodopsis* and *Osteolepis* in the fact that synosteosis has not generally taken place between the frontals and the compound ethmoidal shield, and also in the fact of having three instead of two nuchal plates.

Megalichthys and *Rhizodopsis* are both without the median (pineal) foramen; but this feature is present not only in

Osteolepis itself, but also in *Thursius*, *Diplopterus* and *Glyptopomus*, so that *Megalichthys* is unique among these genera of its family in this respect, but agrees in it with *Rhizodopsis* and the Holoptychiidæ. Strangely enough *Gyroptychius*, one of the Rhizodontidæ, appears to have a pineal foramen.

In *Megalichthys coccolepis* the distinction drawn between the mandibles of the Rhizodontidæ and Osteolepidæ is weakened, if not completely broken down, by the fact that the angular, and at least one infra-dentary, remain separate from the dentary in this species. This is clearly seen in Plate XVI., which illustrates a specimen not described elsewhere.

In both *Megalichthys* and *Rhizodopsis* the first dorsal fin is nearly opposite the pelvic fins, and the second dorsal is almost opposite the anal; but in *Osteolepis* the first dorsal fin is in advance of the pelvic pair, and the second dorsal is opposed to the space between the pelvics and the anal. The tail is hetero-diphycercal in *Megalichthys*, heterocercal in *Rhizodopsis*, and strongly heterocercal in *Osteolepis*. Ring vertebræ occur in all three genera. A comparison of figures of the skulls of the genera from the dorsal aspect will illustrate very clearly the great resemblance between the skulls of *Megalichthys* and *Rhizodopsis*.

It has been recently shewn that there is a fundamental resemblance among the palates of the early Stegocephalian Amphibia which also applies to that of *Megalichthys*, and that the vomerine tusks of this genus are parallelled in the same group. It may be added that the condyle at the base of the skull of *Megalichthys* resembles that of *Loxomma* in its concavity (Pl. XV., fig. 2, and text-fig. 1).

When we turn to the dorsal surface of the skull of *Megalichthys* we find certain obvious dissimilarities between it and a generalised Stegocephalian type. The forward position of the orbits of the fish and the absence of the parietal foramen are noteworthy, the latter character indicating that *Megalichthys* is certainly not the direct ancestor of the Stegocephalia. In the

Photo. E. L. Gill and H. Fletcher.

Fig. 1. *Megalichthys 'hibberti' (pygmaeus).* Low Main, Newsham. Hancock Museum, B17. $1\frac{3}{4}$ natural size.

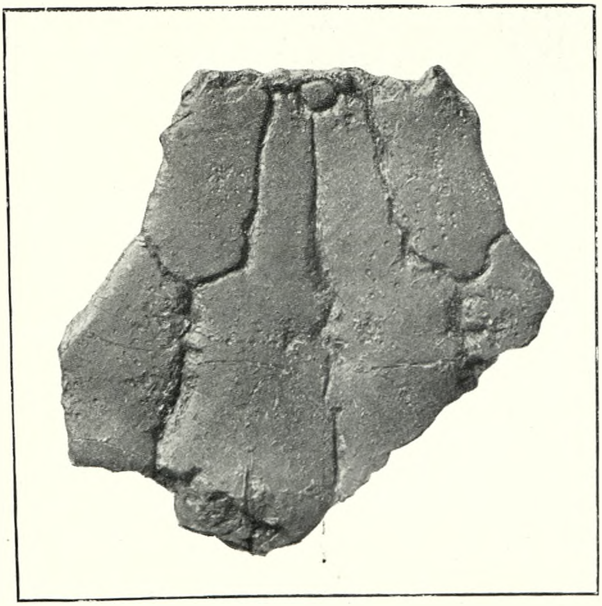


Photo. E. L. Gill and H. Fletcher.

Fig. 2. *Megalichthys coccolepis.* Part of skull. Low Main, Newsham. Hancock Museum, B2. Slightly reduced.

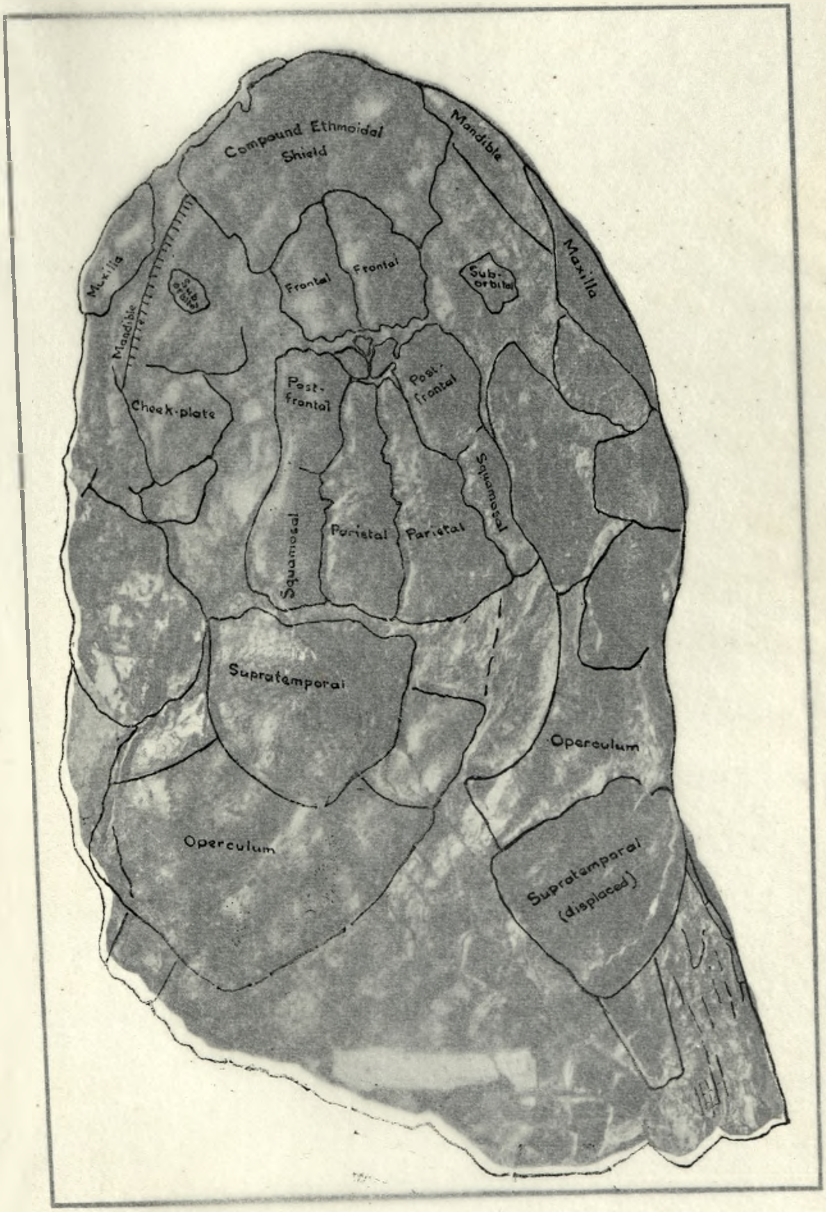
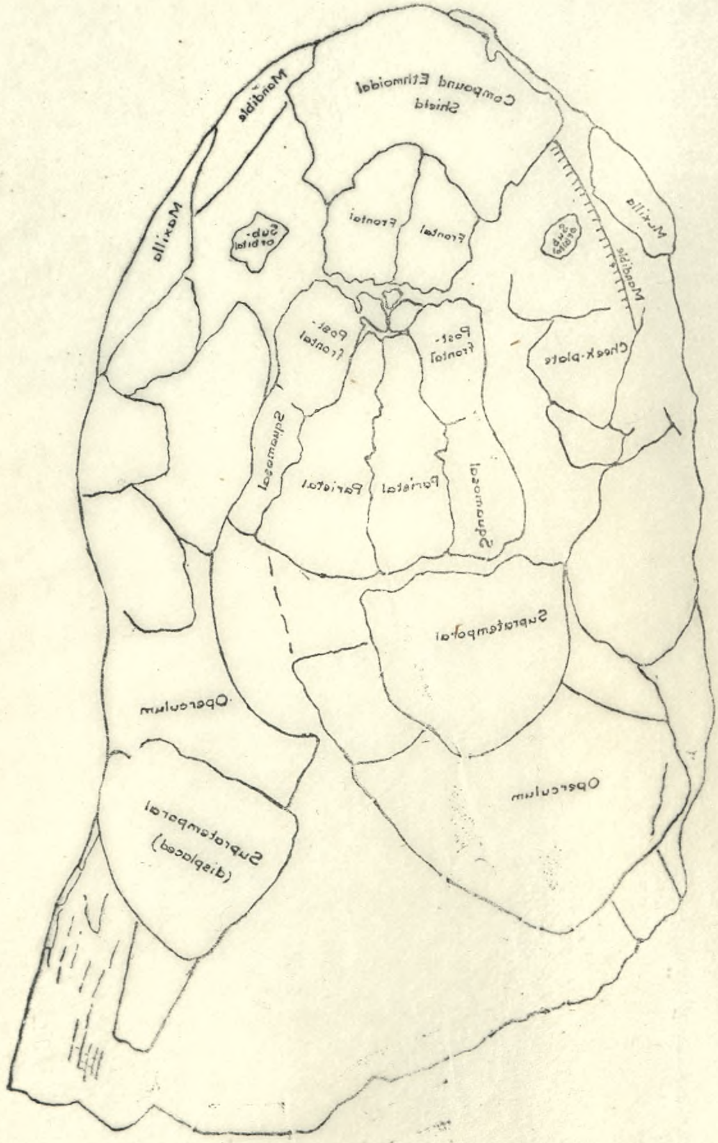


Photo. E. L. Gill and S. Fletcher.

Megalichthys hibberti. Skull; and anterior portion of body, shewing scales and part of right pectoral fin. Low Main, Newsham. Hancock Museum, B1. Four-sevenths natural size.


Compound Ethmoidal Shield
Mandible
Maxilla
Sub-orbital
Frontal
Frontal
Sub-orbital
Maxilla
Mandible
Post-frontal
Post-frontal
Cheek-plate
Squamosal
Parietal
Parietal
Squamosal
Supratemporal
Operculum
Operculum
Supratemporal (displaced)

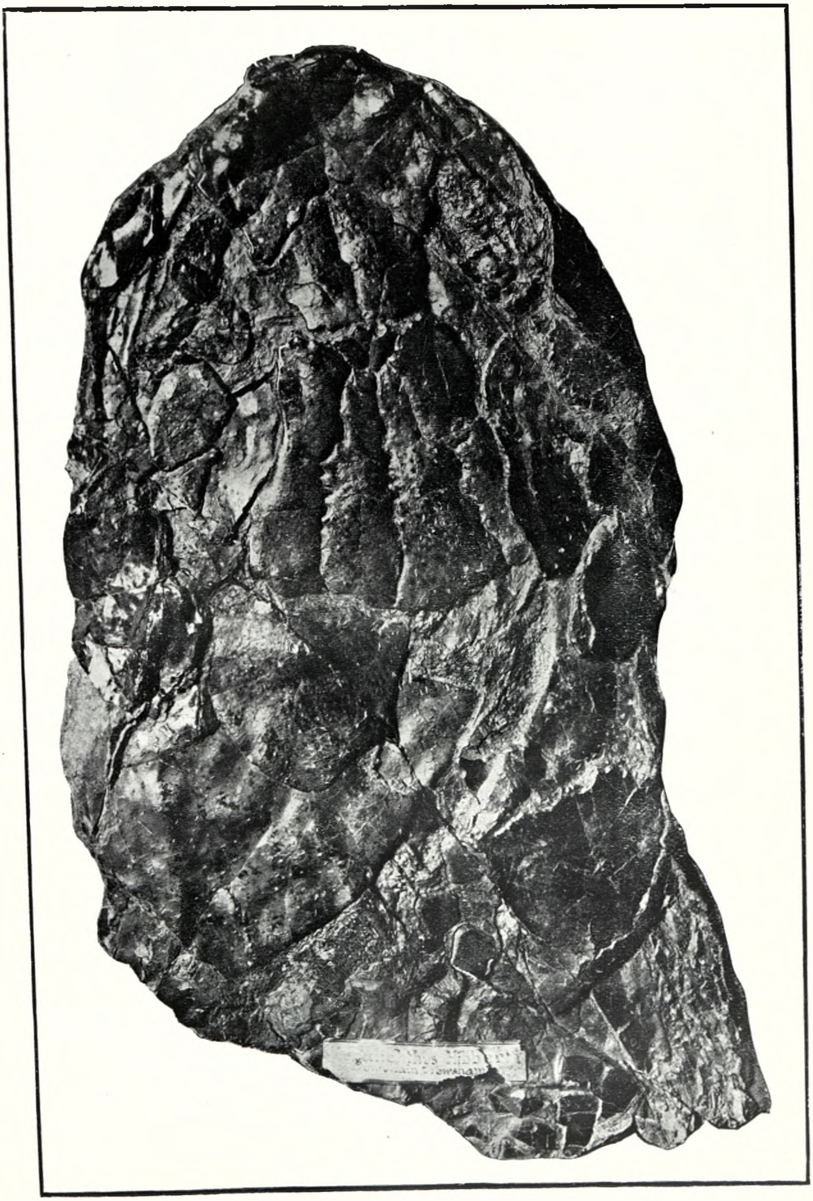


Photo. E. L. Gill and H. Fletcher.

Megalichthys hibberti. Skull ; and anterior portion of body, shewing scales and part of right pectoral fin. Low Main, Newsham. Hancock Museum, B1. Four-sevenths natural size.

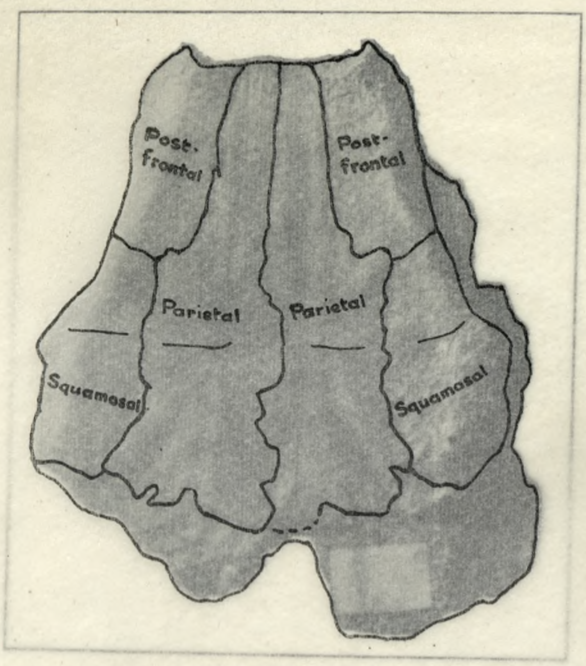
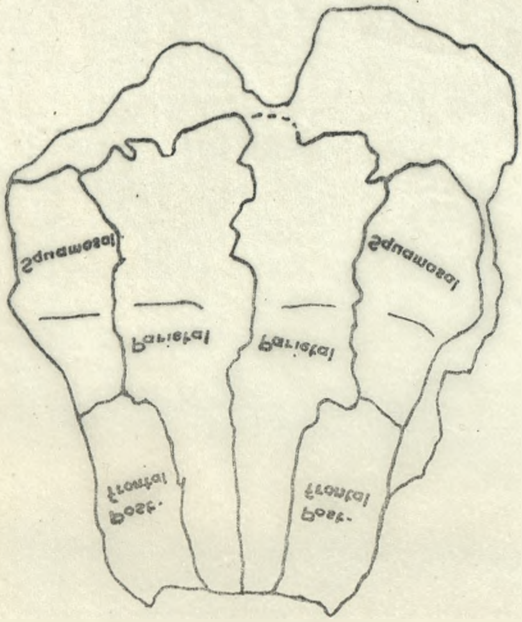


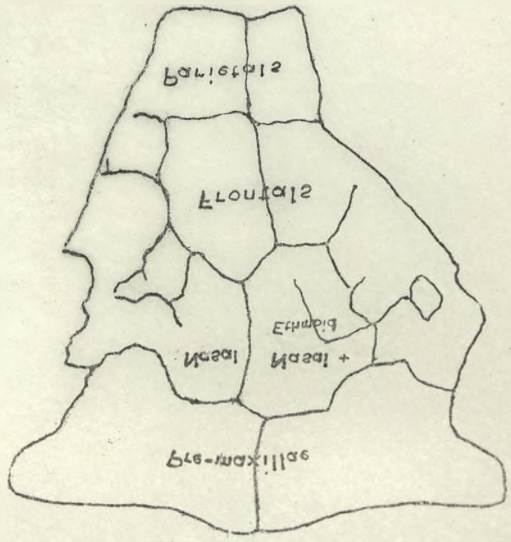
Photo. E. L. Gill and H. Fletcher.

Fig. 1. *Megalichthys hibberti*. Upper surface of part of skull. Low Main, Newsham. Hancock Museum, B11. About two-thirds natural size.

[illegible]

[illegible] Anterior portion of [illegible] Hancock Museum, [illegible]





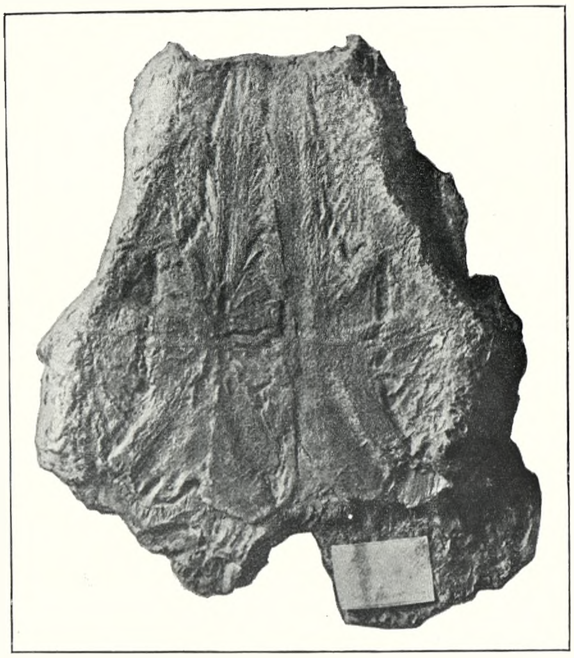


Photo. E. L. Gill and H. Fletcher.

Fig. 1. *Megalichthys hibberti*. Upper surface of part ot skull. Low Main, Newsham. Hancock Museum, B11. About two-thirds natural size.

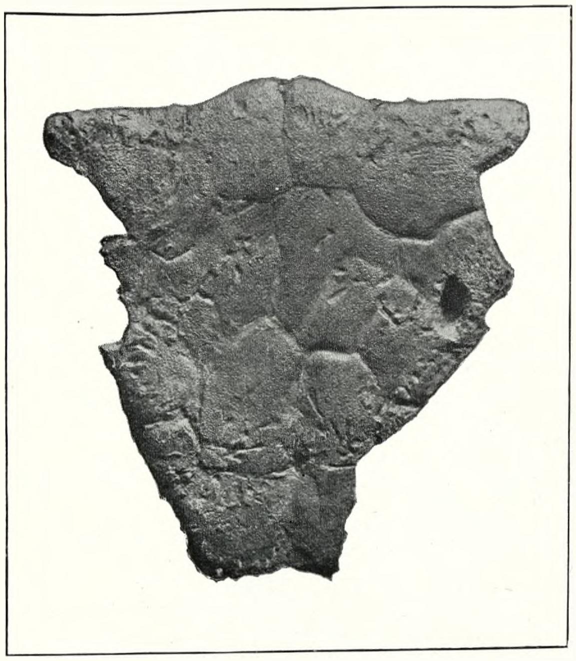


Photo. E. L. Gill and H. Fletcher.

Fig. 2. *Megalichthys coccolepis*. Anterior portion ot skull. Low Main, Newsham. Hancock Museum, B5. Slightly reduced.

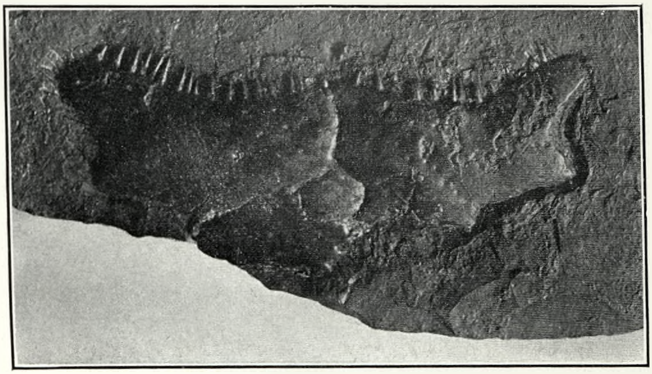


Photo. E. L. Gill and H. Fletcher.

Fig. 1. *Megalichthys hibberti*. Anterior portion of skull. Low Main, Newsham. Hancock Museum, B6. About three-quarters natural size.

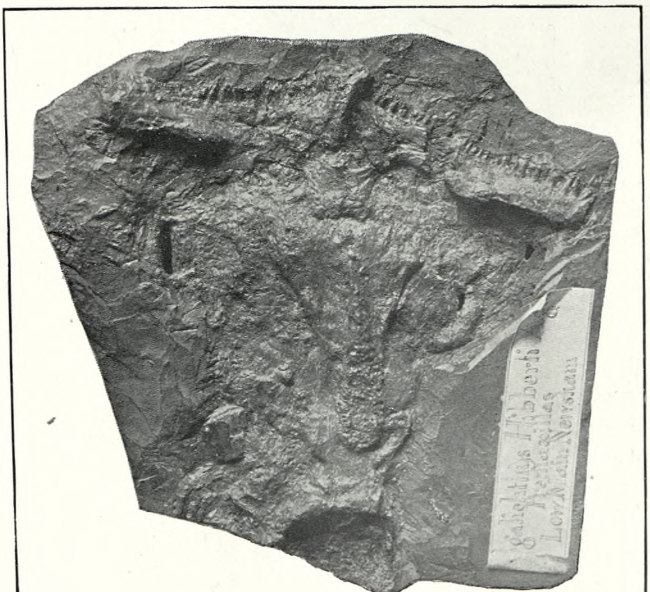


Photo. E. L. Gill and H. Fletcher.

Fig. 2. *Megalichthys hibberti*. Portion of skull, interior aspect. Low Main, Newsham. Hancock Museum, B7. Two-thirds natural size.

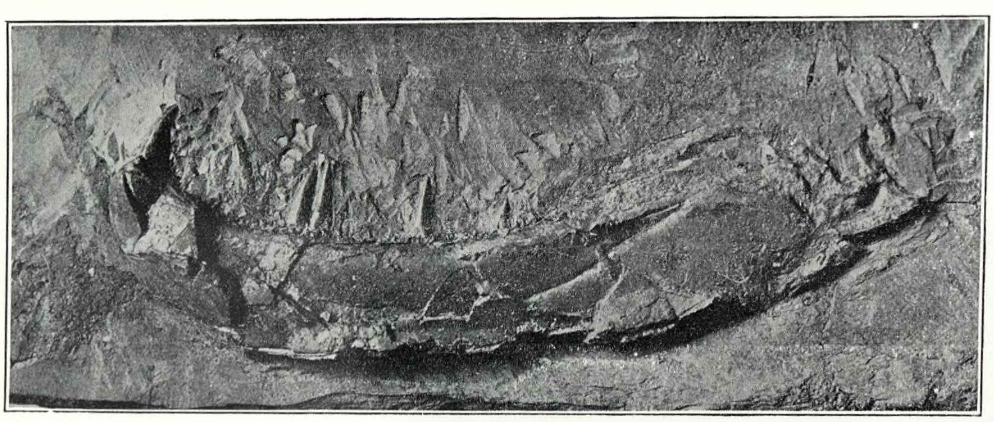


Photo. E. L. Gill and H. Fletcher.

Megalichthys coccolepis. Left mandible, external aspect. Low Main, Newsham. Hancock Museum, B15. About three-quarters natural size.

nature of the decorticated bone and in the arrangement of the cranial roof-bones *Megalichthys* exhibits close affinities with this Amphibian group. Similar affinities have been shewn to exist between *Rhizodopsis* and *Pelosaurus*, but an additional point of resemblance is furnished by the paired nuchal plates of *Megalichthys* (text-fig. 3A).

Although it has been urged that the Crossopterygian brain is retrograde in character, and that the cerebral cortex of Dipnoans is an indication that brain evolution took place through that group, it must be borne in mind that living representatives of the order fall outside the Rhipidistia, and that retrogression of one genus or sub-order is no criterion in this matter, but is a feature which is natural in a late representative of a group in which rapid evolution took place at an early period of its history.

From a consideration of the relationships of *Megalichthys* it is clear, then, that the position of the fish in the family Osteolepidæ is by no means secure, and that there are indications that the classification of Rhipidistia, in part at any rate, is premature and consequently unsatisfactory. Although *Megalichthys* is not itself the ancestral type of the Stegocephalian Amphibia, there can be little doubt that the study of this genus leads inevitably towards the conclusion that its affinities are with the ancestral type, and that the Stegocephalia were evolved from a similar fish and probably from a nearly related form.

*** I wish to express my thanks to all who have helped me, but especially to Dr. Hickling for advice from time to time, and to the authorities and staffs of the Manchester, Hancock, and Leeds Philosophical Society's Museums for giving me access to material and facilities for research.

Since I submitted my paper to the Society Mr. Gill's help in preparing illustrations, as well as in arranging for the printing of the text, has been invaluable. To him also I offer my best thanks for this additional kindness and courtesy.

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"On the Microscopic Structure of the Scales and Dermal Teeth of some Ganoid and Placoid Fish."

1884. *R. H. Traquair*, Proc. Roy. Soc.. Edin., vol. viii. (1883-4), pp. 67 et seq. ; pl. iv., figs. 1-6.
"Remarks on the Genus Megalichthys (Agassiz) with Description of New Species." With references.

1885. *L. C. Miall*, Description of the Remains of Megalichthys in the Leeds Museum. With figures and numerous references to literature.

1889. *R. Howse*, Guide to the Collections of Local Fossils in the Museum of the Natural History Society (of Northumberland, Durham, and Newcastle-upon-Tyne), p. 44.

1891. *A. Smith Woodward*, Catalogue of the Fossil Fishes in the British Museum (Natural History), part 2, pp. 378 et seq. ; pl. xiii., figs. 4 and 5 (G. M. Woodward del.) Numerous references.

1911. *L. Hussakof*, Permian Fishes of North America, p. 168 et seq. ; pl. xxx., figs. 1-4 ; pl. xxxi., figs. 3-3b. With many references.
Note.—This work is bound with the Revision of the Amphibia and Pisces of the Permian of North America, by *E. C. Case*.

1912. *D. M. S. Watson*, Mem. and Proc. Manchester Lit. and Phil. Soc., vol. 57, pt. i., memoir i.
"The larger Coal Measure Amphibia."

1914. *S. Graham Birks*, Lancs. and Ches. Naturalist, no. 77, August, 1914.

"The Crossopterygian Fossil Fishes of this Area*. Occasional papers. I.—Introductory." With plate.

* Lancashire, Cheshire and adjacent districts.

Two newly-discovered Whin-Dykes on the Coast of Northumberland.

By J. A. Smythe, Ph.D., D.Sc., Armstrong College, Newcastle-on-Tyne.

Along the coast-section which stretches from the Seaton Burn to the mouth of the Tyne there occur three well-known basaltic dykes, accounts of which have, at times, been published by various authors.* Taking these dykes in order from the north, the first is exposed at Seaton Sluice, a little south of the harbour; the next, ¼-mile south of this, hard by the Colly Well, from which it takes its name; and the third, the Tynemouth dyke, occurs almost at the extreme south end ot the section, close to the North Pier.

During the autumn of last year (1912), two other dykes, which appear to have escaped notice hitherto, were observed by the author, and it is the object of this paper to record their position and some points of interest connected with them. One of these dykes crops out on the foreshore at the north end of the Whitley sands, just 100 yards south of the Brierdene Burn; this will be referred to as the Whitley Dyke. The other is well exposed in the cliff-section near Hartley, 30

* G. A. Lebour, "Outlines of the Geology of Northumberland and Durham," 2nd edition (1886), p. 86.

J. J. H. Teall, "Petrological Notes on some North of England Dykes," Quart. Journ. Geol. Soc., vol. xl. (1884), pp. 209–46; also Geol. Mag., dec. iii., vol. vi. (1889), p. 481.

M. K. Heslop, "On some elementary forms of Crystallisation in the Igneous Rocks of Northumberland and Durham," Proc. Univ. Durham Phil. Soc., vol. iii., pt. 2 (1909), p. 37.

M. K. Heslop and J. A. Smythe, "The Dyke at Crookdene, Northumberland, and its Relations to the Collywell, Tynemouth and Morpeth Dykes," Quart. Journ. Geol. Soc., vol. lxvi. (1910), pp. 1–18.

yards south of the Collywell dyke, and this will be called the Hartley Dyke.*

The Whitley Dyke.

This dyke can be well seen at times, especially after northerly winds, and is traceable almost from the base of the low boulder-clay cliff for 30 yards seawards. At the cliff-end, just above the high-water mark of ordinary tides, it is 14 inches broad ; it runs due east for 10 yards, then bends gently to the south, but soon recovers its former direction, and, as it approaches the sea, becomes narrower and split up longitudinally by calcite veins. The dyke cuts through thick yellow sandstones which dip inland at a low angle and are jointed in an east-and-west direction ; it makes but little feature, saving what arises from its weathering into rounded blocks, and what is occasionally produced by its erosion below the level of the surrounding rocks, the hardened contact-edges of which stand out somewhat prominently ; and as the weathered surface of the whin closely resembles the sandstone in colour, it is at times difficult to detect the dyke, even when the rocks are swept clear of sand.

The freshest rock obtainable from this dyke is soft, of low specific gravity, 2·817, and contains 7·22 per cent. of carbon dioxide—equivalent to 16·4 per cent. of calcium carbonate.† Owing to the state of weathering thus revealed, a complete analysis of the rock was not made. Thin sections examined under the microscope show the rock to be an ordinary basalt about as coarse in grain as the Tynemouth Dyke. The felspars of the groundmass are clear, show binary twinning, and are frequently arranged in star-like clusters. Oxide of iron is fairly developed as an original mineral and largely distributed in a finely divided form as a product of decom-

* It may be noted that Teall describes the Collywell Dyke under the name of the Hartley Dyke, though locally the dyke always bears the former name.

† In this, as in all the following analyses, the sample was dried at 110° C.

position. The augite which occurs in granular patches and, abundantly, in skeleton crystals, is almost completely replaced by calcite. Irregular green patches, possibly of devitrified and decomposed glassy matter, are fairly common, as are also amygdaloids, filled with calcite, and surrounded tangentially by felspar laths. Calcite also occurs in irregular masses sometimes penetrated by shafts of felspar, the ends of which are weathered. Some of the sections contain porphyritic felspars, usually single, occasionally in small groups. These are strongly zoned, chemically, when in contact with the basalt, and are traversed by irregular cracks filled with calcite; in all respects they are similar to the anorthite phenocrysts of the Tynemouth Dyke. The rock is cut by thin veins of calcite which sometimes enclose fragments of whin. In one case, such a vein breaks through a porphyritic felspar crystal, faulting it slightly without disturbing the optical continuity of the separated portions.

Petrologically, the rock resembles that of the Tynemouth Dyke, and some of the observations seem to point to slight movement in the dyke after consolidation.

The Hartley Dyke.

1. *Field Relationships.* This dyke cuts through the thick shales and thin sandstones which overlie the massive grits of Crag Point. There are two exposures in the cliff-section, the lower in black and sandy shales, the upper in the reddish sandstones which, a few yards north, are overlain by the yellow sands of Permian Age. The vertical distance between the two exposures is about 20 feet, the dyke being effectively concealed in this interval by thick soil and vegetation.

The dyke, where it emerges from the talus at the foot of the cliff, is 6 inches wide and, like its neighbour the Collywell Dyke, appears to come to a head. It is, however, only shifted, for the running is taken up a little to the north, and the dyke then rises in sinuous fashion for 3 feet, when another break with a displacement of 6 inches to the north occurs, the two portions being connected by a very thin string of trap.

The higher portion sends out several small lateral offshoots to the south and a long one to the north. This is intruded in a coal seam, with thin shaly partings, and the coal is baked to a cindery mass having the prismatic structure characteristic of many cinder-coals. The prisms tend to set normally to the whin surfaces, of which there are two at right angles to each other. At the upper exposure the dyke, now increased in breadth to 12 inches, is again displaced to the north, the break occurring along a shaly parting in the sandstone, and the two portions being connected by a band of whin about 4 inches broad.

The general appearance of the dyke and cinder-coal is shewn in Fig. 1. The phenomena exhibited by the dyke would be explicable as the results of intrusion up a highly jointed rock, the molten whin breaking across from one joint to another and the whin-filled fissure closing up, before solidification, at its eastern end. It may be noted, in amplification, that the slope of the cliff virtually gives three vertical sections of the dyke at the positions where displacements occur.

The direction of the dyke is 20° N. of W., the same as the Collywell Dyke and the master-joints and small fissures in the Crag Point sandstone; its hade is about 15° S. In the natural section, the hade appears much greater owing to the slope of the cliff and the fact that the dyke meets it at an acute angle. Hence Fig. 2, which shows the position of the Hartley and Collywell Dykes in section, is drawn at a slight angle to the cliff-line and at right angles to the direction of the two dykes. It will be seen from the sketch that both intrusions occur in a mass of shales and sandstones, which are broken up by a number of small, normal faults.

To amplify the relations between the dykes, a brief account of the outcrops of the Collywell Dyke on the foreshore is necessary. At its most easterly exposure, off Crag Point, the dyke is intruded at the northern edge of a fissure about 20 feet wide. This fissure is traceable across Collywell Bay to the cliff just north of the well and is represented by C in Fig. 2. Throughout its length it is filled with a breccia of thick sandstones and shales, dipping vertically or at a high angle northwards. As it passes, owing to the general north-westerly dip of the rocks, from the sandstones of Crag Point to the shales above, which occupy the bay, the fissure narrows considerably, and in the cliff-section is only 5 feet wide. The Collywell Dyke is intruded in this fissure for some distance, but it changes position gradually when traced inshore from the northern to the southern edge. The latter position is attained when the fissure has reached the shales. In its further passage up the fissure (this is, inshore) the dyke becomes broken up and sends out several small apophyses to the south. In favourable circumstances, a few isolated exposures in the sandy bay intervening between the rocks and the cliff-section show that it has left the fissure, and in the section itself it is found 40 feet south of it.

Now there is no trace of the Hartley Dyke on the foreshore, although in many places there is a continuous exposure of rock, and unless the direction of the dyke has changed very suddenly it should be visible, as the Collywell Dyke is. Considering this, along with the tendency of the Collywell Dyke to divide into branches, as seen in the cliff-section as well as along its outcrop, and to send out strings on its south side, it appears probable that the Hartley Dyke is an offshoot of the Collywell Dyke. If this be so, then it is interesting to note that the intrusive energy of the offshoot is greater than that of the parent mass, for it has pierced the strata which have effectively checked the upward motion of the latter.

2. *The Basalt.* The lower exposure of the dyke consists of a soft, whitish rock, jointed horizontally and bearing little or no resemblance in the field to ordinary basalt. This rock contains 13·66 per cent. of carbon dioxide, an amount equivalent to 31 per cent. of calcium carbonate. The upper exposure is more whin-like in appearance, the rock being rusty in colour and weathered into roundish blocks which show the typical exfoliating structure. When broken open, these

blocks are usually found to have a core of bluish rock resembling ordinary basalt, though lighter in colour. The freshest rock obtainable, however, is very much decomposed. having a specific gravity of 2·658 and containing 10·53 per cent. of carbon dioxide—equivalent to 23·9 per cent. of calcium carbonate.

Under the microscope, the structure of the basalt is plainly discernible. The rock is much finer grained than most of the local dykes, and the amygdaloids, which are abundant, are also small. In the best sections the felspars are fresh ; in the highly weathered rock they show some signs of decomposition. The augite is completely replaced by calcite, and great obscurity results from the dissemination of much secondary oxide of iron. No porphyritic felspars occurred in eight sections of the rock examined.

The whin does not appear to have altered the rocks in contact with it to any appreciable extent, except in the case of the coal, already mentioned, which is converted into a clean, prismatic coke. A proximate analysis of this, kindly carried out by Mr. L. Hawkes, B.Sc., gave the result :

Volatile Matter	19.83
Fixed Carbon	58·88
Ash	21·29
	100·00

The analysis shows the high ash-content and low volatile matter common to cinder-coals.

3. *The Felspar Inclusions.* Although, as stated above, no porphyritic felspars occur in any of the slides examined microscopically, yet several small felspar aggregates were found in the whin of the upper exposure, the largest being about ½-cubic inch in volume. The felspar is, in the main, extraordinarily fresh, with well developed cleavage, and the corners of the aggregates are quite sharp. It was prepared for analysis by crushing and sifting, treatment of the coarse powder with very dilute acid and separation by means of Sonstadt solution. Selected fragments of the felspars thus

treated had all the same density, except when attached to small particles of the much decomposed basalt. The analysis is given in Table A, No. I., and, for comparison, the analysis of the felspar inclusions from the Crookdene and Collywell Dykes (Nos. II. and III. These are quoted from Heslop and Smythe's paper, "The Dyke at Crookdene," p. 7).

Table A. Analyses of felspar inclusions from Hartley (I.), Crookdene (II.) and Collywell (III.) Dykes.

	I.	II.	III.
SiO_2	45·77	45·88	46·61
Al_2O_3	34·20	34·31	35·13
TiO_2	trace	0·04	0·13
Fe_2O_3	0·73	0·83	0·25
CaO	18·52	18·28	16·74
MgO	none	none	none
K_2O	0·12	0·11	0·15
Na_2O	1·04	0·82	1·05
H_2O	0 25	0·14	0·22
	100·63	100·41	100·28

The felspar is thus nearly pure anorthite, CaO, Al_2O_3, $2SiO_2$ (calculated, CaO=20·09, Al_2O_3=36·66, SiO_2=43·25) and, while closely allied to the Collywell inclusion, agrees in composition down to the minutest detail with the felspar of the Crookdene Dyke, 24 miles away. If the soda present be taken as a measure of some admixture with albite, Na_2O, Al_2O_3, $6SiO_2$, or $NaAlSi_3O_8$ (=Ab) and the lime as due to the main constituent, anorthite (=An), then the mineral should contain 8 per cent. of the former and 92 per cent. of the latter, and, in fact, the analysis agrees with that calculated for a rock so constituted (represented by the symbol Ab_1, An_{11}) as is seen from Table B.

Table B. I. Analysis of inclusion from Hartley Dyke. II. Composition calculated for a mixture of 8 per cent. albite and 92 per cent. anorthite (Ab_1, An_{11}).

	I.	II.
SiO_2	45·77	45·34
Al_2O_3	34·20	35·23
CaO	18·52	18·49
Na_2O	1·04	0·94

If the ferric oxide in the Hartley rock (0·73 per cent.) be regarded as replacing alumina, the agreement is still better, for the sum, $Al_2O_3 + Fe_2O_3 = 34{\cdot}93$ per cent. as against 35·23 calculated.

Again, taking the specific gravity of albite as 2·605, that of anorthite as 2·765, the value calculated for the mixture of the two in the above proportions is 2·752; this agrees with the value found for the Hartley inclusion, namely, 2·750.

The microscopic examination of the felspar would be of considerable interest in view of its identity in composition with the Crookdene felspar and the petrological peculiarities of the latter (*op. cit.* p. 8). Owing, however, to its brittleness and the small amount at disposal, it was found impossible to make a section of the mineral thin enough for satisfactory examination.

4. *Weathering of the Whin.* It is unfortunate that no rock fresh enough for analysis is obtainable from the Hartley Dyke. There is, however, every reason to expect that the composition of the fresh rock will correspond closely with that of the other anorthite-bearing dykes in the district, especially the Crookdene and Collywell dykes, which are almost identical in composition (*op. cit.* p. 3). The weathering of the Crookdene Dyke has been worked out in some detail (*op. cit.* p. 7), and it has been shown that the augite, which is replaced by calcite, is rich in magnesium and has a silica-content almost equal to that of the original basalt; further, that the felspars, which resist weathering to a much greater extent than the augite, are allied to labradorite.

The results of a partial analysis of the highly weathered whin from the lower exposure of the Hartley Dyke are given in Table C, No. I., and also, for comparison, the corresponding values for the weathered Crookdene rock (No. II.).

Table C. Partial analyses of weathered rock from Hartley Dyke (I.) and Crookdene Dyke (II.) Total iron reckoned as Fe_2O_3.

	I.	II.
SiO_2	33·37	38·06
Oxides of Fe, Al, Ti	25·10	24·31
CaO	21·63	20·42
MgO	1·11	0·87
CO_2	13·66	10·37

The two are very similar, thus bearing out the petrological likeness of the rocks and rendering it probable that they are weathered in the same manner.

The determination of some constituents in the Hartley rock, soluble in dilute acid, is given in Table D.

Table D. Constituents of the weathered Hartley Dyke, soluble in dilute acid. The sample analysed is the same as in Table C, No. I.

Fe (ferrous)	2·43
Fe (ferric)	0·81
CaO	17·36
MgO	0·83

Comparing this with the analysis in Table C, No. I., some interesting points come to light. Firstly, the attack by weathering agencies on the augite is so complete that what little magnesia remains in the rock is almost wholly in a condition readily soluble in dilute acid; secondly, as the amount of carbon dioxide, 13·66 per cent., is equivalent to 17·36 per cent. of calcium oxide, and as this is the amount actually found, it may be concluded that the carbon dioxide exists entirely combined with lime in the form of calcite, and thus 4·27 per cent. of lime (that is 21·63–17·36) is still present in the form of lime-felspars. This amount corresponds closely to that found in the Crookdene rock, namely 5·4 per cent. Thirdly, it may be noted that the ratio of ferrous to ferric iron in the acid-soluble portion is as 3 to 1; but as it may be safely assumed, judging from many analyses of similar dyke-rocks, that the ratio in the fresh unweathered rock is approximately as 1 to 1, it follows either that the weathering agent has had a reducing action, or, what seems more likely, that it has attacked the ferrous silicates preferentially, producing thereby soluble ferrous compounds and leaving unaltered the ferric silicates.

The question now arises as to the nature of the agent which has been operative in weathering these dykes, and it would seem that calcium bicarbonate, $Ca(HCO_3)_2$, is the only one which could bring about these changes in the augite, replacing, at the same time, the leached-out minerals with calcite and conserving the lime-felspars, especially the purer ones. The differential attack of the bicarbonate solution is clearly not determined by the amount of lime in the minerals presented to its action, for the augite is certainly as rich in lime as the felspar (see calculations, *op. cit.* p. 7): it is rather to be ascribed to those other bases, ferrous iron and magnesium, which, in the form of metasilicates, bulk so largely in the composition of the augite and, like calcium, are capable of forming bicarbonates readily soluble in water. In the case of the lime-felspars, such determining factors of reaction are wanting—hence their immunity from attack by solution of calcium bicarbonate. The carbonic acid set free during the conversion of calcium bicarbonate into calcium carbonate would help to weather the rock by attacking the calcium silicate present (1) originally in the augite and (2) formed by double decomposition of calcium bicarbonate with the silicates of magnesium and ferrous iron.

There is thus considerable probability that both the Crookdene and the Hartley dyke have been similarly weathered by percolating solutions of the same reagent, calcium bicarbonate, and it may be added that though about Crookdene, limestone, from which such solutions could come, makes up much of the country rock, the reverse is the case in the neighbourhood of the Hartley Dyke; and yet not only is the dyke highly calcareous, but the fissures and joints for some distance round it are usually filled with calcite. The supplies of calcium carbonate then are either far-travelled, or possibly they date from some past age when the overlying beds, now removed by denudation, were rich in this mineral. The occurrence of an outlier of Permian Yellow Sands, near to the dyke, suggests that the infiltrated calcium carbonate is a relic of Permian limestones long swept away.

Evidence of a later phase of weathering of the dyke is observable at its upper exposure, just below the top of the cliff. Here the rock assumes a reddish hue and disintegrates into roundish blocks having the exfoliating form characteristic of many whin outcrops. Specimens of the shell-like coating of the blocks, about $\frac{1}{4}$-inch thick (I.), of the rust-coloured layer 1 inch thick below this (II.), and of the bluish cores (III.), were analysed with the following results:

Table E. Upper exposure of Hartley Dyke. Determinations of carbon dioxide and iron (soluble in dilute acid) in the outer scale (I.), the layer beneath (II.) and the central cores (III.) of the weathered whin-blocks.

	I.	II.	III.
CO_2	none	none	10·15
Fe (ferrous)	none	0·36	5·12
Fe (ferric)	2·16	3·32	1·60

The rock at the cores (III.) is thus quite comparable with the rock of the lower exposure, containing carbon dioxide equivalent to 23 per cent. of calcium carbonate, and acid-soluble ferrous and ferric iron in the proportion of 3 to 1. In passing outwards, the calcium carbonate and ferrous iron are quickly abstracted, until at the outer scale only the ferric compounds remain. This phase of weathering is evidently super-imposed on the one described above, and clearly corresponds to the action of water containing carbon dioxide and oxygen in solution. It is the one at present in operation.

The first type of weathering described, namely that assumed to be due to the action of calcium bicarbonate solution, is evidently, so far as the few observations available enable one to judge, the one to which many of the local dykes conform. It is, however, not the only one, and, in fact, most of the well investigated cases are of a very different character, and hardly permit of safe inference as to the agents operative and the mechanism of the processes involved. A few of the best known cases may be mentioned in passing, in order to draw attention to a subject well worthy of study but greatly neglected.

The sill connected with the Hett Dykes has been investigated, though not from the point of view of weathering, with great wealth of chemical detail by Sir Lowthian Bell.* The

* "On some supposed changes Basaltic Veins have suffered during their passage through and contact with Stratified Rocks, and on the manner in which these rocks have been affected by the heated Basalt." I. Lowthian Bell, Proc. Roy. Soc., 23 (1875), pp. 543–553.

analyses of the fresh rock and the weathered (underground) top and bottom of the sill show considerable extraction of lime, and to a less extent of other bases, and conversion of the residual bases almost entirely into carbonates. It is possible, though by no means certain, that the weathering agent in this case has been carbonic acid.

The weathering of the Cleveland Dyke has been studied to some extent by Teall and others* and two radically different types established, namely, carbonation and kaolinisation. Teall has further investigated *(op. cit.)* an interesting case in that of the Highgreen Dyke, where solution and precipitation have taken place concurrently, the result being the production of a cellular structure, the bases being removed from the insides of the cells and the iron precipitated along the cell-walls.

In conclusion, emphasis may be laid on the similarity of the Hartley Dyke to the Collywell and Crookdene Dykes. A considerable amount of evidence has already been given in support of the view that the two last-named dykes are different exposures of the same intrusion (*see* "The Dyke at Crookdene, etc.," p. 12); and the results of the study of the Hartley Dyke, embodied in this paper, lead to the conclusion that this dyke is intimately connected with and possibly an offshoot of this intrusion. The Whitley Dyke has evidently affinities to the Tynemouth Dyke; a thorough petrological examination of the two rocks will probably bring these into clearer light.

* J. J. H. Teall, "Petrological Notes on some North of England Dykes," Quart. Journ. Geol. Soc., 40 (1884), p. 209.

Stanley Smith, "The Cleveland Dyke," Proc. Univ. Durham Phil. Soc., vol. 2 (1906), pp. 239–242.

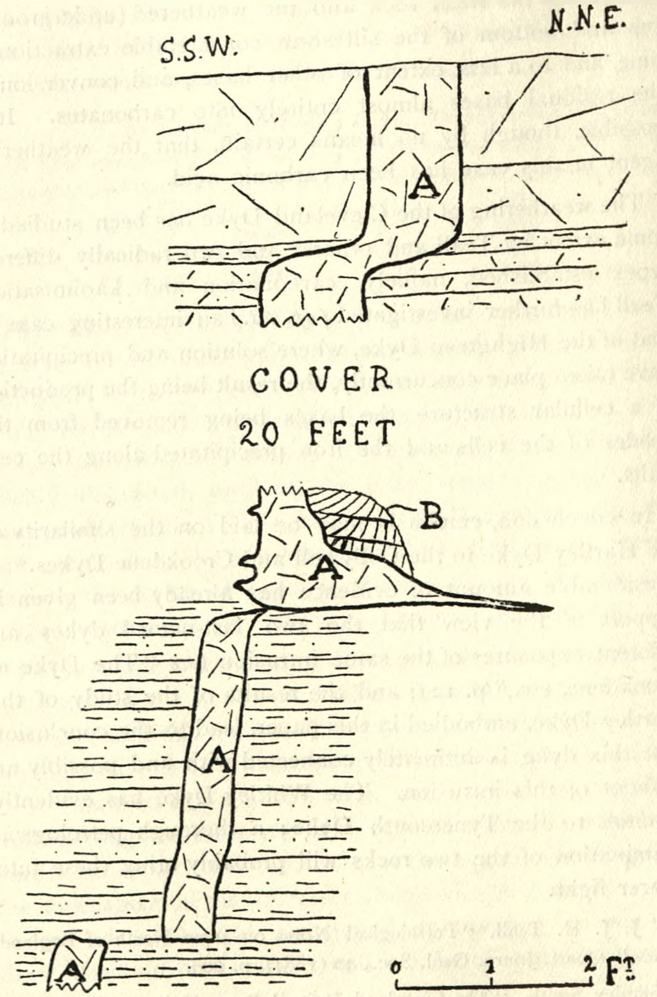


Fig 1. Section showing the Hartley Dyke. The dyke is marked A, and is intruded in shales at the lower exposure, and in sandstone at the upper. B represents the cinder-coal, baked by the dyke. The prisms ot this are frequently curved, and they tend to set normally to the whin surfaces. The general direction of the prisms and the two shaly partings are shewn in the sketch.

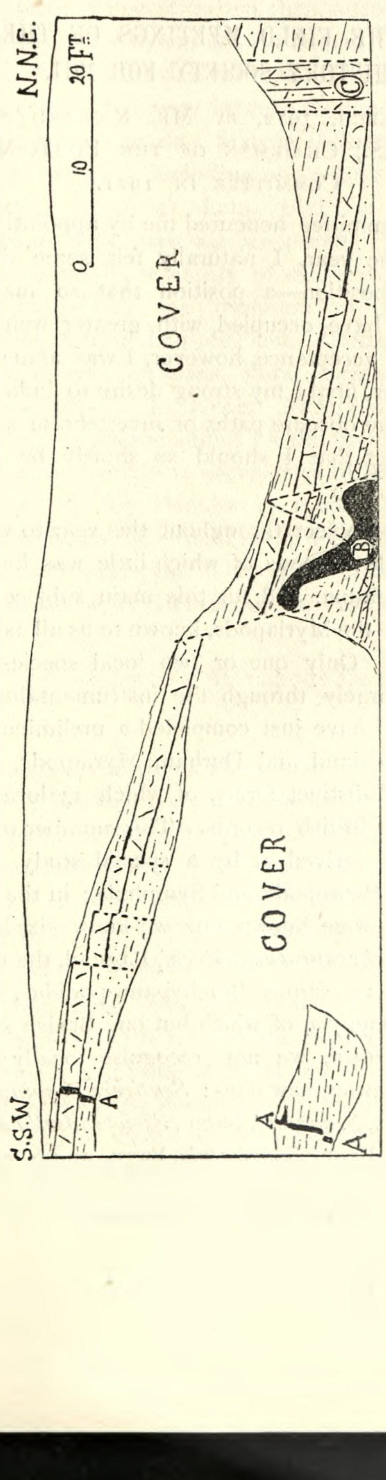


Fig 2. Section showing the Hartley Dyke (A) and Collywell Dyke (B) and the adjacent beds where free from cover. The dotted lines mark small faults. C is the wide fault-fissure mentioned in the text. The natural section runs N.-S., the section figured, N.N.E.-S.S.W. The vertical and horizontal scales are the same.

REPORT ON THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1911.

READ 25TH MARCH, 1912, BY MR. RICHARD S. BAGNALL, F.E.S., F.L.S., CHAIRMAN OF THE FIELD MEETINGS COMMITTEE IN 1911.

When the Committee honoured me by appointing me Field President for the year, I naturally felt some diffidence in accepting the position—a position that so many of our members could have occupied with greater weight and influence. In my acceptance, however, I was actuated by two important factors, firstly my strong desire to influence others to follow the more obscure paths of invertebrate zoology, and secondly the fact that I should so shortly be leaving the district.

It has been my object throughout the year to work at one small group of Arthropods of which little was known as regards the local fauna, and for this main subject I chose—happily, I think—the Myriapods, known to us all as Centipedes and Millipedes. Only one or two local species had been recorded, but largely through the instrumentality of these Field Meetings I have just completed a preliminary account of the Northumberland and Durham Myriapods, comprising no less than 58* distinct forms, of which 23 local examples represent the first British records. This number of additions has been largely arrived at by a special study of the two neglected orders Pauropoda and Symphyla; in the first order two British forms were known, now we know six, including a new species, *Brachypauropus lubbocki*, Bagnall, the first British representative of the family Brachypauropodidæ; and in the second order, Symphyla, of which but one British species was until recently known, we now recognise locally 12 forms, including the following new ones: *Scutigerella spinipes*, Bagn., *S. biscutata*, Bagn., *S. hanseni*, Bagn., *Scolopendrella dunelmensis* Bagn., *S. horrida*, Bagn., *S. delicatula*, Bagn., and *S. minutissima*, Bagn.

* This has now been increased.

This small piece of specialisation, then, accounts for a great many of the additions to the British fauna; but even in the larger forms, the Centipedes and Millipedes proper, many important captures, due very largely to almost phenomenal good luck, have been made. Sixteen different Chilopods or Centipedes are recorded, including one addition to the British fauna, *Lithobius nigrifrons*, Latz., whilst of the Diplopods or Millipedes no less than 24 are noted. Of these Prof. Verhoeff has found it necessary to diagnose a new family, Brachychæteumidæ for the reception of *Brachychæteuma bagnalli*, Verhoeff, from Gibside; and *Titansoma jurassicum*, Verhoeff, *Polydesmus coriaceus*, Porat, *Microchordeuma sp.*, *Isobates varicornis*, C. L. Koch, *Napojulus sp.*, *Glomeris perplexa*, Latz., are also recorded for the first time as British. *T. jurassicum*, Verhoeff, was previously known from a single specimen taken on the Danube in 1910. With us it has occurred in numbers in a dene near Fencehouses, whilst I have taken a few examples in my garden and on the Wear banks near Penshaw, at Gibside, and in Prof. Poulton's garden at Oxford.

Throughout this report the Myriapods are listed in full.

Had I possessed a wider knowledge of the better-known natural objects I should have attempted to review the progress of our knowledge of the local fauna during the year. I must, however, restrict this brief review to those obscure groups to which I more or less confine myself, and which I feel sure would be more closely studied if naturalists would only realize the intense interest attached to some of them.

Perhaps the most interesting piece of work attempted during the year lies in the study of the Arthropod Ectoparasites of the mammals and birds of Northumberland and Durham, commenced in the early spring by Mr. Wm. Hall, of Fatfield, and myself, and in which we have been helped by Messrs. E. L. Gill, Charlton brothers, Walton Lee, etc. Up to the moment we have recognized 28 different fleas (Siphonaptera) including *Trichopsylla dalei* Rothschild, *T. vagabundus* (*insularis* Rothschild), *Typhlopsylla dasycnemus* Rothschild, *T. pentacanthus* Rothschild, and *Ctenopsyllus spectabilis* Rothschild; 4 ticks, including a recently described species, *Ixodes caledonicus* Nuttall, from the starling; 5 Hippoboscid flies including *Oxypterum pallidum* Leach, from the swift, observed by Mr. Alaric Richardson; 6 bloodsucking lice (Anoplura) and 84 bird lice (Mallophaga), of which over thirty are for the first time recorded from Great Britain. Two of these are apparently new, one taken by Mr. Charlton on the teal and the other by Mr. Gill from the little auk, whilst others have only recently been described from North America. There remain numerous birds we have not yet had the opportunity of examining. The study, too, has led to interesting data in regard to the ancestry and evolution of the host species.

In 1907 Prof. Silvestri diagnosed a new order of curious primitive insects, Protura, the Italian species of which have since been monographed by Berlese. I have had the pleasure of discovering, locally, specimens of the three genera falling into the two families of this order, Acerentomidæ and Eosentomidæ. Some of my species are evidently new.

As regards the Myriapoda enough has already been said, so that I must now proceed with my report after a few words on my favourite insects, thrips or Thysanoptera. My collecting in this group has been carried out almost entirely at our field meetings. *Amblythrips ericæ* Bagnall, and *Bagnallia agnessæ* Bagnall, have been taken in new localities, including numerous examples of the previously unknown male of the latter; Mr. H. S. Wallace discovered a new species at Whitfield, *Physothrips latus* Bagnall, of which Mr. Hull sent me further examples later; whilst Prof. Karny, of Elbogen in Austria, has shown that the elm-leaf thrips taken by myself in the Derwent Valley and Teesdale differs from the type of *Liothrips hradacensis* Uzel, to which I referred the species; the species is now known as *Hoodia bagnalli* Karny. At the Harbottle meeting *Chirothrips hamatus* Trybom, *Frankliniella tenuicornis* Uzel, *Bagnallia klapaleki* Uzel, and *B. dilatatus* Uzel, were discovered, all new to the British fauna.

Altogether the year has been an extraordinarily fruitful one, for it must be remembered that these records are merely the results of very limited spare-time collecting and study. The additions to the British fauna may be summarised as follows: one order, four families, eight genera, and about sixty species, of which thirteen or fourteen are new to science.

In the following text or lists a single or double asterisk denotes an addition to the counties' or British fauna respectively.

The Derwent Valley, Saturday, May 13th, 1911.

A beautiful day in May saw the opening meeting of the summer session, when well over a hundred members of our Society, the Vale of Derwent Naturalists' Field Club and the Gateshead Teachers' Natural History Society met together at Swalwell. Mr. Adamson, whose intimate local knowledge was kindly placed at the disposal of the party, led the way to Winlaton Mill, where the Derwent was crossed by the Butterfly Bridge and skirted on the south side to the viaduct. Here the parties divided; some, entering Gibside, spent a pleasant hour in Snipes' Dene, whilst others wandered through the Hollinside fields to the ruins of Hollinside Manor House, where a splendid vista was obtained, including as it did the beautiful Gibside Woods (now clothed in the varied and tender shades of Spring) and the bold outstanding scars. Throughout the afternoon the cuckoo was heard, now on the north bank, now on the south; swallows were seen skimming the air, and a pair of swifts, which build annually in the Hollinside ruins, were watched with interest.

Several ornithologists, botanists, and entomologists were present, whilst geology, archæology and photography each had its devotees.

The ornithologists, led by Mr. T. Robson, made many discoveries; a waterhen's nest with seven eggs, a sparrow-hawk's with five eggs, a blackbird's nest built in a wall, and nests of the hedge-sparrow, missel-thrush, robin, blackbird and magpie, all containing young birds, some of which were pictured by the photographers of the party. Wild duck and a pair of sandpipers were set up from the river, and shortly afterwards that most beautiful of birds, the kingfisher, was observed; the jay, chiff-chaff, willow-wren and redstart were recorded, and towards evening the metallic trill of the grass-hopper warbler was heard both at Hollinside and Gibside, two of the party observing this rare and shy bird at close quarters.

A notable capture was that of a shrimp-like bristle-tail (*Præmachilis brevicornis* Ridley), which had been overlooked by naturalists until recently discovered on the Axwell Park wall; whilst a minute spring-tail (*Megalothorax minimus* Willem), the smallest known insect, was found under bark of old logs. This was of particular interest to me as it was only last year that I had the pleasure of discovering this species in this country; a creature so small that it would require 16,000 specimens to cover one square inch of paper. Of the numerous Myriapods three deserve special mention, the Diplopod *Isobates varicornis* C. L. K., new to the British fauna, *Scolopendrella dunelmensis* Bagnall, a new species of Symphyla, and a centipede, *Scolioplanes crassipes*, new to the counties. An interesting thrips—*Bagnallia agnessae* Bagnall—was found in its original habitat, including the male, which I had not previously found.

I have said enough to show the wonderful nature of the fauna of this fertile valley, and, entomologically, it may be said that the afternoon had been spent on classic ground—the home of the beetles *Pterostichus parumpunctatus*, *Triplax bicolor*, *Agathidium badium*, *Cerylon fagi*, *Rhizophagus coeruleipennis*, *Stenostola ferrea*, numerous rare *Scydmænidæ;* of the spiders *Diplocephalus protuberans*, *Ballus depressus;* of the Myriapods *Lithobius nigrifrons* Latzel, *Scolopendrella* *dunelmensis* Bagnall, *Scutigerella hanseni* Bagnall (Axwell), *Pauropus gracilis* Hansen, *Isobates varicornis* C. L. Koch, *Craspedosoma rawlinsi* Leach and *Brachychæteuma bagnalli* Verhœff; of the spring-tails *Megalothorax minimus* Willem, *Sminthurus coronatus* Bagnall (MSS.), *S. cinctus* Tullb, *Anurida tullbergi* Schött, *Friesia clavisetis* Schött and *Tullbergia krausbaueri;* of the bristle-tails *Præmachilis hibernica* Carp., and *P. brevicornis* Ridley, and of those interesting thrips *Chirothrips similis* Bagnall, *Oxythrips ajugæ* Uzel, *Bagnallia agnessæ* Bagnall, *Trichothrips longisetis* Bagnall, *T. propinquus* Bagnall and the large elm-leaf species *Hoodia bagnalli* Karny; to say nothing of a host of other notabilities.

I take this opportunity of appending a list of the Myriapoda of this part of the Derwent Valley, which is not without interest.

The lovers of archæology evinced great interest in the ruins of Hollinside, a history of which will be found in the *Archæologia Æliana*, Vol. II., and which was related to the party by Mr. Adamson and Mr. W. H. Young, F.L.S.

Altogether a most interesting and instructive afternoon was spent, the party breaking up after partaking of an excellent tea at the Golden Lion, Winlaton Mill, at which the thanks of all were accorded not only to Mr. Adamson for his leadership but to the Earl of Strathmore, Mr. MacIntyre and Mrs. Brown, for their kind permission to roam over the Gibside and Hollinside estates.

A list of Myriapods observed in the lower Derwent Valley, between Rowlands Gill and its mouth.

Centipedes (Chilopoda).

Lithobius forficatus, L., *L. variegatus* Leach (common in the woods), ***L. nigrifrons* Latzel (2 examples, Gibside; I hope to obtain further specimens to confirm the record, resting as it does on these two mutilated specimens), *L. glabratus* C. L. Koch (Gibside and Winlaton), *L. calcaratus* C. L. Koch (Gibside, 1 ♂), *L. crassipes* Koch, *Geophilus longicornis* Leach, *G. proximus* C. L. K. [*G. carpophagus* Leach (Blanchland)], *G. truncorum* Bergs. and Mein., *Schendyla nemorensis* C. L. K. (Gibside and Winlaton), **Scolioplanes crassipes* C. L. K. (Gibside, 2 ♂s and 5 ♀s found at this meeting), and *Stigmatogaster subterraneus* Leach.

Pauropods.

Stylopauropus pedunculatus Lubb. (Winlaton Mill, one example); *Pauropus huxleyi* Lubb. (Scaur banks, Winlaton Mill, and Gibside), ***Allopauropus vulgaris* Hansen (from several localities), ***A. gracilis* Hansen (in numbers, Gibside, etc.)

Symphyla.

Scutigerella immaculata Newp., *S. biscutata* Bagnall, ***S. hanseni* Bagnall (one example, Axwell), ***S. caldaria* Hansen (in hot-house, Winlaton Mill), ***Scolopendrella subnuda* Hansen (Gibside), ***S. dunelmensis* Bagnall (in numbers, Gibside), ***S. vulgaris* Hansen, common.

Diplopods.

Glomeris marginata Vill., ***G. perplexa* Latz. (Gibside), *Polydesmus complanatus* L., *P. denticulatus* C.L.K. (Gibside), *Orthomorpha gracilis* C.L.K. (hothouses), *Brachydesmus superus* Latz. (8 ♂s and 5 ♀s, Gibside), ***Titanosoma jurassicum* Verhoeff (1 ♂ Gibside), ***Brachychaeteuma bagnalli* Verhoeff (described from 1 ♂, Gibside), ***Microchordeuma sp.* (1 ♂, Gibside), *Microphoron latzeli*, Verhoeff (Winlaton Mill), *Atractosoma polydesmoides* Leach (1 ♂ and 1 juv., Gibside), *Craspedosoma rawlinsi* Leach (Gibside), ***C. simile* Verhoeff and the form *rhenanum* Verhoeff, *Julus ligulifer* (♂ and ♀, Gibside), *J. sabulosus* L., *J. albipes* C.L.K., *J. punctatus* Leach, *J. luscus* (Gibside, both sexes), *J. fallax* Mein. (♂s), ***Isobates varicornis* C.L.K., (7 ♂s and juv., Gibside), *Blanjulus guttulatus* Bosc., *B. fuscus* Am Stein and *B. pulchellus* C.L.K. (Gibside ♂ and ♀).

A list of no less than 47 species, of which 26 were observed on the occasion of this meeting.

Ewesley, Longwitton and Hartburn, Thursday, June 1st, 1911.

The second meeting took place in the Font Valley under the able guidance of Mr. Cecil H. Sp. Perceval of Longwitton Hall. Detraining at Ewesley Station the party crossed the Comb Hill Bridge and entered the grounds of Nunnykirk, where they were met by Mrs. Orde, who showed them the beauties of the estate, the gardens, and, most interesting to archæologists, an old Saxon cross, which had been brought to light a few years ago. After refreshments the members were conducted through Netherwitton to Longwitton Hall, where Mr. Perceval pointed out several botanical features of particular interest, including a clump of a rare spurge (*Euphorbia pilosa*) brought from Gloucestershire and quite at home at Longwitton; a magnificent walnut tree; bean and spindle trees; a natural hybrid orchid (*Habenaria viridis Orchis maculata*) discovered by Mr. Perceval; a white variety of the herb robert (*Geranium robertianum*) and a pink form of the common hyacinth.

A short and pleasant stay was made, and after admiring the wide and very extensive view obtained from the Hall, and enjoying Mr. and Mrs. Perceval's kind hospitality, the party proceeded through Longwitton Dene—perhaps the most beautiful walk of the day—to Hartburn. Here the Vicar, Mr. Curtis, joined the party and accompanied them through the woods, pointing out two magnificent silver fir trees and a curious grotto built in the cliff, from which ran (probably for the convenience of bathers) a covered passage to the river; and thence to the peaceful vicarage, once the home of the well-known historian of Northumberland—John Hodgson—who is buried at Hartburn. The peel tower, a part of the vicarage, was admired, and a visit, unfortunately too brief, was paid to the quiet old Norman church. Here the party took leave of Mr. Perceval and Mr. Curtis, and after a brisk walk caught the home-going train at Angerton.

Owing to the length of the ramble and the early hour of the last train home, little specialised work was attempted. The botanists discovered, amongst numerous less rare flowers and ferns, the large-flowered bitter-cress (*Cardamine amara*), the herb Paris, and several double examples of the water avens, one of which had the stem continued through the flower and surmounted by a second smaller flower. They were unsuccessful in their search for the *Pyrola minor* and the toothwort (*Cardamine bulbifera*), features of the local plant-life. A whitethroat's nest was pointed out by Mrs. Orde, whilst a cuckoo and heron were seen in flight, and a tree-creeper and grey wagtail observed.

A small collection of thrips, spiders, millipedes and centipedes, including nothing of striking interest, was made for future study.

The success of the meeting was undoubtedly largely due to the kind forethought of Mr. and Mrs. Perceval, and the gratitude of the Society was also accorded to Mrs. Orde, Mr. F. S. Trevelyan, Mr. Ralph Spencer, and the Rev. W. C. Curtis for their kind permission to ramble over the various estates.

Harbottle, Northumberland, June 30th to July 3rd, 1911.

The third meeting took place in Upper Coquetdale, where several of the members spent a few very happy days, the comfort of the hostelry at Harbottle, the fine weather and the invigorating climate combining to ensure the perfect enjoyment of all.

On the first day the party rambled to Selby's Lough by way of the Drakestone, which was climbed by some of the more venturesome, and Harbottle Lough, returning by Linshiels and Alwinton. The extensive breeding place of the black-headed gulls on Selby's Lough and the presence of three magnificent half-wild goats seen sunning themselves in the crags were interesting features.

Holystone was the object of the second day's outing, the botanists and ornithologists confining their attention to the

Barrow Burn, the Dove Crags and Coquet, whilst the entomologists wandered further afield, collecting on the moors in the vicinity of the Holystone Burn.

The third day was devoted to general rambles by the different sections, whilst some of the party on their return to Rothbury rambled from Thorpton by way of the Blue Mill and woods, over Cartington Moor to Cragside, and thence to the Thrum Mill.

In addition to these rambles, short and pleasant walks were made in the immediate vicinity of Harbottle in the early morning before breakfast, and in the late evening.

At least sixty-eight kinds of birds were either seen or heard, including such interesting species as the ring ouzel, the nightjar, the greater spotted woodpecker, herons near their nests and young, teal, ringed plover (which seldom breeds inland) and young, and the woodcock, and also the following typical upland forms: stonechat, redstart, dipper, grey wagtail, reed bunting, black and red grouse and redshank.

Some of the plants observed were of more than usual interest, such as the crowberry, corydalis, marsh cinquefoil, the bog bean, marjoram, the handsome melancholy thistle, the globe flower and the sweet-scented orchis from the moors. The insectivorous sundew was found in abundance.

The entomologists of the party recorded caterpillars of the emperor moth and other heath-loving species, and the capture of the large heath butterfly. Several giant dragon flies were seen, chiefly *Cordeulogaster annulatus*, and Mr. Woodcock showed how to brace the wings of these creatures to ensure safe examination when alive, and demonstrated the working of their mouth parts.

In regard to the insects and allied creatures in which I am especially interested, many notable forms were discovered, including five thrips new to the British fauna, and a small *Scolopendrella* new to science. The following brief account of the three-days' collecting will be useful, as many of these obscure groups have not before been studied in Coquetdale.

Thrips (Thysanoptera).

It was rather early for the heath and the heather, which was only just breaking into blossom, but the somewhat isolated clumps were crowded with thrips and their larvæ, most conspicuous amongst them being the white-barred *Aeolothrips fasciatus* L., though the two smaller species, *Physothrips ericæ* Hal. and *Oxythrips parviceps* Uzel, were more numerously represented. But best of all was the capture of the minute and wingless **Amblythrips ericæ* Bagnall, a genus and species described only recently from Yorkshire and Scotland. By repeated search this insect was found to be of wide distribution but scarce, less than thirty specimens being ultimately secured. *A. ericæ* is only a little more than half a millimetre in length, and is rather difficult to distinguish in the field from the larvæ of the larger forms. It has, however, an air of distinction, and, unlike the sluggish larvæ, moves about with some alertness and without the hesitation so evident in the former. In colour *Amblythrips* is tinged with reddish-brown, whilst the larvæ of both *Physothrips* and *Oxythrips* are clear yellow or orange-yellow, and the antennæ of our little friend, under a lens, have the definition usually attributed to a mature thrips. *A. ericæ* appears to prefer the large bell heather, *Erica tetralix*, from which plant I have more recently taken it on the moors near Riding Mill, and in numbers from the New Forest and the Isle of Wight.

Hard work examining the junipers which grow so luxuriantly in the Holystone Burn failed to produce the *Thrips juniperina* L. (Bagn.), but special attention to the grasses and sedges of the Loughs brought to light examples of three species new to the British fauna, namely the very distinct ***Chirothrips hamatus* Trybom (*dudæ* Uzel), female; what is apparently the male of ***Bagnallia klapaleki* (Uzel), from sedge-like grasses on Harbottle Lough and females of ***Frankliniella tenuicornis* (Uzel) from a soft pasture grass on the banks of Selby's Lough. Several examples of another recently recognized species, *Physothrips pallipennis* Uzel, females, occurred with the *Chiro-*

thrips, and a mutilated male of ***Bagnallia dilatatus* (Uzel), another addition to the British fauna, was taken from the marsh red-rattle or lousewort, *Pedicularis palustris*, growing in a marshy spot near Holystone. *Oxythrips brevicollis* Bagnall was unsuccessfully searched for in sphagnum, but as the insects usually found in sphagnum were very scarce indeed, little time was spent in what appeared to be a thankless task. Most of the pines were too tall to examine easily, but by jumping up and tapping some of the lower branches over a paper a few examples of *Oxythrips brevistylis* Trybom were shaken from the flowers, together with its earlier stages, and a single example of *O. ajugæ* Uzel. Uzel has also recorded the latter from *Pinus sylvestris*, as well as from the bugle (*Ajuga reptans*). *Aeolothrips vittatus* Hal., which, in my experience, appears to be attached to the pine, was not seen. A good many other species, less typically moorland, from the leaf of the cherry, and flowers of the viper's bugloss, umbels and yarrow were taken for study.

Beetles (Coleoptera).

Owing to the long-continued dry weather beetles were very scarce indeed, but one addition to the local fauna was recorded in the shape of a puzzling Anobiid-like insect found burrowing into the wood of a mountain-ash tree. It had the power of jumping and turned out to be the little Anthribid, **Choragus sheppardi* Kirb. Amongst others *Microglossa pulla* was found in a wren's nest near Holystone; *Liodes glabra* from under bark, Harbottle; *Pterostichus vitreus* and *Calathus micropterus* on the moors; *Longitarsus anchusæ* on the viper's bugloss; *Platambus maculatus* in the Holystone burn; *Orchesia micans* and *Cis bidentatus* in fungi; *Necrophorus vestigator* and *Silpha rugosa* in a dead gull.

Amongst other insects a flea *Ceratophyllus newsteadi* Roths. from the wren's nest already mentioned, two spring-tails, *Sminthurus bilineatus* and *S. novemlineatus* from heather, and the common Thysanuran *Campodea* might be recorded.

Centipedes, etc., and Woodlice.

Satisfactory work was achieved in these groups, a new species of Symphyla, ***Scolopendrella delicatula* Bagnall, being discovered, and also a Diplopod, *Isobates varicornis*, taken for the first time as British at the first field meeting of the year. Two rare woodlice were found near Alwinton, the small *Armadillidium pulchellum* and *Porcellio rathkei*.

The following is a complete list :—

Centipedes (Chilopoda).

Lithobius forficatus, L., very common on the moors; *L. variegatus* Leach, rare; *L. glabratus* C.L.K. (=*melanops* Newp.), 1 ♀; *L. calcaratus* C.L.K., 1 ♂ and 1 ♀; *L. crassipes* C.L.K., common; **Henicops fulvicornis* (Meinert), 3 ♀s on the moors; *Geophilus longicornis* Leach; *G. proximus* C.L.K.; *G. carpophagus* Leach, not uncommon on the moors; *G. truncorum* Bergs. and Mein., in the Holystone Burn.

Symphyla.

***Scolopendrella delicatula* Bagnall, two specimens near Alwinton.

Millepedes (Diplopoda).

Glomeris marginata Vill.; *Polydesmus complanatus* L.; *Brachydesmus superus* Latzel; **Julus ligulifer* Latz.-Verhoeff, 2 ♀s; *J. sabulosus* L.; *J. albipes* C.L.K.; *J. punctatus* Leach; ***Isobates varicornis* C.L.K., 1 ♀; *Blanjulus guttulatus* (Bosc.); *B. fuscus* Am Stein; **B. pulchellus* C.L.K., a few ♀s apparently referable to this species.

Woodlice (Terrestrial Isopoda)

Trichoniscus pusillus; T. pygmæus G. O. Sars, in garden at Harbottle; *Oniscus asellus*; *Porcellio scaber*; *P. pictus*, near the moors, Harbottle; *P. rathkei*, two examples, Alwinton; *Philoscia muscorum* and *Armadillidium pulchellum*, several from under stones near Alwinton.

HASWELL, EASINGTON AND DENEHOLME, FRIDAY, JULY 11TH, 1911.

The fourth meeting of the season was held in South-East Durham under the genial guidance of Mr. Edward Potts. Detraining at Haswell the party proceeded by a lane leading by Easington, to Haswell Moor, which, to the disappointment of all, was found to have been recently drained and brought under cultivation; so that now fertile fields lie where once the *Primula farinosa* and several other interesting marsh plants were wont to grow. At Thorpe the higher reaches of Horden Dene provided a picturesque walk for some distance seawards, when the party followed the sea banks to Blackhall Rocks, where a hearty tea at the inn was enjoyed. Several plants were observed in flower, including the dwarf mallow, the twayblade, the sweet-scented orchis and the *Geranium sanguineum*, its exceedingly handsome crimson flowers contrasting beautifully with an equally profuse display of the golden rock-rose.

After tea an hour was spent investigating the Blackhall Rocks; a huge example of the maritime woodlouse, *Ligia oceanica*, and colonies of the rockpool springtail, *Anurida maritima*, being observed.

Personally I was only able to join the party in the afternoon, and was therefore unable to carry out much collecting. Several thrips, mostly common, were taken from corn, rest harrow and marjoram; a rare and little-known woodlouse, *Trichoniscoides albidus* B.-L. was found on the sea-banks, and several myriapods, listed below, were seen between Horden and Blackhall Rocks.

Myriapods.

Chilopods (Centipedes).

Lithobius forficatus L., *L. variegatus* Leach, *L. crassipes* C.L.K., *Geophilus longicornis* Leach, *G. carpophagus* Leach (**Scolioplanes acuminatus* and *S. maritimus* Leach, May, 1912).

Pauropods.

Allopauropus gracilis Hansen.

Symphyla.

Scutigerella immaculata Newp. (I have also taken *S. biscutata* Bagnall, *Scolopendrella subnuda* Hansen, *S. vulgaris* Hansen and *S. horrida* Bagnall (type), on the sea-banks at Hart, a little to the south of the Blackhall Rocks).

Diplopods (Millipedes).

Glomeris marginata Vill., *Polydesmus complanatus* L., *Brachydesmus superus* Latz., *Microphoron latzeli* Verh., *Julus sabulosus* L., *J. albipes*, C.L.K., *J. punctatus* Leach, and *Blanjulus guttulatus* (Bosc.)

The Northumbrian Coast, near Beadnell, September 9th, 1911.

The fifth meeting of the season was arranged for that part of the Northumbrian Coast lying between Newton Point and Swinhoe Burn, to examine the geology; and for its success Mr. Stanley Smith, M.Sc., who has made a special study of the limestones, was chiefly to be thanked.

I was personally unable to join the party until towards the end of the day, and the following account is drawn from the pleasantly written paragraph of the anonymous correspondent to the "Daily Journal," and from a brief account of the geology given me by Mr. Smith, which I append in its entirety.

Leaving the train at Christon Bank the party made direct for the coast. The hedgerows showed signs of autumn's approach; a strong tinge of rusty brown creeping over the greens, but brightened by the brilliant coral hips and haws growing in great profusion, the ripening blackberries and the golden spikes of agrimony; and clinging by their tendrils the vetches appeared here and there.

Wealth of flowers was scarcely to be expected, since the summer of exceptional heat and sunshine had brought early bloom and fruition, but along the field-paths the bright blue of the veronica carpeted the ground, and the lingering viper's bugloss, too, was seen. Across the prickly grass of the bents round the Football Hole lay the way to the long scar running out to sea, formed by the Whinsill and the Great Limestone. After examination of this interesting structure the firm stretch of sands was followed to the Long Nanny Burn, whereabouts the grass of Parnassus, bloody cranesbill, hemlock storksbill, sea-rocket and thrift were still found in flower; and thence to Beadnell Harbour. Here another sloping scar of the Great Limestone, dolomitic in character, and on which are the ruins of the old chapel said to have been built in the memory of St. Ebba, runs out to sea, buff in colour and some thirty feet in thickness. The use of the hammer here brought to light some interesting fossils, whilst the bird-lovers found the end of the scar a good point of vantage from which to watch the passing flight of sea and shore birds.

Along the sandhills, past Annstead and across the Swinhoe Burn, which runs into the sea at Ebb's Snook—another interesting geological formation—to the thriving fishing village of Seahouses, its fine harbour sheltering a fleet of local and Scotch herring boats. The outer breakwater was crowded with gulls, whilst on a reef lying further out a number of oyster-catchers were running merrily to and fro, and feeding along the sandy shore many of the wading birds were to be seen, young turnstones, ringed plover, sanderlings, redshanks and dunlins, some of which showed little fear, allowing some of the party to approach quite closely.

The following are a few notes by Mr. Smith on the geology of the coast between the mouth of Swinhoe Burn and Newton Point:—

"The strata exposed in the cliffs and on the foreshore between the mouth of Swinhoe Burn and Newton Point belong to the middle portion of the Upper Bernician. The beds emerge from beneath the sands near Annstead, and between a fault near their point of appearance and Ebb's Snook, the complete succession, from a bed a short distance below the Oxford Limestone to the Great Limestone, may be traversed in ascending order. The limestones and sandstones jut out to sea as long scars, whilst the more perishable shales are largely covered by the sand, to the level of which they have been reduced by the erosive power of the waves. The most important limestones are the "Oxford," the "Eelwell," the "Acre" or "Six Yards," the "Four Fathoms" and the "Great"; and the Beadnell coal outcrops near the village of that name, among the beds immediately below the Eelwell Limestone. The Great Limestone at Ebb's Snook is remarkable on account of its highly dolomitic character, containing as it does 42 to 46 per cent of magnesium carbonate. On the south side of Nacker Hole a basaltic dyke may be observed cutting obliquely across the beds in a direction due west to east.

"The coast around Beadnell Bay is fringed by sand dunes, hence nothing of the solid geology is seen until Snook Point is reached, where the Whinsill, associated with the Great Limestone, forms the headland. Owing to repetition these beds also form the point south of Football Hole."

After tea, which was served at the comfortable hostelry of Mrs. Cuthbert's Bamburgh Castle Arms, the harbour, piers, and fish-packing and curing arrangements were visited, and a walk along the sandhills to Monkshouse brought the day's work to a close.

Several members and friends spent the night at Seahouses, and made an early start the following morning for the Farne Islands.

Farne Islands, September 10th, 1911.

A fine autumn morning, a smooth sea and a breeze from off the land helped to make the voyage to the Farnes a quick and enjoyable one. The object of the outing was to procure birds for the study of their insect parasites, but in addition collections of Myriapods and other small fry were made, a full account of which is appended.

Quite apart from the object of the visit to this historic bird station, the day was full of interest. It was late in the season and the eider ducks, guillemots, razorbills, puffins and terns had all left, but other birds were there to watch, including numerous small wading birds—oystercatchers, turnstones, ringed plovers, dunlins, sanderlings, and purple sandpipers. The cormorants were congregated about their nests and several gannets were observed fishing, dropping one after the other with extraordinary velocity like stones into the sea.

The return to the mainland was not, to some of the party, so pleasant as the journey out, as the sea was distinctly rough, but nevertheless all thoroughly enjoyed a hearty meal on the return to the inn, after which the party drove to Chathill to catch the home-going train.

The results of the day's work were very satisfactory, several bird-lice proving, on examination, to be entirely new to the British fauna, whilst a rare flea and a centipede were added to the local list.

Mallophaga or Biting Lice.

The following is a list of the birds examined together with the Mallophaga discovered on them.

CORMORANT: *Docophorus bassanæ* D., a few; ***Lipeurus longicornis* P., both sexes in numbers; ***Menopon brevipalpe* P., in numbers; and ***Nirmus lineolatus* N. (straggler) one specimen.

TURNSTONE: ***Nirmus dispar* P., one example; the species was described by Piaget from two exotic species of cormorant; *N. furvus* N., both sexes common; ***Colpocephalum bicolor* P., a few examples of both sexes.

REDSHANK, RINGED PLOVER AND DUNLIN: several parasites not yet worked out.

LESSER BLACK-BACKED GULL: *Docophorus lari* D., common; ***Nirmus punctatus* N., in numbers.

PUFFIN: *Docophorus celedoxus* N., in numbers; ***D. acutipectus* Kellogg (described from North America from the Horned Auklet) two examples.

Siphonaptera or Fleas.

A very rare species, **Ceratophyllus vagabundus* (=*insularis* Rothschild), in nests of the cormorant and on the bird itself. *C. garei* Rothsch., was found in puffin burrows and bred from nests of the eider duck, whilst on the mainland *Pulex cuniculi* Dale was taken from a rabbit burrow. One of the party reported the presence of the domestic species, *Pulex irritans.*

Coleoptera (Beetles).

Two interesting maritime forms, viz. *Aepus maritimus* and *Micralymma*, were found under some of the larger stones on some of the islands; the maritime bristle-tail *Machilis maritima* was seen, and several thrips were taken from the bladder-campion and other plants.

Centipedes and Woodlice.

Seven different centipedes were noted, viz. *Lithobius forficatus* L., *L. variegatus* Leach, *L. glabratus* C. L. Koch, *L. crassipes* C. L. Koch, *Geophilus proximus* C. L. Koch, *Schendyla nemorensis* C. L. Koch, and **Scolioplanes maritima* Leach. The last-named is a maritime form for which I had often searched, but till now without success.

Of the Woodlice two of our commonest species, *Oniscus asellus* and *Porcellio scaber*, were common, but the maritime *Ligia oceanica* was not seen.

Seaton Sluice and St. Mary's Island, Saturday, October, 1911.

The last field meeting was arranged for a stretch of the nearer Northumbrian Coast. The party, meeting at Hartley Station, walked down the long lane, past Seaton Delaval Hall and across the bents to the shore, and thence to St. Mary's Island, after visiting the curious old disused harbour at Seaton Sluice. As this is a favourite ramble and was taken so recently as 1907, I will not lengthen an already long report in detailing the procedure of the day.

A report of the 1907 meeting under Dr. Woolacott's guidance will be found in Mr. Alaric Richardson's report for 1907 (see Vol. III, pp. 479-480, 1909).

When I say that the party was again indebted to Dr. Woolacott's happy leadership and enlightening exposition of the geological features I need not add that the day was a very enjoyable and instructive one.

Personally I was less fortunate. Business matters prevented me joining the party at the appointed time, and although I followed by the next train I never caught up to the others, perhaps because an old tree trunk and some moss near the Hall, and some wet clayey banks near the old harbour, tempted me to devote some little time to collecting Myriapods and woodlice; the beautiful *Trichoniscus roseus* (generally regarded as a "garden woodlouse") occuring in the latter situation in some numbers.

Myriapods.

Diplopods: *Microphoron latzeli*, *Polydesmus complanatus*, *Brachydesmus superus*, *Julus albipes*, *J. sabulosus*, *J. punctatus*, *J. ligulifer*.

Chilopods: *Lithobius variegatus*, *L. forficatus*, *L. crassipes* and *Scolioplanes maritimus* (St. Mary's Island).

Woodlice: *Trichoniscus roseus* (Seaton Sluice), *T. pygmæus* and *Armadillidium vulgare*.

It should, I think, be the duty of the Field President at the close of his report to bring forward any suggestions that may occur to him which, in his opinion, would materially advance the usefulness of the Society and of field meetings in particular. This is my excuse for still a few more words.

Upon our rambles observations of distinct scientific value can be, and are made, but how many such observations are lost or buried instead of being put upon permanent record? Rare birds and their habits or rare plants are observed, and perhaps noted in the transactions or local papers, but no real effort seems to have been made to provide a scheme whereby one can tell at a moment the state of our knowledge of any one group of our fauna and flora, the local distribution of any one species, and whereby additional records or observations can be at once inserted in their correct places for immediate and permanent reference.

My suggestions to meet these points fall under three headings.

A Resumé of our local Fauna.

Firstly I should like to see a printed account of our present knowledge of the zoology of Northumberland and Durham, from the lowest forms upwards, with notes and comments upon the groups, both large and small, of which so little is now known that they might particularly repay study. An ideal model of such a resumé would be found in Mr. Evans's Presidential Address to the Royal Physical Society upon the Fauna of the Forth area. Thus anyone with a leaning towards zoology and anxious to do original work would see at a glance what had been done, and yet more important, what remained to be done, and his time need not then be taken up by laboriously going over old ground.

A Card Index of the Fauna and Flora.

Secondly the formation of strong sectional committees aided by leading naturalists, whose business would be to collate all records to date in each of the sections on to cards; a system eminently adapted for this work was explained by Mr. Bellamy to the Conference of Delegates at the Dublin Meeting of the British Association in 1908. This piece of work will not be so formidable as it appears on the surface. Contributions dealing with the Lepidoptera, Diptera, Crustacea, spiders and other groups have been published in recent years; lists of Coleoptera, Myriapoda, Thysanoptera, etc., are under preparation; whilst in many groups we should start from practically virgin ground. And once the horse work has been achieved it would be a very simple matter to keep the cards up-to-date. Cuttings, drawings, photographs, charts, etc., can be filed in addition to notes if the largest cards be adopted. Once completed, the museum would have a Card Catalogue of our Fauna and Flora open to all naturalists.

A Quarterly Magazine.

Thirdly—and here my views may be regarded as ambitious—a quarterly magazine, which, run on right lines, would have a larger circulation than the Transactions and Proceedings of our local Natural History Societies, and would act as an organ towards the accomplishment of our ambitions, the encouragement and guidance of local workers, and might bring to being other useful schemes not standing alone but as the integral parts of one united whole, such as :—

a—The mapping out of natural (or defined) areas within the counties' boundaries.

b—*Systematic surveys* of these areas in both counties, and

c—The co-ordination (without affecting the control, scope and status) of all the counties' Natural History Societies.

The scheme I have thus briefly and baldly brought before you is (as regards the first two headings at least) I feel very strongly, one that is necessary. In the carrying out it will prove of distinct value to the museum as an institution, to our Society and Field Section and to all local naturalists. It will at first entail a fair amount of systematic work and an expenditure which I am glad to say is smaller than I first anticipated : but on development such work will, I consider, bear distinctly important results.

Throughout the season the meetings have been well attended, and their success has been largely augmented by the wonderfully open weather that prevailed.

I would here wish to express my hearty gratitude to those friends who, through their local or special knowledge, have added to the interest of the outings, and especially to our hard working, far-seeing secretary, Mr. Robson, whose powers of organisation and energy have always been so generously placed at our disposal. The pleasantly written press notices, too, are of distinct help to our society, and serve to bring before the public the many pleasures to be found in the study of nature.

And now, gentlemen, I must close what, I am afraid, has proved to be a long and, to some at least, a tedious report, with my warm and hearty appreciation to all those whose co-operation has secured to us such a pleasant and successful summer session.

REPORT ON THE FIELD MEETINGS OF THE NATURAL HISTORY SOCIETY FOR 1912.

READ MARCH 19TH, 1913, BY THE REV. J. M. HICK, M.A., CHAIRMAN OF THE FIELD MEETINGS COMMITTEE IN 1912.

On approaching the termination of my term of office as President of the Field Section of the Natural History Society, to which you so kindly elected me last year, it becomes my duty to give you a résumé of the Field Meetings held during the past year. Although we cannot claim that any very great scientific work was done, yet I think that much pleasurable intercourse and exchange of ideas was promoted by them. In a season chiefly remarkable by its inclemency, we were, I think, most highly favoured by the weather, no excursion being marred by storm and tempest.

Our FIRST FIELD DAY was held at STOCKSFIELD on Saturday, May 11th. The number who joined in it was eighteen, and the party left the Central Station at 1.22 p.m. The course planned was, by kind permission of Lord Allendale, through the woods to Riding Mill, not a long journey but a very pleasant one. No great discoveries were made, but many of the harbingers of spring were noted. Remarks were made on the dryness of the woods, and it was difficult to realize that so short a time had elapsed since we all were remarking on the constant rain and the remarkable succession of wet Sundays—eighteen wet Sundays having occurred without a break. The parching winds were doubtless accountable for the extreme dryness. This also may have accounted for the scarcity of bird life seen. The curlew, landrail, cuckoo, willow-wren, chiff-chaff, whitethroat, swallow, martin and pied wagtail practically completed the list, and these were not seen in any number. The entomologists, owing to the same cause and the cold and blustering wind, had little success ; a few micro-lepidoptera and a single specimen of the green-veined white *(Pieris napi)* were all that were seen. The botanists had a better time, not in discovering novelties but in renewing their acquaintance with old friends. They noted about 50 species, among them being—

Menyanthes trifoliata	Buckbean
Adoxa Moschatellina	Moschatel
Chelidonium majus	Greater Celandine
Lysimachia nemorum	Loosestrife
Chenopodium	Goose-foot
Bonus Henricus	Allgood
Geum rivale	Water Avens
Arenaria verna	Vernal Sandwort
Arenaria trinervis	Three-nerved Sandwort
Arum maculatum	Cuckoo Pint
Ranunculus flammula	Lesser Spearwort
Alliaria officinalis	Hedge Mustard
Allium ursinum	Common Garlic
Cardamine pratensis	Cuckoo Flower
Cardamine amara	Large Flowered-bittercress
Stellaria nemorum	Wood Stitchwort
†*Chrysosplenium oppositifolium*	Opposite-leaved Golden Saxifrage
Myrrhis odorata	Sweet Cecily or Wild Anise
Lathyrus montanus	Bitter Wood Vetch
Prunus padus	Bird Cherry
Sarothamnus scoparius	Broom
Luzula sylvatica	Wood Rush
Geranium sylvaticum	Wood Cranesbill
Sanicula Europæa	Sanicle
Fraxinus excelsior	Ash, and others.

† I looked for but did not find *Chrysosplenium alternifolium*, which I used many years ago to find in the neighbourhood.

Specimens of some of these were taken to replenish the living plants in flower, which are exhibited weekly in the Hancock Museum for the benefit of students in botany. A most pleasant afternoon was terminated by tea at the Wellington Hotel, Riding Mill, and we returned to Newcastle well pleased.

Our SECOND FIELD MEETING was held at BELFORD on Saturday, June 1st, Major G. I. T. Leather having given us permission to visit the portion of his estates between Belford and Swinhoe Lake. In the early morning the weather was somewhat threatening; the sky was leaden, and the atmosphere charged with damp, so the number of members who met at the Central Station was only small. As our train travelled northwards we had much foreboding as to the weather, sharp showers of rain falling, but on reaching Belford things looked more promising. We were met by one of the keepers outside the town, who in Major Leather's absence acted as our guide. Entering Middleton by the main Lodge the luxuriance of the well-known timber at once arrested our admiration. Standing on a little bridge we could see a waterhen's nest, quite open to view on a little island in the middle of the stream. There was a beautiful growth of ferns, primroses, water avens, and yellow rocket. The trees in the drive had put on their summer dress, most conspicuous being the horse chestnuts with their spikes of flower and the wellingtonias, while underneath were masses of alkanet with their turquoise blue flowers. Before reaching the Hall we left the beaten track and continued through the home plantation, where the various conifers flourish with brushwood and ferns underneath. Pheasants were nesting every here and there; blackbirds, thrushes, and warblers joined together in filling the woods with song. As we came to more open parts of the woods wild hyacinths and primroses, the latter past their best, carpeted the ground, until we emerged from the woods into a typical hillside meadow, fringed with gorse and heather, through which a burn rippled and gurgled over its pebbles and rocky bed. The redshanks flying round with anxious cry told us their young were near. Unfortunately so difficult is it to recognise the crouching young that one was fatally injured by the foot of a passer-by. In a few minutes Swinhoe Lakes came into view in all their picturesque surroundings of luxuriant trees and capped by the crags forming part of the Whinstone sill. Here was the home of various water birds, and as we sat on a fallen tree, eating our lunch, we saw them leading forth their young. Among the ducks were the mallard, teal and tufted duck, I think there was a fourth species represented but could not quite identify it, and as I only noticed it after leaving the rest in order to catch an earlier train I could not call anyone else to my aid. It might however have been a little grebe, if they are found there. I remember I once had one of these birds alive for some little time, which was caught in a salmon net at Newburn-on-Tyne. Coots and waterhens were plentiful. Three swans kept shyly near the centre of the lake, I was told they were wild swans, but I myself think they were only the mute swan. This bird often wanders into fresh places, I have seen them on the College burn take flight and disappear in the distance. They appeared to have too much plumage for either of the real wild swans. They probably were not placed there but migrated as I have said from some other locality. In addition to the redshanks mentioned above, there were the woodcock, snipe (the latter I set up on my return journey), the stock dove and ring dove, sandpiper, herring gull, pied and grey wagtail and willow wren. Three young moles were captured and restored to their subterranean homes. The ubiquitous lapwings were calling and tumbling about in their usual excited manner. Most of the early summer flowers were in bloom.

Ranunculus aquatilis	Water Crowfoot
Caltha palustris	Marsh Marigold
Cardamine pratensis	Lady's Smock
Barbarea vulgaris	Yellow Rocket
Viola canina	Dog Violet
Viola tricolor	Wild Pansy
Polygala vulgaris	Milkwort
Lychnis diurna	Red Campion
Lychnis vespertina	White Campion
Stellaria holostea	Greater Stitchwort
Stellaria graminea	Lesser Stitchwort
Erodium cicutarium	Hemlock Storksbill
Geranium Robertianum	Herb Robert
Ulex Europæus	Gorse
Sarothamnus scoparius	Broom
Vicia Orobus	Wood Vetch
Vicia sepium	Bush Vetch
Vicia Cracca	Tufted Vetch
Alchemilla vulgaris	Lady's Mantle

Comarum palustre	Marsh Cinquefoil
Potentilla tormentilla	Tormentil
Geum urbanum	Herb Bennett
Geum rivale	Water Avens
Sanicula Europæa	Wood Sanicle
Galium cruciatum	Crosswort
Sherardia arvensis	Field Madder
Doronicum Pardalianches	Leopard's Bane
Erica cinerea	Fine-leaved Heath
Solanum nigrum	Woody Nightshade
Veronica hederifolia	Ivy-leaved Speedwell
Veronica Chamædrys	Germander Speedwell
Pedicularis sylvatica	Lousewort
Ajuga reptans	Bugle
Myosotis arvensis	Field Scorpion-grass
Myosotis palustris	Forget-me-not
Anchusa officinalis	Alkanet
Orchis mascula	Early Purple Orchis
Orchis latifolia	Marsh Orchis
Hyacinthus non-scriptus	Wild Hyacinth

There was also a rose which I was not able to identify. I tried with the aid of Mr. Baber's monograph on the genus *Rosa*, but I had not sufficient data to go upon, as I should have had the fruit as well as the flower.

Those who were not frightened by the threats of the weather in early morning were rewarded by a most interesting and enjoyable day.

I had a solitary but most refreshing tea at the "Blue Bell" Hotel, and started for my train just as the rest of the party arrived.

Our NEXT MEETING was held at RICHMOND, Friday to Monday, June 21st to 24th. This being a week-end trip I was only able to be present on the Saturday, when I enjoyed the walk to Marske, a place well-known to me in boyhood when I went to fish in the Marske and Clapgate Becks. Here my father also fished as a boy, when my grandfather lived in the vicarage. Among his pupils was the father of the unionist candidate for Gateshead, Col. Surtees. No more delightful place could be chosen for an outing than this valley of the Swale, with its lovely scenery and its health-giving air. A small party of members left Newcastle, arriving at Richmond in the evening of Friday, and after leaving their belongings at the comfortable quarters of Mr. Atkinson of the "Black Lion" Hotel, strolled by the pathway below the Castle, which is perched high on the rocks, with the Swale winding round its base far below their feet. Along the edge of the pathway the mallow was growing freely. In the crannies above the ivy-leaved toadflax was festooned, and in the higher cracks the wallflower was in its true haunt, its yellow flowers in contrast with the brilliant blue of the viper's bugloss. Lower down amidst the dense foliage which covers the abrupt bank of rock, the clary or wild sage threw up its whorled spikes. Returning by the quaint old streets and wide open market square, the party went by way of Sandford House along the leafy lane to Easby; very fine were the woodland trees hereabouts, with magnificent boles and wide spread of branches. Twilight was drawing in as the party viewed the venerable monastic pile so beautifully situated by the rippling stream, and as they wound their way home by its banks numbers of bats were passing above their heads, wheeling in rapid flight hawking for food. On Saturday the party was augmented by the Field President and another member, and a start was made up the dale on a morning of perfect summer sunshine. Leaving the highway a cart track took us into the Low Whitcliffe Woods, where the red campion, purple geranium, and yellow pimpernel were growing profusely, and in the boggy bottoms the lingering blooms of the marsh marigold and the spotted and palmate orchis were found. Now a meadow bounded by the circling river was our path. In the cliffs above us used to be various caves, which as a boy I used with my brother and a companion to explore, at I believe the imminent risk of our lives. They are, I understand, the remains of old mine workings. The whin and the broom were here and there, and up and down the stream the sandpiper was flying. In the next coppice the rock rose was abundant, and before reaching

Marske the mimulus was found in the bed of Clapgate Beck. After resting some time and waiting for the members of our party who had taken a slightly different route (we did not, however, see them until we reached Richmond), we followed the track past Applegarth Farm to the High Whitcliffe Woods, and a brisk climb up the craggy slope took us to Willan's Leap and the moor. Here the golden cross of the tormentil dotted the short crisp herbage, and a pond silvered by the water crowfoot shone in the sunlight. In the early hours of Sunday morning a thunderstorm raged (I narrowly escaped one as I was returning home on Saturday evening), cooling and clearing the atmosphere after the sultry night; and after breakfast a start was made across the old bridge by the side of the Swale below the Billy Bank Woods. Both the pied and the grey wagtail with young were darting in and out of the low deep shadow of the opposite woods, chasing insects and alighting on the stones in the river's bed. Our path lay in the shadow, close below the limestone crags and caves which stand out from the foliage as though sculptured by hand. The dominant plant was the dog's mercury, whose dense growth choked the humbler flowers, and was only pierced by the higher stems of the campion, enchanters nightshade and sanicle, while nearer the river the delicate purple and yellow vetchling and the coarse figwort were growing. As we passed out of the woods the twayblade and palmate orchis were seen, and in the meadows the parasitic eyebright and yellow-rattle were thick in the hay crop. Hovering and flitting here and there were the wild bees, the white and a single small blue butterfly. Our path was now along the road for a couple of miles, the wooded heights towering on either hand, with verdant fields alongside, starred by the discs of the oxeyed daisy. The hedges and walls, with wide strips of green sward running alongside, were fringed with trees; here and there a yellow cushion of meadow vetchling, or purple or red bed of geraniums and ragged robin; and a specimen of the stone bramble was found among the rocks. A little beyond the point where the Marske Beck bubbles over its stones into the Swale, our path turned to the south, climbing toward Downholm, a group of rather gloomy stone cottages planted against the hillside, whose strength spoke of wind and snow to be withstood in the storms of winter. The clouds which had been gathering up the dale with ominous scowl now broke, and rain followed us across Hudswell Moor. The piping and the chattering of the stonechats and wheatears was added to the plaintive cry of the lapwing and the whistle of the curlew in the solitude of the moor. A snipe arose, and darting high into the air, kept up a wide circular flight, then dropped obliquely for a short distance, uttering that peculiar bleating noise or "drumming," the production of which has puzzled so many observers, and then rose in flight to repeat the manœuvre again.

From the height of Hudswell Moor probably the finest and most extensive view of the Swale, as it flows from its hilly bed to the plain towards York with the Hambledon Hills shewing against a hazy bluish background, is obtained. One regrets that with such an outlook and with such health-giving air, the village itself in its deserted and ill-repaired cottages reflects one of the signs of the times; so we gladly turn off to the fields to reach home by the Billy Bank Woods.

Starting on our last day's expedition up the steep bank leading to Leyburn, a soaking rain and dull ominous skies altered our plans; and after following the Badger Burn a short distance we struck for the uplands towards Hipswell. As we proceeded by the shelter of the plantations the rain gradually ceased and the sun broke out, drawing forth the fragrant odour of the conifers, and the larks overhead poured forth their melody. Along the road the wild roses were still in abundance, and the hedgerows were filled with the summer flowers, leading us pleasantly to Hipswell, a smiling village whose roseclad cottages surround the broad open green. Nestling behind the trees in one corner stand the church and towered parsonage bearing the date 1589. A small crayfish was found in the trough of the spring where we stopped to quench our thirst. Across a sheep meadow by the mill we strike the

Colburn, and thence along the high banks of the Swale to Catterick Bridge, whence we wheel round for the homeward road by Brompton. Here there is more arable land, but the scarlet poppy, though appealing to the eye of the artist and naturalist, is too prolific to be pleasing to the farmer. We were fortunate in seeing the yellow wagtail sitting on a wall outside the village. On our approach it wheeled round to the rails opposite and back again, affording us a good view of its gay plumage and graceful antics. On the river were the sandpipers and martins hawking up and down, and by winding meadow and wooded knolls, with constant changing views, were we led back towards Easby—near which the comfrey and rose-bay willow-herb were noted—to Richmond, where our pleasant meeting ended. Mr. Beck kindly supplied the following list of birds seen:—lesser whitethroat, greater whitethroat, willow wren, tree pipit, pied, grey, and yellow wagtails, common sandpiper, dipper, redshank—golden plover, wheatear, whinchat (to which I can add the stonechat), snipe (drumming), tawny owl—and others.

We held our FOURTH MEETING at BLACKHILL AND SHOTLEY BRIDGE on Saturday, July 13th, in which the Vale of Derwent Field Club were invited to join. Leaving Newcastle at 10 a.m. the party walked to Allansford and then through the woods by the banks of the Derwent to the Sneap, and returned to Allansford by the southern side of the river. The day was fine and hot and we much enjoyed our walk, much of it being beneath the shade of the trees. No novelties were observed, but much of interest was seen. The early summer flowers were mostly over, but there were noticed between Blackhill and Allansford the broad smooth-leaved willow herb, dovesfoot cranesbill, jagged-leaved cranesbill, small St. John's wort, cathartic flax, and three varieties of wild rose. Between Allansford and the Sneap, spotted orchis in abundance, a few butterfly orchis, herb-Paris, columbine (the latter I rather think a garden escape; it did not coincide with the columbine which used to grow on the limestone at Ferryhill), honeysuckle, meadowsweet, ragged robin, cowwheat, giant bellflower, fine-leaved heath, broad-leaved helliborine, wall lettuce, golden rod, comfrey cultwold, dyer's greenweed (very plentiful in one field), wintergreen and viper's bugloss. Few birds were seen: bullfinches, redstarts, whin and stonechats, gold crests, spotted flycatcher, tree creepers, magpie, and dipper were about all seen of any note. Among insect life were seen the meadow brown butterfly in abundance, the common blue, the small heath, larvæ of *Vanessa urticæ* feeding on nettle, a few leaf-rolling larvæ, some plume moths, the species of which I am not certain of, the bordered-white moth, a few microlepidoptera, mostly *Litho-colletis*, and a few common noctuæ. But though no great discoveries were made, all agreed that the day had by no means been wasted. The day was fine, the woods looking their best. We were much interested in a plantation of Japanese larches, which have been planted to test their disease-resisting qualities. A very enjoyable day was brought to a most enjoyable close, the members of the party being entertained to tea by Mr. and Mrs. J. Ford Maling at Shotley Bridge. Their kind hospitality was appreciated by all, and acknowledged by a hearty vote of thanks.

The FIFTH FIELD MEETING was held at BRANCEPETH on September 25th—rather later than was first intended owing to my absence in Norway. Again we were favoured by a fine day, a somewhat rare occurrence during a most inclement summer. Leaving Newcastle at 10.4 a.m. the party arrived at Brancepeth about 10.45, and walked down the road, with its avenues of trees, and through the village, with its comfortable houses covered with creepers of various kinds, to the entrance of Brancepeth Castle. I am sorry to say that I had mistaken the time of the train's arrival, or rather I did not know that there was a connection at Durham. The party therefore retraced their steps and entered the Stockley Gill near the Station, closely following the course of the stream. Here among the thick undergrowth the bulk of the botanical work was done.

Noticeable so late in the season was the growth of the campion, scabious, mallow, and ragwort; also beds of campanula, angelica, and great valerian. In all about 28 species of wild flowers were noted. In the pools numbers of trout were darting hither and thither. The approach of autumn was already making itself known by the changing colours of the trees. The effects of the cold wet summer were very visible in the withered leaves, which seemed about to fall without taking on the many hues of the average autumn. Many fine oaks and larches were noticed. Not many birds were noticed; among those seen were the heron, herring gulls, wild duck, kestrel, blackcap, cole tit, pied and grey wagtail, and hooded crow. The rooks and jackdaws were vociferously soaring in the evening above their nesting places. A visit was paid to the old parish church, which shewed signs of careful attention. We all admired the old oak pews and chancel screen. After leaving the church, we were, by kind permission of Viscount Boyne, shown over the castle by the housekeeper. The armour and pictures were viewed with much interest; indeed so much interested were all in the castle and grounds that the latter part of our programme, namely a visit to Binchester (Vinovium castra) with its Roman camp on the site of an ancient British camp, had to be postponed to a future occasion. Walking through the Park, where the fallow deer lent a picturesqueness to the view – I forgot to mention a newly constructed rock garden below the Castle, in which we were much interested—we crossed the Wear by Pagebank, past the Deer Park of Whitworth to Whitworth Vicarage, where Mrs. Hick and I were pleased to be able to offer refreshments. After a welcome rest and a stroll in the Vicarage grounds, a return was made to Brancepeth.

The following flowers were found in bloom:

Lychnis diurna	Red Campion
Malva moschata	Musk Mallow
Geranium sylvaticum	Wood Geranium
Geranium Robertianum	Herb Robert
Potentilla tormentilla	Tormentil

Angelica sylvestris	Angelica
Valeriana officinalis	Great Valerian
Scabiosa succisa	Devil's-bit Scabious
Leontodon autumnalis	Autumnal Hawkbit
Leontodon hispidus	Rough Hawkbit
Lapsana communis	Nipplewort
Senecio Jacobæa	Ragwort
Senecio aquaticus	Marsh Ragwort
Arctium lappa	Burdock
Carduus acanthoides	Spotted Thistle
Carduus palustris	Marsh Thistle
Centaurea nigra	Black Knapweed
Centaurea scabiosa	Greater Knapweed
Achillea millefolium	Yarrow
Campanula latifolia	Giant Bell-flower
Scrophularia nodosa	Knotted Figwort
Digitalis purpurea	Foxglove
Stachys sylvatica	Woundwort
Galeopsis Tetrahit	Hemp Nettle
Prunella vulgaris	Selfheal
Strachys Betonica	Betony

Our SIXTH and LAST FIELD MEETING was held at HOLY ISLAND on Tuesday, October 22nd. This meeting was originally planned for Alnmouth or Blackhall, but the month having advanced to this date, it was decided that it was really too late in the year, and so it was changed to Holy Island, the idea being to note the various migratory birds. Some of the party travelled by the early train, and these were most successful in seeing various birds. Those who arrived at Beal by the later train, including myself, were not so successful; nevertheless, we thoroughly enjoyed the day. After driving across Fenham Flats, and luncheon at the Iron Rails Hotel, a move was made to visit the Priory. From there we made our way to the Castle, which has been furnished at great expense by Mr. Edward Hudson, the lessee. We were much interested in the many pieces of antique furniture and other curios which he has gathered together here. I did not notice any plants of the henbane, *Hyoscyasnus niger*, which formerly grew on the slopes below the Castle. The beds of sea campion, so conspicuous on a former visit, were now out of flower. Insect life, too, had yielded to the oncome of autumn. The bird life about the island, though it included nothing at all startling, was nevertheless interesting and characteristic. Among the sandhills were many redwings and one small party of fieldfares. The latter bird I had seen a month before congregating on the Norwegian coast, preparing for their migration.

A single woodcock was put up among the bents. I remember seeing a great number of these birds at later date, during one visit to Holy Island many years ago, evidently just arrived, from their tired appearance, after being buffeted by a gale. Thrushes and blackbirds, which were also in scattered parties in the sandhills, were doubtless immigrants like the redwings and fieldfares. A striking juxtaposition of summer and winter birds was provided by some house martins that were still lingering about their nesting quarters in the Priory. Lapwings were very numerous all over the Island, and linnets near the village. Skylarks were singing merrily during the morning. Two hawks, a kestrel and a hen sparrow hawk, were seen about the sandhills. But the main object of the ornithologists was naturally to see what they could of the waders and sea birds. On the spits of rock the most conspicuous and noisy were the redshanks. One large party of turnstones was seen, a good many oyster-catchers, and many small flocks of dunlins. Near the Pond on which there were many coots and waterhens, a solitary sanderling was running about busily feeding. At first I thought it must be a wounded bird, as it allowed me to approach within a few feet, but it apparently was quite uninjured and could fly well. I tried a snapshot photograph of it, but the light was so bad, both from the lateness of the hour, and the overcast sky, that no result was obtained. Curlews were seen and heard in all parts of the Island, and out on the flats they were almost the only waders that could be detected; this of course on account of their size, not because the smaller waders were not there. The best time to see the waders is at high water, when they are driven from the flats to the shore. A few godwits were noticed on the North Shore; one or two large flocks of ringed plovers were met with, but these curiously enough in the meadows, comparatively few were to be seen nearer the sea. On the rocks frequented by the waders were a few rock pipits, characteristic small birds of the North-East Coast, and it was amusing to see a wren hopping about and singing on the most exposed part of the shore. Of the actual sea birds, the gulls (of all the usual species) were the most conspicuous. A good many flocks of ducks were seen flying in the distance, but mallards and wigeons were all that could be definitely recognised. A few small parties of eiders were on the water. One string of geese was seen, too far off to be identified; we were told, however, that some bernicle geese were on the flats and that a few had been shot. Cormorants were as numerous as ever, and one gannet was noticed, in the dark plumage of youth. After a cup of tea we again essayed to cross the flats, and arriving safely at Beal Station, returned to Newcastle. Thus having a pleasant ending to our Field Meetings for the year.

During the winter three evening meetings have been held. At the first a very interesting collection of conifers and other trees was exhibited, showing the arrangement of the leaf buds for the coming year. The fruit of the monkey-puzzle was most interesting to us all, as few had ever seen it before. Our second meeting was mostly talk on the subject of the proposed introduction of the card system for recording natural history observations, Mr. R. S. Bagnall kindly explaining its working. I think that when in full working order, it will be most useful in all the branches of natural history. The third meeting held on Wednesday, February 26th, was devoted to a lesson to beginning lepidopterists in the relaxing and setting of lepidoptera. A fine collection of silk-producing moths, lately acquired in exchange by the Society, was also on view in the Committee Room where our meeting was held. This, I think, concludes our résumé of the year's work. These evening meetings I hope may be continued, as it is desirable that the members should from time to time meet together to exchange in an informal way their knowledge and experiences to their mutual advantage. It is with much regret that I conclude this, I fear, somewhat bald address, knowing that it is improbable that I shall be able to attend many, if any more, Field Meetings, as I am only in the North partly for this meeting, and my future life, whether long or short, will be passed in the extreme South. And it may be that this is what I may call my farewell words. My connection first of all with the Tyneside Naturalists' Field Club, from the time when I was proposed as a member by our late friend John Hancock, and then with the Field Branch of the Natural History Society, has been a great source of pleasure to me, in the social intercourse and pleasant companionship of so many kindred spirits, some of whom alas have left us and "gone before," but many of whom are still left to remembrance dear, in my future life.

It only remains for me to thank you for the honour you did me in electing me Field President, and to wish all success and prosperity to the Natural History Society, and health and happiness to the members of the Field Section, that they may have many pleasant and instructive meetings in the future.

Terrestrial Acari of the Tyne Province.

By the Rev. J. E. Hull, M.A.

I.—ORIBATIDAE.

The Oribatidae of Northumberland and Durham—the Watsonian Tyne Province, comprising three vice-counties: Durham (66), Tyneland (67), and Cheviotland (68)—are set forth, in the present list, to the number of 116 species, in thick type. Precise localities are not given, but after the name of each species its distribution is indicated by the numbers of the vice-counties in which it has occurred, each vice-county being further divided into three regions—the hill country (*a*), the coast (*c*), and the intervening region (*b*). But it is to be understood that the nine regions thus formed have only been explored by sample. Thus, 67a practically stands for West Allendale, and similarly 68a may be taken as representing Wooler and Cheviot Hill, and 67c the immediate neighbourhood of Whitley Bay, while 66b is made prominent mainly by Mr. R. S. Bagnall's exhaustive collecting at Gibside and Chopwell.

To the local species I have added the other 44 British species (names in italics) so as to present a complete up-to-date British list for the convenience of students. The basis of the list is of course Michael's British Oribatidae (indicated below by the initials B.O.); Irish records are from Halbert's list (Clare Island Survey, Part 39 ii.); Scottish records from a MS. list (very kindly supplied by Mr. Wm. Evans of Edinburgh) of the Oribatidae taken in the Forth area. I am heavily indebted to Dr. Randell Jackson for copious supplies of material from Cheshire and North Wales; also to Mr. Varty Smith of Penrith for excellent consignments from Cumberland and Westmoreland. I have had the privilege of examining a fine collection made at Southport by the late Dr. Chaster (list included in my paper on Dr. Jackson's earlier consignments—*Lancashire and Cheshire Naturalist*, February, 1915); and I am now publishing in the same periodical an account of collections made by Mr. Bagnall at Grange-over-Sands. With regard to Yorkshire I have not been quite so fortunate, though several correspondents have favoured me with a few specimens from time to time.

For many years Dr. Berlese, the Italian acarologist, has been the leading authority on Oribatidae. His knowledge of the family is quite unrivalled, and I have felt constrained to follow his classification and nomenclature as far as I conscientiously could. A vast increase in the number of species, European and otherwise, has caused him to establish many new genera; but he has not recently published any complete systematic list, so that I have found it necessary to propose a few new genera to preserve the balance of groups. Moreover to equalise values as far as possible I have raised some of his subgenera to the rank of genera. In fact I have eschewed subgenera altogether, as I see no practical advantage in them, and have no liking for a cumbrous multinomial nomenclature.

I have incorporated in this list an analytical key of genera and species for two reasons—first, because it seems well to make it as clear as possible in what sense each name is used; and secondly, because it may thus serve as a preliminary guide to the study of the family.

A.—Sub-family Tegeocraninæ.

Legs ii., iii., iv. inserted under the body so that the lateral margins of the sternal plates are approximately parallel.

1.	Dorsum smooth (if pitted, the pitting very minute) ...	2
	Dorsum rough (granulate, furrowed, ridged, or deeply pitted)...	4
2.	Mandibles styliform, serrate	*Serrarius.*
	Mandibles normal	3
3.	Usual sensory seta on tibia i.	*Liacarus.*
	No sensory seta on tibia i.	*Phyllotegeus.*
4.	Claws tridactyle	5
	Claws monodactyle	8
5.	Dorsum marginate	*Ommatocepheus.*
	Dorsum without any diverse margin	6
6.	Front margin of dorsum much modified	*Scutovertex.*
	Front margin of dorsum normal	7

7. Dorsum without humeral projections	*Cepheus.*
Dorsum with humeral projections	*Tritegeus.*
8. Lamellæ large pale upright	*Tegeocranus.*
Lamellæ dark horizontal, or 0	9
9. Dorsum projecting far over the cephalothorax ...	*Tectocepheus.*
Dorsum not so projecting	10
10. Abdomen with a projecting lateral pore	*Hermaniella.*
No lateral pores	11
11. Dorsum elongate, with appressed setæ...	*Odontocepheus.*
Dorsum broad (rather quadrate) setæ erect	*Carabodes.*

SERRARIUS, Mich.

1. *Serrarius microcephalus*, Nic.
Essex, Cornwall, Dorset (B.O.).

LIACARUS, Mich.

The three British species at present known represent three distinct groups which may be indicated as follows :—

Liacarus (type *nitens* Gerv.)—translamella represented by a forward-pointing mucro.

Adoristes (type *ovatus* K.)—no trace of translamella or mucro.

Astegistes (type *bicornis* P. & W.)—site of translamella grooved.

2. Liacarus coracinus, K.
Leiosoma simile, Nic. (B.O.). 66, 67, 68.
General in Britain. Xylophilous.

3. Liacarus ovatus, K.
Leiosoma ovatum, K. (B.O.). 66, 67, 68.
General in Britain; much more frequent than the preceding. Xylophilous.

4. *Liacarus bicornis*, P. & W. (P. Z.S., 1905).
Yorkshire and Cambridgeshire (P. & W.). Cumberland and Westmoreland (J. C. Varty-Smith.) Scotland.

PHYLLOTEGEUS, Berl.

5. *Phyllotegeus palmicinctus*, Mich.
Leiosoma palmicinctum (B.O.).
Cornwall (B.O.). Mycophilous.

OMMATOCEPHEUS, Berl.

6. *Ommatocepheus ocellatus*, Mich.
Cepheus ocellatus (B.O.).
Cornwall (B.O.). Mycophilous.

TRITEGEUS, Berl.

7. Tritegeus bifidatus, Nic.
Cepheus bifidatus (B.O.). 67a.
General, though never frequent.

CEPHEUS, Koch.

8. Cepheus tegeocranus, Herm. 66, 67, 68.
Lamellæ ending in two contiguous acute cusps.
Common throughout the British Isles.

9. *Cepheus latus*, Nic.
Terminal cusps of lamellæ blunt.
Epping Forest (B.O.). Oxfordshire (Bagnall). Cheshire (Jackson).

TEGEOCRANUS, Nic.

1.	Dorsum without a border	*T. hericius*
	Dorsum with a diverse margin	2
2.	Lamellæ with subterminal cusp	*T. dentatus*
	Lamellæ with cusp	3
3,	Lamellæ meeting in front	*T. cepheiformis*
	Lamellæ not meeting in front	*T. latus*

10. *Tegeocranus hericius*, Mich.
New Forest, on oaks (B.O.).

11. Tegeocranus dentatus, Mich. 66ab.
Local; Cheshire, Cumberland, Scotland.

12. Tegeocranus latus, K. 66, 67, 68.
Common everywhere on dead wood.

13. Tegeocranus cepheiformis, Nic. 66, 67c, 68a.
Very like the preceding, but much smaller; local.

TECTOCEPHEUS, Berl.

14. Tectocepheus velatus, Mich. 66ab, 67, 68.
Generally distributed.

HERMANIELLA, Berl.

15. Hermaniella granulata, Nic.

Hermannia arrecta, B.O. 66b.

Michael says this is generally distributed: I find it decidedly local.

Cumberland, Cheshire, Scotland.

SCUTOVERTEX, Mich.

16. Scutovertex sculptus, Mich. 66a, 67c, 68a.

The only moss-species in this genus. Local.

Cumberland, Lancashire, Cheshire, Scotland, Ireland.

17. Scutovertex maculatus, Mich.

This form, with 10 'knobbed' spines in the hinder and lateral margin I have never seen. Cornwall (Michael), Scotland, Ireland. Whether the Scottish and Irish belong to this or the next I do not know.

var. pseudomaculatus, Hull. 66ac, 67c.

Spines on hinder margin stout and acute.

Swarms on the Northumbrian coast near Whitley Bay and ascends to 1,600 feet on Muggleswick Common, Durham.

Cheshire, rare.

var. insularis, Hull. 67c.

Dorsum transversely wrinkled (as the nymph, but black).

St. Mary's Island, Northumberland, with the preceding.

18. Scutovertex lineatus, Thor.

S. corrugatus, B.O. 67c.

Always aquatic, sometimes in fresh water, but never beyond the reach of sea spray.

Anglesey (B.O.). Ireland.

19. Scutovertex bilineatus, Mich. 67c, 68c.

Wholly aquatic, nearly always in pure sea-water.

var. spoofi, Oud 66c.

Roker pier (Bagnall).

ODONTOCEPHEUS, Berl.

20. **Odontocepheus elongatus, Mich.** 66ab, 67ab.

This species like its allies of the genus *Carabodes* is xylophilous.

Cheshire, Cumberland, Yorkshire, Scotland, Ireland.

CARABODES, Koch.

1.	Dorsum uniformly granulate	2
	Dorsum furrowed	5
2.	Dorsum without diverse margin	*labyrinthicus*
	Margin and disk diverse	3
3.	Sensillus doubly curved, acute	*marginatus*
	Sensillus simply curved, blunt	4
4.	Marginal setæ thick	*nepos*
	Marginal setæ fine	*scymnus*
5.	Dorsal hairs thick white conspicuous ...	*coriaceus*
	Dorsal hairs inconspicuous caducous ...	*femoralis*

21. **Carabodes labyrinthicus, Mich.** 66b, 67ab, 68a.

Mycophilous; generally distributed but varying in frequency.

Cheshire, Lancashire, Yorkshire, Scotland, Ireland.

22. **Carabodes marginatus, Mich.** 66b, 67ab, 68a.

Cheshire, Cumberland, Scotland, Ireland.

23. **Carabodes nepos, Hull.** 66ab, 67a.

Cheshire, Cumberland.

24. **Carabodes scymnus, Hull.** 66b, 67a, 68a.

Cheshire, Yorkshire.

25. **Carabodes coriaceus, K.** 66b.

This would seem to be a southern species, as Michael calls it common (B.O.). It has not been recognised in Scotland or Ireland, and I have seen one specimen only (from Chester-le-Street).

26. **Carabodes femoralis, Nic.** 66ab, 67a.

Epping Forest, Cumberland, Scotland.

B.—Sub-family Oribatinæ.

Legs all lateral and therefore sternal plates with lateral margins diverging backwards. Pteromorphæ present, fully developed or vestigial.

1.	Mandibles styliform, integument usually roughened...	2
	Mandibles normal, integument smooth	3
2.	Interlamellar setæ flattened horizontal	*Pelops*
	Interlamellar setæ normal erect	*Peloptulus*
3.	Pteromorphæ fully developed	4
	Pteromorphæ imperfect or vestigial (or 0, exceptionally)	*Oribatula*
4.	Translamella laminate	*Sphærozetes*
	Translamella a mere linear fold	5
	Translamella 0	8
5.	Pteromorphæ strap-shaped	*Limnozetes*
	Pteromorphæ otherwise	6
6.	Dorsum setate	*Melanozetes*
	Dorsum hairless	7
7.	Lamellar cusps prolonged	*Ceratozetes*
	Lamellar cusps simply angular	*Euzetes*
8.	Lamellæ large broad horizontal	*Achipteria*
	Lamellæ small erect, or 0	9
9.	Pteromorphæ projecting beyond the front of dorsum.	*Oribates*
	Pteromorphæ normal	10
10.	Claws tridactyle...	*Chamobates*
	Claws monodactyle	11
11.	Sensillus porrect, horizontal or nearly so	*Minunthozetes*
	Sensillus not porrect, upright	12
12.	Femora i with blades	*Mycobates*
	Femora i without blades	*Zetomimus*

PELOPS, Koch.

1.	Apex of sensillus blunt	2
	Apex of sensillus acute	4
2.	Pteromorphæ black, similar to dorsum ...	*major*
	Pteromorphæ brown	3
3.	Dorsal setæ blunt, slightly clavate ...	*acromius*
	Dorsal setæ acute	*perarmatus*
4.	Posterior dorsal setæ thicker than the rest.	*fuligineus*
	Dorsal setæ all similar	5
5.	Two smooth spaces on the dorsum ...	*approximatus*
	One smooth space only	*farinosus*

27. **Pelops acromius**, Herm. 66bc, 67ac.

General, according to Michael—which presumably is true for the south of England. I find it distinctly local.

Oxford, Lancashire, Scotland, Ireland.

28. **Pelops perarmatus**, sp. nov. 66b.

Length just over 1 mm. Prodorsal extension flat, front margin straight, brown like the pteromorphæ. Sensillus similar in form to that of *acromius* but relatively shorter. Dorsum black, with a long oval clear spot on the median line. Dorsal setæ uniform, thick, rigid, long and acute.

In nests of *Formica rufa* at Chopwell, Durham (P. Charlton).

29. **Pelops farinosus**, Nic. 67a.

This species seems to be rare east of the Pennines, but in Cheshire and Flintshire it appears to be the commonest of the genus. Also pretty frequent in Cumberland.

30. **Pelops major**, Hull. 67c.

Very like *perarmatus*, but the dorsal hairs are quite slender, and the secretion sets in fine granulate wrinkles, the surface of the pteromorphæ being similar and of the same colour—dead black.

Cumberland.

31. **Pelops fuligineus**, K. 66bc, 67ac, 68a.

Dorset, Cumberland, Scotland, Ireland.

32. **Pelops approximatus**, sp. nov. 67a.

Length, 510 μ.

Clear spot present but indefinite. Dorsal hairs all similar, a little thickened and blunt, short, not conspicuous except the posterior four (two divergent on the margin, two nearer together and convergent immediately above). Dorsum when coated with secretion showing two elongate irregular smooth spaces on the median line; when clear reddish brown minutely punctate (like *Peloptulus phæonotus*). Sensillus slender, fusiform distally, with an imbricate or serrate head ending in a point.

Among pine needles and moss in a pine wood, West Allendale: a few specimens only.

PELOPTULUS, Berl.

Pteromorphæ mutually disjunct ...	... *phæonotus*
Pteromorphæ conjunct in front of dorsum	... *montanus*

33. **Peloptulus phæonotus**, Koch. 67a.
Cornwall, Scotland, Ireland.

34. **Peloptulus montanus**, Hull. 67ac.
Taken first, as the name indicates, in the hill country (West Allendale, at 1,000 feet). Also immediately afterwards in submaritime localities (Holywell Dene, R. S. Bagnall). Frequent in moss from Delamere Forest, Cheshire.

SPHÆROZETES, Berl.

Oribatine species with well-developed membranous lamellæ, and a similar laminate translamella.

Type species : *orbicularis*, K.

1.	Dorsum hairless, pteromorphæ disjunct, setæ glabrous	2
	Pteromorphæ joined by a narrow band, thoracic setæ serrate	3
2.	Lamellar and translamellar cusps equal ...	*orbicularis*
	Lamellar cusp exceeding the translamellar.	*piriformis*
	Cusps wanting	*rubens*
3.	Dorsum hairless	*montivagus*
	Dorsum setate	4
4.	Sinus of translamella wide, cusps short ...	5
	Sinus of translamella deeper than wide, cusps long	7
5.	Inner (translamellar) cusp wanting ...	*notatus*
	Both cusps present, acute	6
6.	Translamella broad	*picipes*
	Translamella narrow	*oblongus*
7.	Cusps unequal acute	*setosus*
	Cusps equal truncate	*fuscipes*

35. **Sphærozetes orbicularis**, K. 66, 67, 68.
I have this species from North Wales. Whether other records under this name are referable to the species as here defined, I do not know.

36. Sphærozetes piriformis, Nic. 66b, 67a.
[Scotland and Ireland: but possibly not referring to the species as here defined].

37. *Sphærozetes rubens*, K.
See Pearce and Warburton, P. Z. S., 1905.

38. Sphærozetes montivagus, Hull. 66b, 67a.
Cheshire.

39. Sphærozetes picipes, K. 66, 67, 68.
The commonest species in this genus, to which most of the existing records of *setosus* should be referred.
Cumberland, Yorkshire, Scotland (J. E. H.)

40, Sphærozetes oblongus, L. Koch. 66b, 67a.
Cumberland, Oxford (Bagnall).

41. Sphærozetes notatus, Thorell. 66b.
Flintshire (J. E. H.)

42. Sphærozetes setosus, K. 66b, 67ac, 68a.
More or less hygrophilous: in summer not arboreal but very partial to meadow grass, on which it sometimes swarms in countless myriads. It has been confounded with the three preceding species which are more or less arboreal from May to September.
Cheshire, Cambridgeshire, Cumberland, Lancashire, Scotland, Ireland.

43. Sphærozetes fuscipes, K. 66ab, 67a.
Hygrophilous: nevertheless it ascends into trees and shrubs in summer.
Leicester, Cumberland, Cheshire, Epping Forest, Scotland, Ireland.

ACHIPTERIA, Berl.

1.	Pteromorphæ with a pointed lobe in front.	2
	Pteromorphæ without the lobe	5
2.	Dorsum dull, punctate	*ovalis*
	Dorsum shining, not punctured	3
3.	Dorsum setate	*var. nitens*
	Dorsum hairless	4

4. Outer margin of lamella sinuate ... ... *redux*
Outer margin of lamella straight ... ... *hasticeps*
5. Dorsum setate ... ... *quadricornuta*
Dorsum hairless ... ... *tecta*

44. **Achipteria ovalis**, K. 66, 67, 68.

Oribata punctata, B.O.

Common everywhere, Very variable in size.

44a. *var. nitens*, Nic. 66b, 67c.

Cuticle not punctate, glossy.

45. **Achipteria redux**, Hull, 67a, 68a.

Cheshire, Cumberland, Lancashire.

46. **Achipteria hasticeps**, Hull. 67ac.

Flintshire, Cheshire, Lancashire, Cumberland.

47. **Achipteria quadricornuta**, Mich. 66, 67, 68.

Generally distributed in England, Scotland, Ireland. A very common species on wood.

48. *Achipteria tecta*, Mich.

Epping Forest, Surrey, Scotland.

LIMNOZETES, gen. nov.

Aquatic. Pteromorphæ strap-shaped. Translamella a mere transverse fold, hardly visible.

Type species: *sphagni*, Mich.

49. **Limnozetes sphagni**, Mich. 67a.

Epping Forest, Cheshire, Cumberland, Scotland. Ireland.

CERATOZETES, Berl.

50. **Ceratozetes gracilis**, Mich. 66, 67, 68.

Everywhere in England, Scotland, Ireland.

EUZETES, Berl.

51. **Euzetes globulus**, Nic. 66, 67, 68.

Abundant in England, Scotland, Ireland.

52. **Euzetes lapidarius**, Lucas. 66c, 67ac.

Common, according to Michael. I find it local.

Lancashire, Cumberland, Scotland, Ireland.

MELANOZETES, gen. nov.

Integument usually dead black. Dorsum with long setæ.

Dorsum of nymph with wide deflexed lateral margins.

Type species: *mollicomus*, K.

1.	Femora i and ii with large blades	2
	Femora i and ii without large blades ...	*edwardsii*
2.	Dorsum with soft white setæ	*mollicomus*
	Dorsum hairs erect rigid	*stagnatilis*

53. Melanozetes mollicomus, K. 66, 67a.

General but not abundant.

Cheshire, Cumberland, Scotland, Ireland.

54. Melanozetes stagnatilis, Hull. 67a, 68a.

North Wales, Cumberland, Ireland (*Oribata alpina*, Halbert).

55. Melanozetes edwardsii, Nic. 66, 67, 68.

Uncommon, according to Michael (B.O.); but in the North of England one of the commonest species.

Hertfordshire, Staffordshire, Cheshire, Cumberland, Scotland, Ireland.

ORIBATES, Latr. (amend. Dugès).

Type species: (*Notaspis*) *alata*, Herm., which is sufficiently well characterised to indicate the genus, but not to determine the species. Similarly *castanea*—the residual species of Hermann's *Notaspis*—is assignable as type of *Notaspis* though itself not determinable as a species. See *Notaspis* below.

1.	Interlamellar seta minute	*obvius*
	Interlamellar seta normal	2
2.	Sensillus filiform	*longiplumus*
	Sensillus with fusiform head	3
	Sensillus slender clavate	*rastratus*
3.	Pteromorphæ wrinkled transversely ...	*nervosus*
	Pteromorphæ veined but not wrinkled ...	*elimatus*

56. **Oribates elimatus**, K. 66bc, 67a, 68.

O. lanceatus, Oud.

Cheshire, Lancashire, Cumberland, Scotland?

57. **Oribates longiplumus**, Berl. 66b, 67b.

Myrmecophilous: a guest of *Formica rufa*.

Ireland.

58. **Oribates obvius**, Berl. 66b, 67c.

O. dorsalis, *K.* (Oudemans, Michael, &c.)

Westmoreland (J. C. Varty-Smith).

59. *Oribates nervosus*, Berl.

Grange-over-Sands (Bagnall).

60. **Oribates rastratus**, Hull. 67a.

Pteromorphæ not extending beyond the middle of the caphalothorax, striate (fanwise) at their base. Lamellæ conspicuous.

West Allendale, among dead hawthorn leaves. Not met with elsewhere as yet.

CHAMOBATES, Hull.

Small species. Lamellæ small. Translamella o. Tridactyle.

Type species: *cuspidatus*, Mich.

1.	Lamellæ with distinct cusps	2
	Lamellæ without distinct angle or cusp ...	3
2.	Cusp rounded, produced forward	*omissus*
	Cusp acute, not produced	*cuspidatus*
3.	Dorsum finely punctate	4
	Dorsum not punctate	5
4.	Sensillus reflexed	*dominæ*
	Sensillus inclined forward	*avenifer*
5,	Sensillus reflexed	*lucifer*
	Sensillus inclined forward	*vartismithii*

61. **Chamobates cuspidatus**, Mich. 66, 67, 68.

Ubiquitous. Scotland, Ireland.

62. **Chamobates dominæ**, Hull. 66b, 67ac.

63. **Chamobates omissus**, P. & W. 67a.

Cambridge, in moss. (Pearce and Warburton).

64. *Chamobates vartismithii*, sp. nov.

Length, half a millimetre; greatest breadth about 350 μ.

Lamellæ cuspless, dark, slightly sinuate, converging forwards but always pretty wide apart, of almost uniform width, running rather abruptly to a basal point in front, from which point rises the lamellar seta. Sensillus slenderly clavate, inclined forwards. Femur i very broad (vertically) with a narrow blade underneath. Claws rather large but slender, heterodactyle, the two laterals being elbowed.

Superficially resembling *cuspidatus*, but larger and much less active. Named in honour of Mr. J. C. Varty-Smith who sent it to me from Newton Moss, near Penrith.

65. Chamobates lucifer, Hull. 66bc, 67a,

Oxford (Bagnall). Cheshire.

66. Chamobates avenifer, Mich. 66b, 67ac.

Cornwall, Dorset, Surrey (B.O.) Cheshire, rare.

MINUNTHOZETES, gen. nov.

Monodactyle. Lamellæ parallel. Sensilli inclined forwards horizontally. Tectopedia i dorsal. Dorsum glabrous.

Type species: *fusiger*, Mich.

67. Minunthozetes fusiger, Mich. 66, 67, 68.

Sensillus bristle-tipped.

A common species in sphagnum and wet moss.

Essex, Surrey, Dorset (B.O.) Cheshire, Cumberland, Scotland, Ireland.

68. *Minunthozetes humectus*, Hull.

Sensillus with oblong clavate head, blunt.

Delamere Forest, Cheshire; Newton Moss, Cumberland.

ZETOMIMUS, gen. nov.

Monodactyle. Lamellæ converging forwards. Sensilli upright.

Femora i without blades. Dorsum glabrous.

Type species: *furcatus*, P. & W.

69. *Zetomimus boothianus*, Hull.

Sensilli straight, strongly clavate and pectinate.

A single example was found in the nest of a Coal-tit sent to me from Ben Rhydding, Yorkshire, by Mr. H. B. Booth.

70. *Zetomimus furcatus*, P. & W.

Sensilli sinuous, nude. Lamellæ similar to those of *Ceratozetes*.

Yorkshire (Pearce and Warburton). Cumberland, Westmoreland.

MYCOBATES, gen. nov.

Monodactyle. Tectopedia i lateral. Femora i bladed. Dorsum setate.

Type species: *parmeliæ*, Mich.

71. *Mycobates parmeliæ*, Mich.

Cornwall (B.O.). Oxford (Bagnall). Scotland, Ireland.

ORIBATULA, Berl.

1.	Tridactyle	2
	Monodactyle...	7
2.	Lamellæ with obvious cusp	3
	Lamellæ without cusp	4
3.	Cusp rounded	*exilis*
	Cusp acute	*affinis*
4.	Dorsum setate	*tibialis*
	Dorsum glabrous	5
5.	Sensillus pyriform not reflected	*plantivaga*
	Sensillus long, strongly reflexed	6
6.	Dorsum quite smooth, polished, red-brown	*michaelii*
	Dorsum shagreened, very dark	*lucasii*
7.	Dorsum continuous with cephalothorax ...	*anomala*
	Dorsal front margin normal	8
8.	Dorsum elongate, pointed behind	*humerata*
	Dorsum normal, rounded behind	*similis*

72. **Oribatula exilis**, Nic. 66, 67, 68.

Ubiquitous.

73. **Oribatula tibialis**, Nic. 66b, 67ab.

General (B.O.). Cheshire, Cumberland, Scotland.

74. *Oribatula venusta*, Berl.

Recorded from the west of Ireland by Halbert.

75. **Oribatula affinis**, Hull. 66b, 67a, 68a.

This appears to be a subalpine species.

76. **Oribatula carnea**, sp. nov. 67b.

Length, 410 μ.; greatest width, 240 μ.

Rostral setæ long and set rather far back. Lamellar and interlamellar setæ stout but simple. Lamellæ of uniform width throughout, their proximal ends (with the æstheterium) hidden by the projecting margin of the dorsum. Sensillus fairly long, rather abruptly reflexed, its head clavate, slightly gibbous on the forward side where it is clothed with minute appressed hairs.

Dorsum hairless, its fore margin projecting very considerably with two little indentations on each side, the inner more distinct than the outer. Humeral projections large, transparent, extending to the middle of the dorsum.

Tibia i expanded and truncate at its distal end where it bears a long tactile hair (97 μ.); a similar shorter hair (62 μ.) on the patella. Femur i with a very narrow blade; tarsus slightly longer than the tibia, straight and feathered with fine hairs beneath, gibbous with five irregular hairs above. Claws tridactyle.

A few specimens from a nest of *Formica rufa*, Riding Mill.

77. **Oribatula lucasii**, Nic. 67a.

(*non Oribata lucasii*, B.O.)

Cumberland. Scottish and Irish examples under this name may belong to this or the next, or possibly to both.

78. **Oribatula michaelii**, Hull. 66b, 67ac.
Cheshire, Lancashire, Cumberland.

79. **Oribatula plantivaga**, Berl. 67c.
On rock-lichen (*Physcia*) on the coast (Whitley Bay).

80. **Oribatula similis**, Mich. 66, 67, 68.
England generally. Scotland, Ireland.

81. **Oribatula anomala**, sp. nov. 66, 67, 68.
Dorsum and cephalothorax continuous between the æstheteria. The dorsal margin curves in from the shoulder round the inner side of the æstheterium, vanishing at the proximal end of the lamellæ. Abdomen suborbicular. Otherwise like *similis*.
More frequent in Northumberland than *similis*.

82. **Oribatula humerata**, sp. nov. 66bc, 67ac, 68a.
Elongate, dorsum somewhat depressed and subacuminate behind. Humeral alæ large making the whole expanse in front as wide as the greatest breadth of the dorsum, or even a trifle wider. Cephalothorax small in comparison with the dorsum.
Less frequent than the two preceding forms, and remarkably like a small specimen of *Liacarus coracinus* at first glance. Always in moss.

CULTRORIBULA, Berl.

83. *Cultroribula juncta*, Mich.
Epping Forest (B.O.). Scotland.

C.—Sub-family Notaspidinæ.

Legs all lateral; no alar projections: dorsal setæ fine, in four longitudinal series or wanting altogether.

1.	Claws tridactyle	2
	Claws monodactyle	5
2.	Sensillus flabellate	*Licneremaeus*
	Sensillus otherwise	3
3.	Integument reticulate, legs rough	*Cymberemaeus*
	Integument and legs smooth	4
4.	Lamellæ large and prominent	*Ceratoppia*
	Lamellæ small or 0	*Notaspis*

5.	Dorsum with a broad smooth boss at the front margin	*Hydrozetes*
	Dorsum otherwise	6
6.	Mandibles styliform	*Suctobelba*
	Mandibles normal	7
7.	Disk of dorsum dotted or otherwise sculptured ...	8
	Disk of dorsum quite smooth and polished	9
8.	Dorsum uniformly convex	*Damæolus*
	Dorsum convex in the middle only	*Caleremaeus*
9	Large species, with lateral extension between dorsum and thorax	*Damaeosoma*
	Smaller species, the lateral extension not developed	10
10.	Lamellæ blade-like pale	*Zetobelba*
	Lamellæ 0	*Amolops*
	Lamellæ ridge-like dark	11
11.	Prodorsal margin more or less broken in the middle...	*Dissorhina*
	Prodorsal margin with a dark rim, unbroken ...	*Autogneta*

CERATOPPIA, Berl.

84. Ceratoppia bipilis, Herm. 66, 67, 68.

Ubiquitous. Scotland, Ireland.

NOTASPIS, Herm.

Type species: *castanea*, Herm. (Possibly identical with *lucorum*, K., but certainly congeneric with that species.)

85. Notaspis lucorum, K. 66, 67, 68.

Mycophilous. I have shaken this species from a lichen-covered apple bough in such numbers as to cover a sheet of paper as it were with dust. General.

86. *Notaspis pilosa*, Mich.

Apparently a southern species. Michael found it in Epping Forest, New Forest and Cornwall. Not reported from Sçotland or Ireland.

87. Notaspis oblonga, K. 66, 67, 68.

General throughout the three kingdoms.

88. *Notaspis serrata*, Mich.

Tricheremaeus serrata, Berl.

Recorded by Michael from Cumberland, Westmoreland, Warwickshire, Staffordshire and North Wales. I know of no other British records.

HYDROZETES, Berl.

Very near *Notaspis* but monodactyle.

89. Hydrozetes lacustris, Mich. 67a, 68a.

In ponds, &c., everywhere.

Cheshire, Cumberland, Scotland, Ireland.

CYMBEREMÆUS, Berl. (emend.)

90. Cymberemæus cymba, Nic. 67b.

New Forest (B.O.). Oxford, beaten from furze (Bagnall). Ovingham (Bagnall).

91. *Cymberemæus brevipes*, Mich.

New Forest, Epping Forest, Surrey (B.O.) Oxford (Bagnall).

CALEREMÆUS, Berl.

92. *Caleremæus monilipes*, Berl.

Yorkshire, Warkwickshire (B.O.).

LICNEREMÆUS, Paoli.

93. *Licneremæus licnophorus*, Mich.

Warwickshire, Epping Forest (B.O.).

DAMÆOLUS, Paoli.

94. *Damæolus maculosus*, P. & W. 520 μ.

Cambridge (Pearce and Warburton).

SUCTOBELBA, Paoli.

95. Suctobelba trigona, Mich. 66b.

Apparently rare. Scotland, Ireland.

DAMÆOSOMA, Berl.

96. Damæosoma denticulatum, G. & R. C. 66bc, 67bc.

Damæus nitens (B.O.).

Yorkshire, Cheshire, Lancashire.

ZETOBELBA, gen. nov.

Prodorsal margin with a dark rim. Lamellæ and translamellæ similar to those of *Sphærozetes*.

Type species: *jugorum*, Hull.

97. Zetobelba jugorum, Hull. 66b, 67a, 68a.
Westmoreland (Varty-Smith).

AUTOGNETA, gen. nov.

Prodorsal margin with dark rim, unbroken. Lamellæ ridge-like, dark, starting as usual from the aestheterium and converging inwards; or median and parallel; or both.

Type species: *longilamellata*, Mich.

1.	Lamellar ridges median only	*vitrina*
	Lamellar ridges otherwise	2
2.	Sensillus bluntly clavate	*quadricarinata*
	Sensillus fusiform-clavate	3
	Sensillus acute pectinate	4
3.	Sensillus bristle-tipped	*lanceolata*
	Sensillus without the apical bristle ...	*formosa*
4.	Genital and anal plates approximate ...	*pectinata*
	Genital and anal plates normal	5
5.	Lamellar ridges very long, subparallel ...	*longilamellata*
	Lamellar ridges short, abruptly convergent	*corrugata*, *sculptilis*, *fallax*

98. Autogneta vitrina, Hull. 66b, 67a.
Lamellar ridges basal short parallel. Not common.

99. *Autogneta quadricarinata*, Mich.
Cheshire, Scotland.

100. Autogneta lanceolata, Mich. 66b, 67a, 68a.
Generally distributed.
Cheshire, Scotland, Ireland.
var. lunaris, Hull.
Same distribution as type.

101. Autogneta formosa, Hull. 66a.
Delamere Forest, Cheshire.

102. Autogneta pectinata, Mich. 66b, 67a.
Moles' nests in the Midlands (B.O.). Same habitat, Grange-over-Sands (Bagnall).
Yorkshire, Scotland.

103. *Autogneta corrugata*, Berl.

To this species I refer examples sent to me by Dr. Jackson, from Cheshire. They may possibly be identical with the following species.

104. *Autogneta sculptilis*, P. & W.

Hindhead (Pearce and Warburton, P. Z. S., 1905). Also reported from Scotland.

105. Autogneta fallax, Paoli. 67a.

Cumberland, Cheshire.

var. obsoleta, Paoli.

Cheshire.

106. Autogneta longilamellata, Mich. 66b, 67a, 68a.

Epping Forest (B.O.). Cheshire, Scotland.

DISSORHINA, gen. nov.

Prodorsal margin more or less broken by median ridges, parallel or divergent on the cepherlothorax. Rostral hairs borne on a small apical tubercle.

Type species: *splendens*, K.

1.	Median ridges short, divergent	*tricarinata*
	Median ridges parallel	2
2.	No lateral ridges	*vetula*
	Lateral ridges present	3
3.	Median ridges long exceeding the lateral...	*captator*
	Median ridges very short	*splendens*

107. Dissorhina vetula, Hull. 66b, 67a.

Not yet met with outside of the Tyne province.

108. Dissorhina splendens, K. 66b, 67ac.

Perhaps quite generally distributed, but some of the records may belong to allied species. Scotland, Ireland.

109. Dissorhina tricarinata, Paoli. 66b, 67c.

Cumberland.

var. corniculata, Paoli.

Cheshire.

110\. *Dissorhina captator*, Hull.
Cheshire (Delamere Forest). Cumberland (Newton Moss).

AMOLOPS, Hull.

111\. Amolops clavipectinatus, Mich. 66bc, 67c.
Warwickshire (B.O.) Yorkshire, Lancashire, Cheshire, Scotland, Ireland.

112\. *Amolops bagnallii*, Hull.
Distinguished from the preceding most readily by the form of the sensillus which is hardly thickened at its extremity, where it bears three stout acute spines behind exactly resembling the apex of the main stem itself.
Grange-over-Sands (Bagnall).

D.—Sub-family Damæinae.

Legs lateral, very long, verticillately spinous. Abdomen globose, rough but not granulate.

DAMÆUS, K.

The only British genus.

1.	Sensillus pileate	... *tenuipes*
	Sensillus flagelliform	... *michaelii*
	Sensillus otherwise	2
2.	Process between first and second legs rounded	... *sufflexus*
	Process otherwise	3
3.	Two tubercles at base of cephalothorax ...	... *tecticola*
	Four tubercles at base of cephalothorax	4
4.	Dorsal spines bent in form of a hook	... *riparius*
	Dorsal spines otherwise...	5
5.	Dorsal spines prostrate or nearly so	6
	Dorsal spines erect	7
6.	Femur iv and coxa iv subequal	.. *alienus*
	Femur iv more than double the length of coxa iv	... *gracilipes*
7.	Femur iv one and a half times length of coxa iv	... *geniculatus*
	Femur iv double the length of coxa iv ...	... *clavipes*

113\. *Damæus riparius*, Nic. *D. auritus*, B.O.
Midland counties.

114. Damæus alienus, Hull. 66, 67, 68.
Cheshire (rather rare). Cumberland, North Wales; Scotland?

115. Damæus gracilipes, Kulcz. 66b, 67c.
Holywell Dene and Chopwell Woods (Bagnall). This is the first British record.

116. Damæus michaelii, Oud.
D. verticillipes, B.O. 66b, 67ac.
Epping Forest (B.O.). Cheshire, Scotland, Ireland.

117. *Damæus sufflexus*, Mich.
Staffordshire (B.O.). Cheshire, Cumberland, Scotland.

118. Damæus tenuipes, Mich. 67a.
Among needles and moss in pine woods, West Allendale.
Cornwall (B.O.).

119. Damæus tecticola, Mich. 66b, 67ac.
Warwickshire, New Forest (B.O.). Cheshire.

120. Damæus clavipes, Herm. 66, 67, 68.
Ubiquitous. Scotland, Ireland.

121. Damæus geniculatus, L. 66, 67, 68.
Equally as common as the preceding. Scotland, Ireland.

E.—Sub-family Nothrinæ.

Cephalathorax not hinged to the abdomen.

1.	Integument imperfectly chitinized	2
	Integument chitinized and pigmented	7
2.	Dorsum transversely divided	3
	Dorsum undivided	5
3.	Dorsal setæ very long and serrate	*Cosmochthonius*
	Dorsal setæ of moderate length, simple	4
4.	Body pearshaped	*Hypochthonius*
	Body oval	*Brachychthonius*
5.	Coxæ iv approximate : colour pale	*Malaconothrus*
	Coxæ iv normal : colour darker	6
6.	Sensillus filiform	*Angelia*
	Sensillus clavate	*Nothrus*

7.	Claws tridactyle	... *Neoliodes*
	Claws monodactyle	... 8
8.	Genital and anal plates with a common rim	... *Lohmannia*
	Genital and anal plates separate	... 9
9.	Dorsum strongly convex	... *Hermannia*
	Dorsum concave	... *Heminothrus*

HERMANNIA, Nic.

Type species : *convexa*, K.

1.	Dorsum reticulate, dorsal setæ 4-seriate	... *quadriseriata*
	Dorsum granulate or scabrid	2
	Dorsum pitted	3
2.	Dorsal setæ 6-seriate	... *convexa*
	Dorsal setæ 4-seriate	... *scabra*
3.	Dorsum uniformly convex : small species...	*nana*
	Dorsum with submarginal furrow : large species	... *fluviatilis*

122. Hermannia convexa, K.

H. picea, B.O. 66, 67, 68.

Everywhere, usually in moss.

123. Hermannia quadriseriata, Banks.

H. reticulata, B.O. 67c.

Cornwall, Staffordshire, North Wales, Isle of Man, Cumberland, Scotland, Ireland.

124. Hermannia scabra, L. Koch. 66, 67, 68.

Everywhere, with a partiality for maritime localities. Semiaquatic in its habits, but in inland localities generally found on dead wood.

125. Hermannia nana, Mich. 66ab, 67a, 68a.

Epping Forest, &c. (B.O.). Cumberland, Cheshire, Scotland, Ireland.

126. Hermannia fluviatilis, Hull. 66b, 68a.

HEMINOTHRUS, Berl.

"Characters of Nothrus but monodactyle. Sensilli elongate cylindrical subsetiform" *Berlese*.

Type species: *targionii*, Berl.

1. Posterior margin of dorsum convex ... *targionii*
   Posterior margin of dorsum straight ... 2
2. Posterior setæ curled ... ... *bistriatus*
   Posterior setæ long flexuous ... ... *crinitus*
   Posterior setæ short straight ... ... *valentianus*

127. Heminothrus targionii, Berl. 66b.
In moss from Waldridge Fell.
Mole's nest, Warwickshire (B.O.).

128. *Heminothrus crinitus*, P. & W.
Cumberland, Scotland.

129. Heminothrus bistriatus, K. 66, 67, 68.
Abundant everywhere.

130. Heminothrus valentianus, sp. nov. 68a.
Differs from the preceding species (1) in the absence of the bowl-shaped hollow near the posterior margin of the dorsum; (2) in the lesser distinctness of the median ridges; (3) in the shortness of the lateral border of the dorsum which is wanting in the posterior half; (4) in the shorter length of all the dorsal seta; (5) and in the form of the sensillus, which is rather shorter and more distinctly clavate.
Three examples were obtained from sphagnum sent from Cheviot Hill (Bagnall).

ANGELIA, Berl.

1. Monodactyle ... ... *silvestris*
   Tridactyle 2
2. Two very long setæ on posterier margin of dorsum ... ... *palustris*
   Posterior setæ shorter than width of dorsum *anauniensis*

131. Angelia silvestris, Nic. 66, 67, 68.
Cheshire, Yorkshire, Scotland, Ireland.

132. Angelia palustris, K. 66, 67, 68.
All the North of England, Scotland, Ireland.
General, according to Michael.

133. *Angelia anauniensis*, Can.
Cambridge (Pearce and Warburton, P. Z. S., 1905).

NEOLIODES, Berl.

134. *Neoliodes theleproctus*, Herm.

Leicester, Cheshire, Scotland, Ireland.
General, according to Michael.

NOTHRUS, Koch.

1.	Lateral margin of dorsum with projecting apophyses	*spinifer*
	No lateral apophyses (or they are very small)	2
2.	Posterior margin of dorsum rounded ...	*invenustus*
	Posterior margin more or less emarginate	3
3.	Without inferior median apophyses behind	4
	With a pair of median apophyses below the posterior margin	5
4.	Three long lateral spines on each side of dorsum	*umbratilis*
	No long lateral spines	*segnis*
5.	Posterior median apophyses large... ...	*biverrucatus*
	Posterior median apophyses smaller (not emerging from sinus)	*horridus*
	Posterior median apophyses inconspicuous	*bicarinatus*

135. Nothrus spinifer, K 66ab, 67ab, 68ab.
Cumberland, Yorkshire. Lancashire, Cheshire, Scotland, Ireland.

136. Nothrus horridus, Herm. 66ab, 67ac, 68a.
General, according Michael. Scotland, Ireland.

137. Nothrus biverrucatus, K. 67ac, 68a.
Cumberland, Lancashire, Cheshire, Scotland.

138. Nothrus bicarinatus, K. 66b, 67ab, 68a.
Yorkshire, Scotland, Ireland.

139. Nothrus invenustus, Mich. 66a.
The only local specimen I have seen was one sent by Mr. J. W. H. Harrison from Upper Teesdale.
Clifton Bridge and Malvern (B.O.). Scotland, Ireland.

140. *Nothrus umbratilis*, Hull.
Cheshire, once only, not seen elsewhere.

141. Nothrus segnis, Herm. 66ab, 67ab, 68a.
Common everywhere. Scotland, Ireland.

MALACONOTHRUS, Berl.

1.	Monodactyle	... *monodactylus*
	Tridactyle	... 2
2.	Dorsum not acuminate behind ...	... 3
	Dorsum more or less pointed behind	... 4
3.	Sensillus long narrowly clavate ...	... *tectorum*
	Sensillus short with fusiform head...	... *crassus*
4.	Cuticle reticulate	... *tardus*
	Cuticle smooth	... *glaber*

142. *Malaconothrus monodactylus*, Mich.
Cannock Chase (B.O.). Cheshire, Scotland, Ireland.

143. Malaconothrus glaber, Mich. 66a, 67a, 68a.
Epping Forest, New Forest, Midlands (B.O.). Cheshire, Cumberland, Scotland, Ireland.

144. *Malaconothrus tardus*, Mich.
Land's End, on lichen (B.O.). Ireland.

145. *Malaconothrus crassus*, P. & W.
Aquatic, in sphagnum, Bournemouth (Pearce and Warburton).

146. *Malaconothrus tectorum*, P. & W.
Wall and roofs, Grantchester (Pearce and Warburton).

LOHMANNIA, Mich.

147. *Lohmannia insignis*, Berl. 1000μ.
Dorsum flat, rectangular truncate in front, rounded behind, with several short simple hairs. Cuticle shining. Tarsus i, wide oval.
On roots of kidney-beans, Dublin.

HYPOCHTHONIUS, Koch.

148. Hypochthonius rufulus, K. 550-750μ. 66b, 67ab.
Cumberland, Cheshire, Scotland, Ireland.

149. *Hypochthonius pallidulus*, K.
Epping Forest (B.O.). Scotland.

COSMOCHTHONIUS, Berl.

150. *Cosmochthonius lanatus*, Mich.

"Not uncommon" (B.O.)! No other record.

BRACHYCHTHONIUS, Berl.

151. Brachychthonius brevis, Mich. 66b.

Epping Forest, Staffordshire (B.O.). Scotland, Ireland.

F.—Sub-family Phthiracarinæ.

Cephalothorax hinged to the abdomen so as to be movable (vertically).

Claws monodactyle	... *Hoploderma*
Claws tridactyle	... *Phthiracarus*

HOPLODERMA, Michael.

1.	Cephalothorax with a median carina ...	2
	Cephalothorax without carina	3
2.	Front margin of dorsum produced forward	*anomalum*
	Front margin of dorsum normal	*magnum*
3.	Dorsum smooth polished	4
	Dorsum pitted	*stricula*
4.	Sensillus bluntly fusiform, erect	*dasypus*
	Sensillus linear fusiform, needlepointed ...	*affine*

152. Hopeoderma magnum, Nic. 66bc, 67ac, 68a.

Cumberland, Yorkshire, Lancashire, Cheshire, Scotland, Ireland.

153. *Hoploderma anomalum*, Berl.

Gomshall, Surrey (B.O.).

154. *Hoploderma stricula*, K.

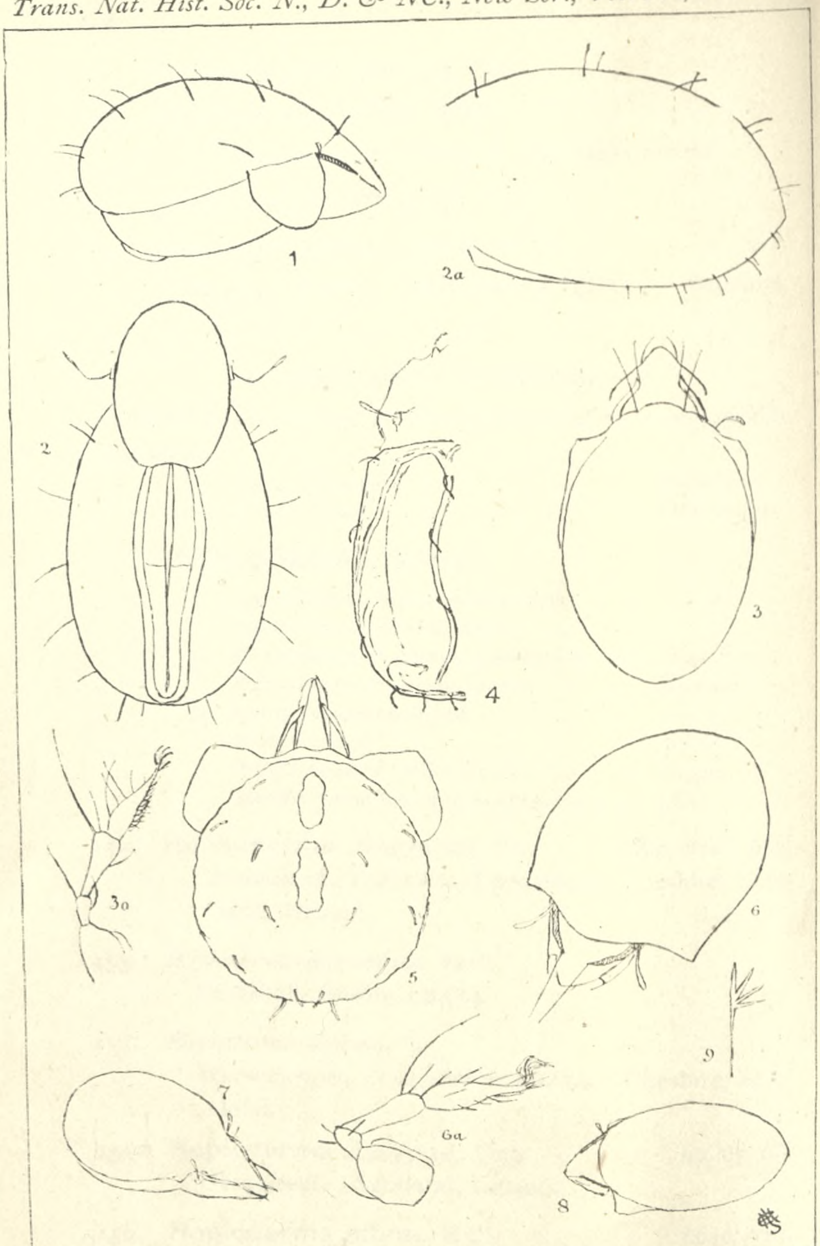
Warwickshire, Staffordshire (B.O.). Cheshire, Scotland.

155. Hoploderma dasypus, Dug. 66, 67, 68.

Ubiquitous. Scotland, Ireland.

156. Hoploderma affine, Hull. 66ac, 67a.

Cumberland, Cheshire.



J. E. Hull del.

TERRESTRIAL ACARI.

PHTHIRACARUS, Perty.

Cuticle of dorsum irregularly striate ... *arduus*
Cuticle of dorsum spotted ... ... *bagnallii*

157. Phthiracarus arduus, K. 66b, 67c.

Essex, Surrey, Staffs. B.O.). Lancashire, Cheshire, Scotland, Ireland.

158. Phthiracarus bagnallii, sp. nov. 66b.

Length about 600μ.

Seen from below the outline of the abdomen is elliptic-oblong; above the dorsum adjacent to the posterior margin is slightly compressed laterally.

The dorsum is pale pinkish, smooth and shining, but uniformly pitted (about 100 to the linear millimetre). The æstheteria are rather large and the sensillus is characteristic—strongly elbowed about a third of its length from the base; below the elbow gently curved, above quite straight, a bluntly clavate opiculate head forming the distal third.

Stables at Gibside, Durham, January, 1915 (Bagnall). A single specimen at Fatfield, December, 1915 (Bagnall).

REFERENCES TO PLATE XVII.

1. *Melanozetes (?) cambricus*, side view (legs omitted).
2. *Phthiracarus bagnallii*, ventral view omitting cephalothoracic appendage; (*a*) side view of abdomen.
3. *Oribatula carnea*, dorsal view; (*a*) leg of first pair.
4. *Heminothrus valentianus*, half of dorsal aspect.
5. *Pelops approximatus*, dorsal view.
6. *Chamobates vartismithii*, dorsal view, slightly oblique; (*a*) leg of first pair.
7. *Oribatula anomala*, oblique dorsal view (legs and dorsal hairs omitted).
8. *Oribatula humerata*, oblique dorsal view (legs and dorsal hairs omitted)
9. *Amolops bagnallii*, sensillus.

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