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OF THE

COTTESWOLD NATURALISTS'

FIELD CLUB

1915 — 1917

VOLUME XIX.

Part I., 1915. Part II., 1917. Part III., 1918.

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VOL. XIX. PART I.

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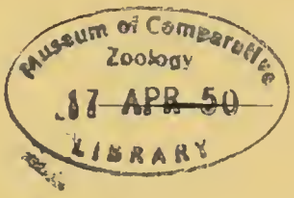

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*†The Wiltshire Archæological and Natural History Society, The Museum, Devizes.

*†The Woolhope Naturalists' Field Club, c/o Hon. Librarian, Woolhope Club, Free Library, Hereford.

†The Presidents and Secretaries of these Societies are considered as Ex-officio Members of th Club, and are cordially invited to the Meetings; Programmes of Meetings to be sent to them as invitations.

INCOME AND EXPENDITURE FOR THE YEAR ENDING 31st DECEMBER, 1915

INCOME

	£ s d	£ s d
To Balance from 1914	2 15 11	
,, 5 Subscriptions for 1914 @ 15/-	3 15 0	
,, 101 do. 1915 @ 15/-	75 15 0	
,, 2 do. 1915 @ 10/-	1 0 0	
,, 5 Entrance Fees 1915 @ £1	5 0 0	
		88 5 11
,, Sale of Proceedings		2 3 7
		90 9 6
Balance against Club		11 15 0
Assets—		
Subscriptions in arrear ..	12 0 0	
		£102 4 6

J. H. JONES, *Hon. Treasurer.*
January 26th, 1916.

EXPENDITURE

	£ s d	£ s d
By Hon. Secretary's Expenses	8 6 0	
,, Treasurer's do.	15 0	
,, Lionel Herbert, Teas (1914)	4 8 6	
,, do. (1915)	1 15 3	
,, Roland Austin, preparing index to Vol. XVIII.	2 2 0	
,, do. Postages, &c.	0 6 1	
,, do. Public Library Rent and Insurance	1 3 6	
,, Gloucester Technical Schools — Rent of Room, Session 1914-1915	2 10 6	
,, Ditto Custodian, Cleaning, &c.	0 18 0	
,, Bristol and Gloucestershire Archæological Society — One-third Share cleaning and fires, from 31st March, 1914 to 31st December, 1915	1 12 0	
,, John Bellows—Printing Proceedings ..	67 5 2	
,, do. Receipt Book, &c.	1 2 3	
,, A. H. Pitcher—Lantern	0 9 0	
,, Norman Sawyer & Co.—Printing	9 11 3	
		102 4 6
,, Balance due brought down		11 15 0

Audited and found correct,
F. HANNAM-CLARK.
January 26th, 1916.

RULES OF THE CLUB

1.—The Objects of the Club are to study the Natural History and Antiquities of the County and the adjacent districts.

2.—The Club shall use its influence to obtain the record of all details of geological interest, to promote the preservation of all antiquities, and to prevent, as far as possible, the removal of scarce plants and the extermination of rare species of the flora or fauna.

3.—The Club shall consist of a President, Vice-Presidents (not exceeding seven in number), an Honorary Secretary, Honorary Assistant Secretary (when required), an Honorary Treasurer, an Honorary Librarian, and Honorary, Ordinary and *Ex-officio* Members.

4.—Before anyone can be elected a Member, he must be duly proposed and seconded on a printed form provided for that purpose, and supplied by the Honorary Secretary upon application. His name will be placed on the circular and will come up for election at the next meeting of the Club; one dissentient in ten to disqualify.

5.—The Entrance Fee shall be £1. The Annual Subscription of Ordinary Members shall be Fifteen Shillings, due in advance on the first day of January. For Members elected after September, the Subscription for that year shall be Ten Shillings.

6.—Any Member in arrear with his Subscription for the year is liable to removal from the list of Members.

7.—No Member shall be entitled to a copy of the Proceedings whose Subscription is one year in arrear.

8.—The Club may admit a limited number of Honorary Members (See Rule 3), whose scientific work entitles them to the distinction, and who must be elected at the Annual Meeting.

9.—The Executive Council for the Management of the Club shall consist of the Officers of the Club, namely, the President, Vice-Presidents, the Honorary Secretary, the Honorary Treasurer and Honorary Librarian, and four Members, all of whom shall retire at the Annual Meeting, but are eligible for re-election (by ballot); but the President shall not hold his office for more than two consecutive years.

10.—The Annual Meeting shall be held in January, at which Meeting the President's Address shall be read, the Financial Statement of the Honorary Treasurer shall be presented, and the Officers and other Members forming the Council shall be elected, and the dates and places of the Field Meetings be fixed; but the arrangements for the Winter Meetings shall be left to the Council.

11.—The Club shall usually hold yearly four Field Meetings, and also four Winter Meetings for the reading and discussion of Papers. At the Field Meetings any Member may introduce one Visitor, and at the Winter Meetings more than one; and at the Winter Meetings the term "Visitor" may include ladies. Members must give due notice to the Honorary Secretary of their intention to be present at any Field Meeting, and should any Member, having given such notice, fail to attend, he will be liable for his share of the expenses.

12.—All papers communicated to the Club shall be submitted to a Publication Committee, which shall consist of the President, Honorary Treasurer, Honorary Secretary, and two other Members appointed at the Annual Meeting. The decision of the Publication Committee shall be final. Any gentleman who favours the Club with Lectures on any subject shall be invited to furnish an abstract of the lecture for publication in the Proceedings of the Club.

13.—The Council may at any time call a Special General Meeting of the Members. Upon the requisition of any eight Members being sent to the Honorary Secretary, a Special General Meeting shall be convened; and any proposition to be submitted shall be stated in the Notice. Not less than seven days' notice of any such General Meeting shall be given.

COTTESWOLD NATURALISTS' FIELD CLUB

Transactions and Proceedings of the following Societies are in the Club's Library :—

Anthropological Institute. Journal, 1871-1900.

Bath Natural History and Antiquarian Field Club. Proceedings, 1890-1909. (Club dissolved.)

Birmingham Natural History and Philosophical Society. Annual Reports, from 1909. *In progress.*

Bournemouth Natural Science Society. Proceedings, from vol. I., 1908-9. *In progress.*

Bristol and Gloucestershire Archæological Society. Transactions, from vol. I. *In progress.*

Bristol Naturalists' Society. Proceedings, from 1874. *In progress.*

Cardiff Naturalists' Society. Transactions, from 1911. *In progress.*

Derbyshire Archæological and Natural History Society. Journal, from 1909. *In progress.*

Geologists' Association. Proceedings, from vol. I, 1859. *In progress.*

Glasgow Geological Society. Transactions, from 1863. *In progress.*

Northamptonshire Natural History Society and Field Club. Journal, from 1884. *In progress.*

Staffordshire (North) Naturalists' Field Club and Archæological Society. Annual Reports, from 1878. *In progress.*

Warwickshire Naturalists' and Archæologists' Field Club. Proceedings, from 1867. *In progress.*

Wiltshire Archæological and Natural History Society. Magazine, from 1904. *In progress.*

Woolhope Naturalists' Field Club. Transactions, 1856-1864, and from 1869. *In progress.*

Worcestershire Naturalists' Club. Transactions, from 1847. *In progress.*

BRISTOL AND GLOUCESTERSHIRE ARCHÆOLOGICAL SOCIETY

The Bristol and Gloucestershire Archæological Society has agreed to permit members of the Cotteswold Naturalists' Field Club to borrow Transactions and Proceedings which it receives in exchange from the following Societies :—

Society of Antiquaries of London.
Society of Antiquaries of Scotland.
Royal Society of Antiquaries (Ireland).
Royal Archæological Institute of Great Britain and Ireland.
British Archæological Association.
British School at Rome.
Birmingham and Midland Institute.
Bureau of Ethnology, Smithsonian Institute.
Cambrian Archæological Society.
Cambridge Antiquarian Society.
Chester and North Wales Archæological Society.
Royal Institution of Cornwall.
Cumberland and Westmorland Antiquarian Society.
Derbyshire Archæological and Natural History Society.
Dorset Natural History and Antiquarian Field Club.
Essex Archæological Society.
Exeter Diocesan Architectural and Archæological Society.
Kent Archæological Society.
Society of Antiquaries of Newcastle-upon-Tyne.
London and Middlesex Archæological Society.
Norfolk and Norwich Archæological Society.
Powys Land Club : Montgomeryshire Records.
William Salt Archæological Society.
Somerset Archæological and Natural History Society.
Shropshire Archæological and Natural History Society.
Suffolk Institute of Archæology and Natural History.
Surrey Archæological Society.
Sussex Archæological Society.
Thoresby Society of Leeds.
Thoroton Society of Nottingham.
Wiltshire Archæological and Natural History Society.
Worcestershire Architectural Society.
Yorkshire Archæological and Topographical Association.

PROCEEDINGS

OF THE

COTTESWOLD NATURALISTS' FIELD CLUB

AT THE

ANNUAL GENERAL MEETING

JANUARY 19TH, 1915

PROF. J. R. AINSWORTH-DAVIS, M.A., F.C.P.

IN THE CHAIR.

The Minutes of the last Annual Meeting were read and confirmed. The President then delivered his

ANNUAL ADDRESS.

This, our 67th Annual Meeting, takes place while a war of unparalleled extent and intensity is being waged by land and sea, though we have met before during times of national stress, such as those occasioned by the Crimean War, the Indian Mutiny, and the South African campaign. We now hope and believe that final victory is definitely inclining to the side championing right and justice, but so critical were the days of last September that we deemed it necessary and fitting to cancel our last summer excursion of the year 1914. Since then we have adapted ourselves to an abnormal environment, and, most of us being unable to take up arms, we have considered it no ignoble task to pursue with unruffled minds our peaceful investigations into the secrets of Nature. It therefore gives me great pleasure to announce that our Club still prospers.

During the year that has now elapsed we have lost by death our old and esteemed friend Dr. Oliver Fowler. Though making no pretence to be a scientific expert, his cheerful and inspiring personality added materially to the pleasure of many

excursions, and we shall miss him greatly. He was a favourable example of the rapidly disappearing type of the old-fashioned country doctor, ripe in medical wisdom and experience, whose buoyant and inspiring presence inspired desponding patients with new life, and soothed the pillows of those whose days were numbered.

It gave me much pleasure to accept your flattering invitation to fill the presidential chair of the premier provincial Field Club, especially because this has brought it once more into touch with the Royal Agricultural College, which had much to do with its inception so many years ago. Unusual pressure of both civil and military duties has precluded me from attending all the meetings, but my friend and predecessor, Rev. W. Butt, has more than made up for my shortcomings. When able to be present I greatly appreciated the honour, and have been much impressed by the enthusiasm and devotion shown by Members to the old-established association that serves as a link of genuine brotherhood.

The Club is much indebted to Mr C. O. Hanson, of the Crown School of Forestry, for his able guidance on the occasion of our visit to the Forest of Dean ; to Sir George Holford for the facilities he so readily afforded us at Westonbirt, when Mr David Lindsay acted as a courteous intermediary ; to Earl Bathurst, Mr Robert Anderson, Captain Gordon Dugdale, and Mr Edward C. Sewell, who made our day at Cirencester rich in interest ; and to Mr A. J. Morton Ball, whose hospitality at Stroud was much appreciated.

Full details of the Excursions made during 1914 will be published in the "Proceedings," which will appear in the course of the next few weeks. It may be permitted me to pay a personal tribute on your behalf to all those who have co-operated to make the publications of the Club of general interest and permanent scientific value. We are particularly indebted to the strenuous and successful labours of Mr Richardson, aided by Mr E. T. Paris, to whom we have a competent and valued successor in Mr Walter Butt.

THE FUNCTIONS OF A NATURALISTS' FIELD CLUB.

Many years ago my revered teacher and master, the late Professor Huxley, chose this subject as the theme of an address

to the Quekett Club, and it is one deserving special attention in these days of specialization, when no man can aspire to be an authority in more than a small part of one subject. Even now some are inclined to dismiss the field naturalist with the old jibing question "Cui bono?" to which many eminently satisfactory answers can be given, especially as the question no longer disputes the place of pride now occupied by "Natural Knowledge," to quote old Gilbert White's vivid phrase.

The Field Naturalist, in the first place, is a magician of no mean order, who carries the neophyte into a "high place," and shows him "all the kingdoms of the world and the glory thereof." Such a magician, long years ago, gave me some glimpses of an infinite horizon, and the "trailing clouds of glory"—supposed by Wordsworth to be the privilege of childhood only—have not yet departed entirely from my sight, nor will they ever. To impart some knowledge of the world in which we live to impressionable youth, to awake imagination, and to create a lasting interest in the beautiful environment of mankind, is one of the high offices of the Field Naturalist. And were there no more this would amply justify his existence. But there is much more. Some of us no longer in our first youth, are perhaps apt to think our activities compare but ill to those of the professional naturalist, whose business it is to produce the learned memoirs and monographs that make their appearance in ever-increasing number. A comparison is unjust, for the rôle of the Field Naturalist is quite different, though hardly less important. He is usually a professional or business man whose material prospects are unaffected by his scientific hobby, which is his delight and relaxation. Above all things he is not in a hurry, not unduly desirous of academic distinctions, while the professional man of science not unseldom works with feverish haste at high pressure, knowing that recognition of his work spells promotion, often necessary to secure a position free from financial anxiety.

One of the primary duties of the Field Naturalist is to verify and make additions to the facts relating to the Natural History—using the word in its widest sense—of his particular domain. The kind of professional naturalist whose province it is to construct far reaching generalizations must have these

facts, unless he be content to essay brick-making without the necessary straw. Darwin and Wallace, as we well know, were first of all Field Naturalists, laboriously collecting their own materials, and afterwards theorists, erecting astonishing superstructures with the results of their earlier toil. That our Members have done their duty by rendering available much accurate scientific information regarding Gloucestershire and its borders, will be obvious to anyone glancing through our "Proceedings," which have far more than a local status. Nor does it appear that any decline in enthusiasm or standard is taking place. The "County Flora," for which Mr Riddelsdell and his helpers are responsible, is continuing to make good progress, while Mr Knight is continuing his valuable work on the Bryophyta. Investigations on our Fungi and Algæ are greatly needed. In the department of Zoology, Mr Charles Upton stands for the land and freshwater Mollusca, and Mr Clutterbuck for the Lepidoptera Rhopalocera, while we are expecting much from Mr Walter Butt in the latter domain. It is greatly to be desired that one or more of our members may feel moved to continue Mr W. L. Mellersh's work on the Birds of Gloucestershire, and there are many other animal groups that could be studied with advantage. Insects other than butterflies, Arachnids, Myriapods, Rotifers, Protozoa and Mammals are cases in point.

The Club has always been particularly strong in Geology, and it is gratifying to notice that Mr Richardson and Mr Paris have been building effectively on the sound foundations laid by Buckman, Wright, Lycett and others. Dr. Ellis has devoted himself to the study of later geological phases in so far as they concern the evolution of local topography; while Dr. Wilson continues to extend his knowledge as an unrivalled specialist on our prehistoric implements. Archæology, merging into history in the more limited sense, always finds a warm place in our regard, and Mr John Sawyer's fascinating book on Gloucestershire suggests many county lines of study. The perennial activities of Mr Roland Austin have fortunately relieved the Club from anxieties with reference to local bibliography, leaving it free to pursue branches of work more peculiarly belonging to its province. Many other names might be mentioned, but enough has been said to prove our vitality.

The constant progress of natural knowledge has opened fresh lines of work to the Field Naturalist since the early days of the Cotteswold Club. The geographical distribution of plants and animals is one, and to this many Members have already contributed, especially as regards our flora. But much more remains to be done, and Wallace, the great exponent of the subject, placed high value on the local naturalist. He says, in a note to the first chapter of "Island Life:" "The employment in each of our possessions, and those of other European powers, of a resident naturalist at a very small annual expense, would have done more for the advancement of knowledge in this direction than all the expensive expeditions that have again and again circumnavigated the globe."

Related to and springing from the subject of Geographical Distribution we find the new science of Ecology, dealing with organisms at home, and studying in detail their relations to one another and the physical environment. Here we have the opportunity, with pleasure and profit, of giving fresh values to familiar facts, a case of "new lamps for old." Plants have so far received most attention in this way, working on lines laid down by Schimper and Warming, and elaborately developed by the American School. We might with advantage, as a Club, make a beginning by preparing a map of the county, as has been done in Yorkshire and elsewhere, indicating the main boundaries of the plant geography, and distinguishing between woodland, swamp, pasture, and so forth. Within each area so delimited, endless problems concerning plant "associations" await solution. We shall find, for example, that the woodland flora has certain characteristic features, differing with the kind of wood, whether deciduous or coniferous, and with many other factors. We firstly determine the actual facts of the case, and then endeavour to adequately explain them. More fascinating but more difficult problems are presented by Animal Ecology, where particularly abundant material is afforded by birds and insects. And that the complex lives of plants and animals are interwoven in a complex living network needs no demonstration.

The Field Naturalist can also study and add to the theories of Variation and Heredity, which are the foundations of

evolutionary theory. He can investigate the variations in single recent or fossil species : he can repeat and amplify the classical work of Mendel, who was essentially a Field Naturalist, though his duties were those falling to the abbot of a Moravian monastery. Nevertheless, his observations and deductions, rediscovered less than two decades since, startled the biological world, and have led to the foundation of an important biological school, by which new and useful varieties of plants have been produced in no haphazard fashion.

Lastly, in my opinion, our Members can, and ought, to find scope for their efforts, as some of them do, in helping on the development of our county educational system in so far as natural knowledge is concerned. It has been my good fortune to come into close contact with many of the primary, secondary, and technical teachers of this area with reference, more particularly, to nature study, and my views thereon are set forth for the guidance of teachers in a little book named "The Pursuit of Natural Knowledge," which my friend Mr John Sawyer has recently published. The vast majority of these teachers keenly appreciate the value and importance of nature study as an educational instrument of high order, but many of them lack precisely the knowledge that we possess, and which I am sure we are all willing and anxious to impart.

Permit me, in concluding my address, to express very hearty good wishes for the continued and increased prosperity of this good old Club, founded so many years ago in the old grey town on the Cotteswold Hills, and now finding its appropriate home in the county centre. And to the everlasting benefit of human happiness and human progress, may overwhelming and final victory crown the arms of the Allies long before the time comes for another presidential address.

At the close of the address the President vacated the chair to enable the Rev. H. H. Winwood, the senior Vice-President, to nominate him for another year of office, and at the same time to congratulate him on his able effort. The address, said Mr Winwood, was admirable in every way.

The Rev. Walter Butt seconded the nomination, and said that in the past they had listened to many addresses—some learned, and some (speaking for himself) foolish (laughter) ; but he questioned whether a more helpful address had ever been given than the one to which they had just listened (hear, hear). It was calculated to help every one of them in endeavouring to cultivate a greater love for Nature and for all such a study could help them to.

In responding to the complimentary things said about his address the re-elected President said he did not try to prepare a learned address, and he was quite content if he had made a successful appeal to men eager to develop their taste for nature study in the open-air.

The other officers of the Club were re-elected and thanked for their untiring services, and the following fixtures were made for the next summer meetings:—Tuesday, May 18th, the Western part of the Forest of Dean; Thursday, June 3rd (half-day), Deerhurst and Tewkesbury; Tuesday, June 15th, Stanton Drew and Dundry Hill; Saturday, June 26th (half-day), May Hill; Tuesday, July 6th, Avebury; Wednesday, June 16th, Stanway and Hayles Abbey.

The Hon. Treasurer's Financial Statement was read and approved.

ORDINARY WINTER MEETINGS, 1915

Tuesday, February 23rd, 1915.

Prof. J. R. Ainsworth-Davis, M.A. F.C.P., President, in the Chair.

The Minutes of the last Meeting were read, confirmed, and signed by the Chairman.

Mr Herbert Haigh, of Llandogo, near Tintern, exhibited two excellent stone arrow-heads, found at Conygar, south of Llandogo Station, by Mr W. Rooke. Opposite here, on the Gloucestershire side of the Wye, on Gumber's Farm, just below St. Briavels, Mr Haigh stated that it was possible to pick up hundreds of flint flakes and occasional arrow-heads.

Mr J. W. Skinner exhibited the skull of an animal picked up near Painswick Edge, and suggested it might be that of a badger. He was confirmed in this opinion first by an examination of a stuffed badger in the adjoining Museum, and next by the emphatic testimony of the President, who pointed out the characteristic features, and said it was undoubtedly the skull of a badger. It was something like a dog's skull, but there were striking features of dissimilarity. The front teeth were like those of a dog, but the back ones were flattened for grinding an omnivorous diet. Also the lower jaw was locked to the upper one and could not be detached.

The following papers were then read :—

1.—" White's Thrush on the Lassington Estate," by the Rev. A. R. Winnington-Ingram.

2.—" The Control of River Channels," by T. S. Ellis, M.R.C.S.

It was considered that there was considerable doubt as to whether the bird seen by Mr Winnington-Ingram was White's Thrush.

Tuesday, November 23rd, 1915.

The Rev. Walter Butt, M.A., Vice-President, in the Chair.

The Minutes of the last Meeting were read, confirmed, and signed by the Chairman.

Sir Francis Darwin, F.R.S., and Mr E. Rogers were elected Members of the Club.

Specimens were exhibited by the Rev. H. H. Winwood, the Rev. Walter Butt, Lieut.-Col. J. C. Duke, and by Mr Richardson on behalf of Mr E. C. Sewell. The last exhibit consisted of five bronze celts from Ireland, six large Roman beads from Cirencester, two from Wilderspool, Warrington, one from Colchester, a number of small ones from Gloucester, and a large bead said to have been obtained from a Saxon grave near Cheltenham. Also, a number of barbed flint arrow-heads collected in 1914 at Rodmarton. They were of late Neolithic age.

The following papers were read :—

1.—" The Codling Moth (*Carpocapsa pomonella* Linn.)" by C. Granville Clutterbuck, F.E.S.

2.—"A Deep Boring at Shipton Moyne, near Tetbury," by *L. Richardson.*

3.—" Some *Chirodota*-spicules from the Lias and Inferior Oolite," by *Charles Upton.*

Fig. 1.—The Wye and Coppet Hill (from "The Rock"), Symond's Yat.

(Photograph reproduced by kind permission of Valentine & Sons, Dundee.)

A. J. Lumbert, photo.

Fig. 2.—The Wye at Symond's Yat.

(Block kindly lent by the publishers of "A Week's Holiday in the Forest of Dean.")

EXCURSIONS

1915

EXCURSION TO THE FOREST OF DEAN.

TUESDAY, MAY 18th, 1915.

Directors : FRANK SMITH and L. RICHARDSON.

(*Report by* L. RICHARDSON and W. THOMPSON.)

So pleased were Members of the Club with their visit in May, 1914, to study forestry in the Forest of Dean[1] and the evidence disclosed of a bold attempt to deal with the important question of afforestation on scientific lines, that it was considered advisable to commence the summer excursions of 1915 with another visit to the arboreal nurseries and plantations under Government control. No doubt the war has materially quickened interest in this important question, for with the great demand for timber has also come the thought that there must be no further delay in approaching the question of afforestation in a less perfunctory way than has obtained up to the present. That is to say, the nation must do something more than utter pious opinions respecting what is necessary. An impetus was given to the feeling on Tuesday in the Forest of Dean, when the Members inspected thousands of seedlings and other trees of young growth and listened to the explanatory remarks of Mr Frank Smith, Head Crown Woodman, who deputised in place of Mr. Osmaston, Deputy-Surveyor of the Forest of Dean, and Mr C. O. Hanson, Assistant Deputy-Surveyor, who, owing to pressure of work due to the war, were unable to be present. Last year Mr Hanson acted as cicerone, and previously he had lectured to the Members at Gloucester. He had also kindly welcomed three Members of the Club to the nurseries situated not far from the School of Forestry, and provided one of them with facilities for writing particulars, which were afterwards incorporated in the "Proceedings" of the Club,[2] so it may be claimed that a good deal of attention has been paid to one of the most important enterprises being carried on in the County. [W.T.]

The Members motored from Gloucester direct to "The Rock" at Symond's Yat. Here the Hon. Secretary made some remarks on the geology of the district.

Arising out of the Secretary's remarks on the geology of this district, Mr F. H. Bretherton said that he understood that the main reason why no serious attempts were made to work the iron ore in the Forest now was because of the uncertainty as to the extent of the deposits or "churns."[3]

Mr Richardson added that until the introduction of machinery for the purpose, nail-making was an important petty industry. He had obtained information that nails used to be made in sheds adjoining cottages in Newland Street, Coleford ; at Little Dean, where there is ample evidence of the

1 Proc. Cotteswold Nat. F.C., vol. xviii., pt. 3 (1914), pp. 197-204.

2 W. Thompson, *id.*, vol. xviii., pt. 1 (1913), pp. 63-65.

3 An excellent account of the iron-making in the Forest of Dean up to 1866 is contained in the Rev. H. G. Nicholls' book—"Iron Making in the Olden Times, etc.," which is still obtainable at Coleford.

industry in the soil of the cottage gardens, and where the last nail-maker died early in 1915; at Clearwell, where they were made in a shed at the back of the present Nailers' Arms, and in sheds adjoining certain of the cottages; and probably at Ellwood.

Mr Richardson then made some remarks on certain river features as exemplified in the part of the Wye Valley between Goodrich and Redbrook. He referred to Mr S. S. Buckman's observations on the meanders of the Wye as recorded in the "Proceedings" of the Club,[1] and said that it appeared to him (Mr Richardson) that at Redbrook they had an example of a large meander whose neck had been cut through, and that the Wye had there straightened and shortened its course. If they referred to maps of the neighbourhoods of Goodrich and Redbrook they would see that at the former locality the Wye from the east side of Goodrich went round a six-mile course to near Rocklands, where it was distant only three-quarters of a mile from its portion to the east of Goodrich. It was obvious that the neck was once narrower, but the river had ceased impinging near Rocklands. If it had gone on impinging the neck would eventually have been severed, the river would have straightened its course, the stream at Lydbrook and that from the neighbourhood of English Bicknor would have passed along the line of the present deep valley at Coldwell Rocks to the straightened Wye, and probably in the valley between Kerne Bridge and Lower Lydbrook there would have been one stream flowing towards Kerne Bridge and another towards Lower Lydbrook with a low divide between them.

In the neighbourhood of Redbrook it looks very much as if the Wye had, when at a level of about 430 to 450 feet, followed a course very similar to that which it now does in the neighbourhood of Goodrich, only the meander-neck has been severed at Redbrook. The road from Upper Redbrook to Newland passes up a valley, which would correspond with that between Kerne Bridge and Lower Lydbrook. At Newland a stream, fed by brooks from Clearwell and the neighbourhood of Whitecliff (Coleford) proceeds south to Valley House, bends round and goes first northwards and then north-westwards to the Wye at Lower Redbrook—a course that corresponds very well with that of the valley between Lower Lydbrook and Rocklands.

At the conclusion of the Secretary's observations, Dr. T. S. Ellis also made some remarks. Maps were examined and the prominent points of interest in the landscape, such as The Buckstone and the Great Doward close at hand, were indicated by Members familiar with the locality, after which *al fresco* luncheon was taken on a spot much frequented by excursionists, but which on this occasion had been left nearly entirely to the use and enjoyment of the Club. Far below the winding river, discoloured by the red soil disturbed by rain and flood, flowed rapidly towards its junction with the Severn at Chepstow, but time did not permit of a descent to its banks, nor even of a visit to the neighbouring Coldwell Rocks, which, like the Seven Sisters and other sections of the limestone gorge through which the river meanders, add so much to the picturesque features of the scenery. [L.R.]

After a short motor ride the Members reached Mailscot Lodge, where a walk was taken in the wood under the guidance of Mr Frank Smith. Here was to be seen a windbreak of spruce planted along the eastern side of the wood to protect it from cold winds. The oak which formerly grew here was felled in 1898, and the spruce was planted the following year. The Mailscot Forest Nursery is one of the best in the Forest, and Mr Richardson mentioned that Mr Hanson had informed him that 450 lbs. weight of seed of spruce, larch, and silver fir had been obtained and sown in the Forest nurseries. This is an emergency sowing and will be used probably in planting

1 *Loc. cit.*, vol. xiii., pt. 1 (1899), pp. 25-32.

up some of the waste areas in Wales. It was considered advisable to have plants in readiness in case planting of waste lands is undertaken to reduce unemployment after the war. This is in addition to the 50 lbs. of seed sown for ordinary planting in Dean Forest. The beds of seedlings—larch, spruce, ash, beech, etc.—are in excellent condition, and give evidence of the best possible treatment. Manure has been recently used for the first time, but not animal manure. Samples of soil are sent to London to be analysed, and suitable artificial manures are selected for use. Curious sports from beech seed were noticed, but these are very rare—about one in 500,000 seeds—and Mr Skinner said two of these trees, known as the "fern beech," are to be seen at Horsepools, near Painswick. Reference was made to the hornbeam, which Mr Smith said was a good resister of frost, and is planted extensively in France. One pound of spruce seed has produced a fine bed of seedlings, it being estimated that a thousand seedlings go to the yard. Passing from the nursery to the wood, attention was drawn to a clump of well-grown larch, about 50 to 60 years old, now in need of thinning. Members were also interested in some felled oak timber which grew among a crop of young larch. The operation, although a difficult one, has been successfully performed, and now in the opening it is proposed to plant Douglas firs and beech. Mr Smith said that the next awkward job would be to remove the felled oaks, but the purchasers are under agreement to make good any damage they may cause! With regard to the larch disease, Mr Smith said the opinion now held was that it started from the branch and worked back to the tree. In proof of this it was a fact that no disease could be found on trees that had been pruned back. If branches were diseased the only remedy was to cut them off.

The felling and regeneration of woods by the method of groups was noticed. Fellings were made in 1906-07 in groups, and the groups were then planted up in the following years. As the young trees now require more light, the groups are being enlarged by cutting strips round them. This method is a useful one on estates when large clear cuttings are undesirable. The natural beauty of the woods remains unspoilt.

The next move was to Woodcastle Hill, a charming spot of the Forest, where the Members saw a large area which had been cleared and replanted. In the distance were groups of oaks and a windbreak. The Braceland Larch is a famous tree, the tallest and best of its kind in the Forest. Its dimensions, when last measured, were as follow:—Height to top, 98 ft.; girth at 5 ft., 10 ft. 3 in.; estimated volume, about 200 cubic feet. The age is believed to be about 90 years. When examining some fine oak at Cope's Wood varying from 100 to 160 years old, Mr Smith was asked when he thought the trees would be ready for felling. He humorously replied that if the timber belonged to him he would have no hesitation in naming the present moment as the right one, but the cutting of the oak really depended on the size of the beech undergrowth. When the beech trees were large enough to be used as pit-props, and therefore, were of commercial value, they might take it for granted that the oak would also be ready for felling. Mr H. W. Bruton capped Mr Smith's humorous sally by recalling the remark of a landowner that "trees are a natural excrescence provided by Providence for the payment of debts."

Whilst in this part of the Forest the botanists made good use of their opportunity. Flowers, ferns, grasses, rushes, etc., were sampled and annexed, and those of the party who did not collect admired the fine patches of blue hyacinths and woodspurge, the mingling of blue and pale yellow in the cheerful sunshine producing a striking effect.

As on a former occasion, "the Long Stone" by the side of the Staunton Road was visited. There was another stone at St. Briavels, but this suffered

from vandalism, and Mr G. Pavey Smith produced two fragments of what was once a conspicuous landmark. When the Club last inspected the stone a photographic illustration appeared in the "Proceedings."[1]

Mr Richardson said that at the time the Rev. H. G. Nicholls published his book on "The Forest of Dean," namely, in 1858, there were two menhirs in the Forest: this one near Staunton, and the other "a large mass of grit-stone from nine to ten feet high, standing in a field on the north side of the road leading from Bream to St. Briavels, also named 'the Long Stone,' but sometimes 'Cradock Stone.'" The latter—according to G. F. Playne—was purposely blown to pieces by gunpowder in 1875, and its fragments carted away into an old quarry. The St. Briavel's "Long Stone" was a large block of the sandstone of the district and, according to Rudder, 10 feet high, 6 feet broad, and 5 feet thick. Playne has remarked that the St. Briavels Long Stone was situated five miles due east of the fine megalithic monument at Trelleck, and that the Staunton Long Stone is situated due east of the Buckstone, and that "they may possibly have been set to mark the orientation from these "Highplaces."

Mr Frank Smith pointed out where a face had been carved on the side of the Staunton Long Stone (facing the road) by a passing sculptor in 1857, but it is almost obliterated now.[2]

In the wood on the right hand side of the Staunton-to-Coleford road, at its junction with that to Lower Berry Hill, is situated Robin Hood Pit, one of the few iron mines now in work in the Forest.

After tea at the Speech House the Rev. P. M. C. Johnstone, M.A., Cheltenham, was elected a Member of the Club, and R. Adams Brewis, M.D., Dursley, and the Rev. J. J. D. Cooke, M.A., Churchdown, were proposed for membership.

The Club is a "Corresponding Society" of the British Association, and Mr J. W. Gray, F.G.S., was elected to represent the Club at the British Association meeting to be held at Manchester in September.

The return journey *via* Westbury-on-Severn, Minsterworth, and Highnam proved a delightful finale to a successful excursion, albeit the air was keen and suggestive of frost. Scores of orchards were passed, bright with bloom and the promise of a heavy crop. A fleeting glimpse was obtained of Mr Colchester-Wemyss' Dutch gardens and the house to which they are attached, and admiration was kindled by the profusion of lilac, laburnum and chestnut bloom in the many gardens and shrubberies situated near the high road, from which also were disclosed some of the charms of Sir Hubert Parry's estate at Highnam.

Those present were Mr W. R. Carles, C.M.G. (Vice-President), Mr L. Richardson (Hon. Secretary), Messrs. F. H. Bretherton, O. A. Brown, G. N. Bruton, H. T. Bruton, H. W. Bruton, J. D. Crewdson, F. J. Cullis, T. S. Ellis, F. Hannam-Clark, J. W. Haines, H. H. Knight, J. W. Skinner, A. J. Stephens, G. H. Pavey Smith, A. S. Montgomrey, W. Thompson, Dr. J. Middleton Martin, Dr. Dixon, Lieut.-Col. J. C. Duke, etc. [W.T.]

1 Proc. Cotteswold Nat. F.C., vol. xvi., pt. 1 (1907), pl. iv., fig. 1, and page 34.

2 See also "Notes on Staunton Topics" collected and arranged by Ernest G. Fraser. 1906. Privately printed.

EXCURSION TO TEWKESBURY.

THURSDAY, JUNE 3rd, 1915.

Directors : The REV. WILLIAM DAVIES and L. RICHARDSON.

(*Report by* L. RICHARDSON.)

The following Members attended this Meeting : Mr W. R. Carles, C.M.G. (Vice-President), L. Richardson (Hon. Secretary), the Rev. J. J. D. Cooke, the Rev. P. M. C. Johnstone, Lieut. Col. J. C. Duke, Messrs. F. H. Bretherton, F. J. Cullis, J. M. Collett, G. M. Currie, J. M. Dixon, T. S. Ellis, J. C. Frith, E. W. Fyffe, C. I. Gardiner, F. Hannam-Clark, E. Hartland, A. E. Hurry, E. Lawrence, F. J. Mylius, H. H. Knight, J. A. Smithin, Charles Upton, etc.

The Members arrived at Tewkesbury at 1.50 p.m., and at once proceeded to the Senior Council School to the School Gardens and the Domestic Science Centre. In the absence of the Headmaster, owing to ill health, the Hon. Secretary explained briefly the objects of the School Garden, and then led the way into the Domestic Science Room, where a cookery demonstration was in progress.

From the school the Members walked to the Tewkesbury Pumping Station of the Cheltenham Corporation Waterworks. Mr J. S. Pickering, M. Inst. C.E., the Borough Surveyor, wrote expressing his regret at being unable to meet the Members himself, as he was going to Scotland, but he had instructed the Works Manager, Mr Walker, to meet them and show them round. No pumping or filtering was going on, as Cheltenham was at the time being supplied from its reservoirs.[1]

From the Pumping Station the Members went on to the Mythe Tute, whence splendid views are obtained over a reach of the Severn to Pull Court and the serrated ridge of the Malvern Hills beyond ; of Bushley and Sarn Hill ; the Severn Ham and the site of the battle of Tewkesbury (between Edward IV. and Queen Margaret, May 4th, 1471) ; and of Tewkesbury and its historic Abbey.

The fine Mythe Bridge, which spans (170 feet) the Severn close at hand, was designed by Thomas Telford, the great engineer, and erected in 1823-26. With its long road approaches it cost £35,000, which was subscribed by shareholders. In spite of heavy tolls on the traffic—which fell far short of expectation—the venture failed as a commercial enterprise, and in 1891, by the combined efforts of the Gloucestershire and Worcestershire County Councils, the bridge was thrown open free of toll.

The Hon. Secretary made some remarks on the geology of the district.

The country to the west of a line running approximately north and south through Tewkesbury, and between this line and the Malverns, is composed of Upper-Keuper rocks—principally marl like that seen in the Mythe Cliff. In the marls, however, is a bed of sandstone—the "Arden Sandstone."[2] Sandstone and marls have been flexured to a considerable extent by crust-pressures, and the result of " differential denudation " upon these rocks has been the undulating and pleasing country of to-day.[3] At Heath Hill, Sarn Hill, and Berrow Hill, are outliers of Rhætic and basal Lower-Lias beds.[4] The Keuper beds are of great thickness, as the deep and costly boring for water at Upton-on-Severn has proved.

1 A full account of these Works, by Mr Pickering, will be found in Trans. Inst. Water Engineers, vol. xiii. (1912), pp. 71-75.

2 Quart. Journ. Geol. Soc., vol. lxviii. (1912), pp. 252-280.

3 L.R., Proc. Cotteswold Nat. F.C., vol. xv., pt. 2 (1905), pp. 93-100.

4 L.R., Trans. Worcestershire Nat. Club, vol. iii., pp. 192-195 ; Quart. Journ. Geol. Soc., vol. lxi. (1905), pp. 425-430.

The country to the east of the line referred to above, between it and the Cotteswold Hills, is floored with Lower-Lias clay, on which dairy-farming predominates. Here and there, however, are deposits of gravel ("Northern Drift") and sand, and where they occur (as at Eckington) the ground is very suitable for market-gardening.

Great accumulations of "Northern-Drift" pebbles occur on the banks of the Avon (as at Twyning Fleet), above the level of the Alluvium.

The flat ground alongside the Avon and Severn is formed of Alluvium—the mud brought down and deposited by the rivers. In times past there were small lakes on the line of the Severn. One such lake existed where the Severn Ham is now situated. When some deep excavations were made in connection with the Tewkesbury Docks, lacustrine deposits were proved. In very rainy seasons, owing to the overflowing of the rivers, the Severn Ham and neighbouring low-lying meadows soon become covered with water (Plate II., figs. 1 and 2).

In times past the limestone-beds, which are so numerous in the lower portion of the Lower Lias, were extensively worked on Brockridge Common (near Ripple), Heath Hill, and Sarn Hill, for burning for lime, for paving cattle-sheds, and to a certain extent for road metalling and building purposes.[1] As is obvious, however, in Tewkesbury, brick, and, in the older picturesque houses, brick and oftimes "wattle-dab" and oak were the building materials. The bricks were made from the alluvium, and the numerous, now usually flooded, pits by the Severn-side show how extensively this material was used in the past. Now, however, there is only one brick-works in activity—that near the Lower Lode.[2]

The old flooded pits are now usually used for osier-beds to furnish material for willow basket-making. Osier-growing and basket-making are important Severn-side industries. By the Severn-side at Deerhurst—where the industry has been carried on for centuries—the basket-makers carry on their work in sheds adjoining or close to their cottages.[3] The baskets principally made are coal-kipes, fruit-kipes, and square pot-baskets for fruit. These baskets are mostly sent to the large towns—Gloucester, Cheltenham, Birmingham, Liverpool, Nottingham, Sheffield, etc.

The Mythe Cliff is the one place in Gloucestershire where the Woad (*Isatis tinctoria* L.) is now found, and the Members were fortunate in finding several specimens in flower. The plant belongs to the Cruciferæ, and has been grown from the earliest times in Britain for the sake of its leaves, which contain indoxyl—an unstable compound whose watery solutions produce indigo-blue after treatment with an alkali and an acid. It is probable that this is the plant which is mentioned by Cæsar and other Roman authors as being employed by the ancient Britons for staining their bodies. Since the introduction of indigo from the indigo plant in the 16th century the cultivation of woad has almost disappeared. According to Mr. J. M. Dixon, it used to be grown in Gloucestershire on the ground (Lower Lias clay) still known as "Wad Ground," near Broad Marston Halt on the Honeybourne-Stratford Railway.

After tea at the Swan Hotel, the Members walked to the Abbey gates, where they were met by the Rev. William Davies, of Tewkesbury, who was to show them some of the less-visited buildings in Tewkesbury.

1 The water in a well in the Lower-Lias clay at Walton Cardiff closely resembles the "Cheltenham Waters," and in 1746 some idea was entertained of making this hamlet a place of resort.

2 Proc. Cheltenham Nat. Sci. Soc., n.s., vol. 1, pt. 4 (1910), pp. 240-241.

3 Except for this industry here, "gloving" in three or four cottages at Ashton-under-Hill, and shirt-making for a Worcester firm in three or four cottages at Forthampton, cottage-industries have died out altogether in the Tewkesbury Area. In the past, "gloving" was done in Alderton (for an Evesham firm, until some ten years ago), Beckford, Forthampton, and Hasfield.

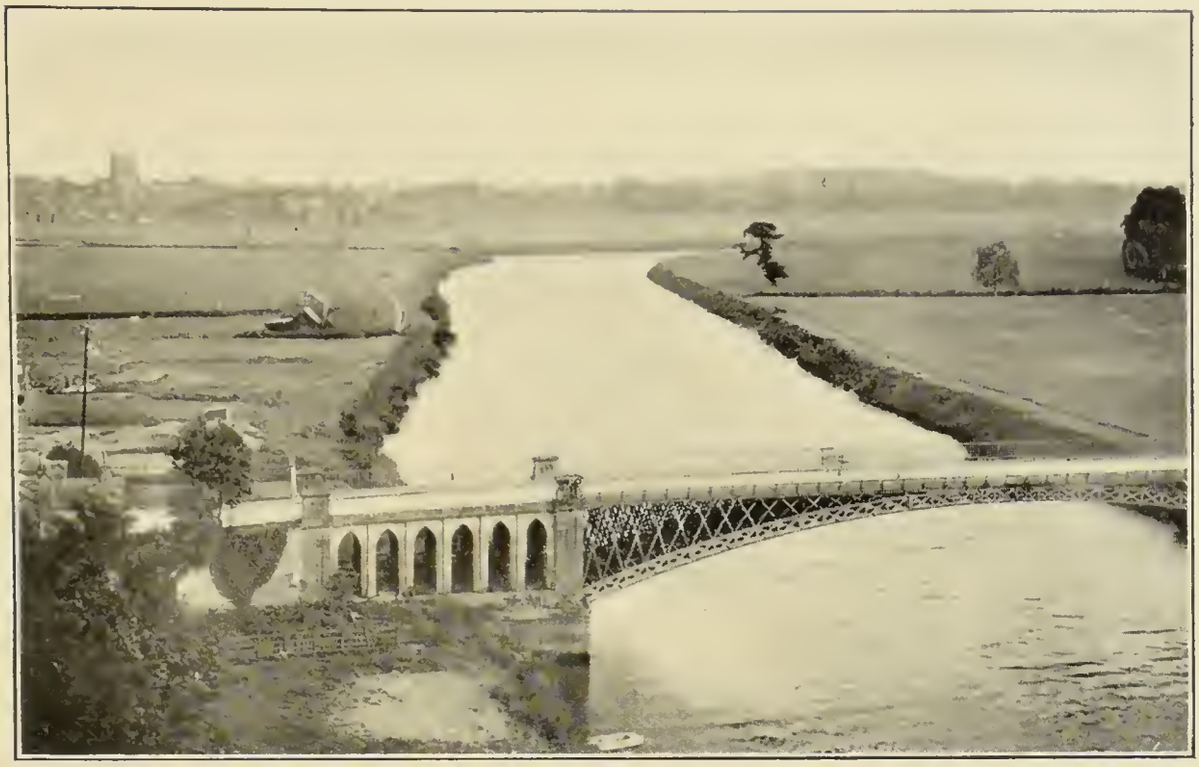

Fig. 1.—The River Severn, Mythe Bridge, and level alluvial ground (Severn Ham), viewed from the Mythe Tute, Tewkesbury.

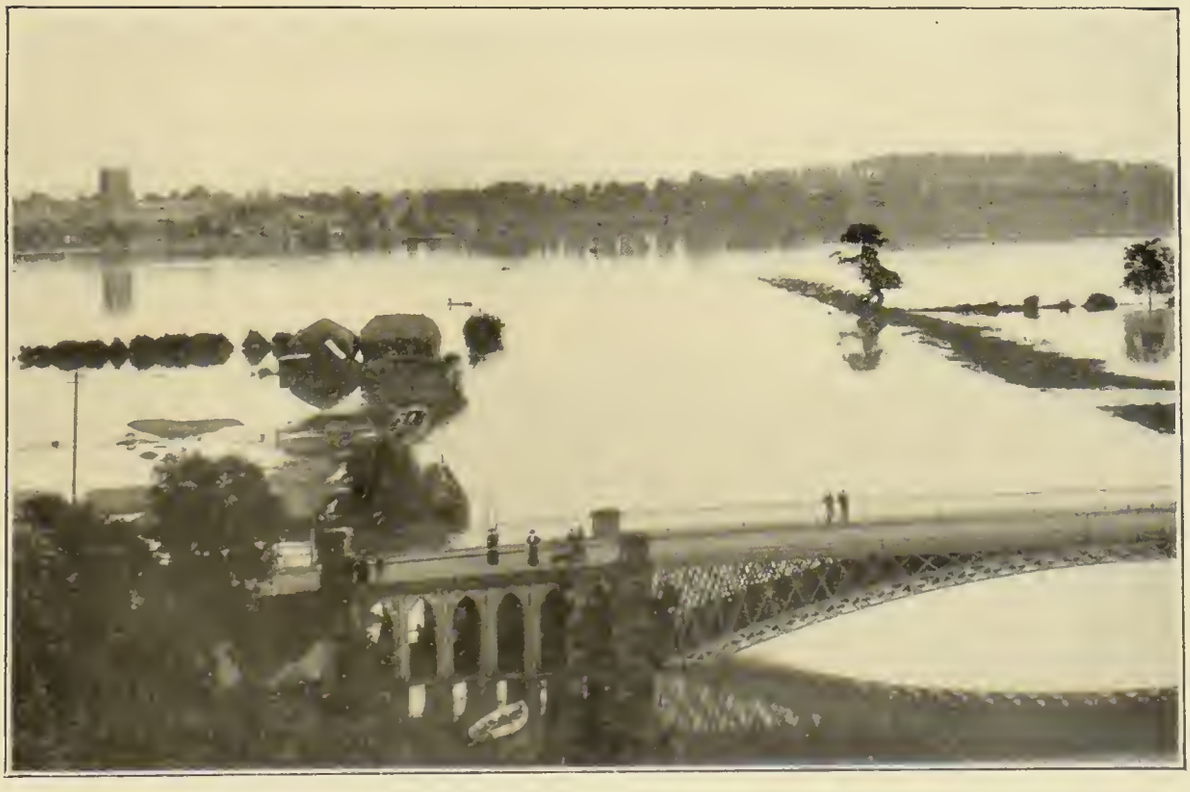

Fig. 2.—View from near the same place during flood-time.

(Reproduced by kind permission of Messrs Mallett & Sons, Tewkesbury.)

Abbey Tower and old houses, Tewkesbury.

(*Photo by Messrs Mallett & Sons.*)

The name "Tewkesbury" at once brings to mind the fine old Abbey Church and the picturesque half-timbered houses of the town (Plate III.).

The history of the Abbey has indeed been closely interwoven with that of the town. It is probable, however, that there were habitations at Tewkesbury before the Abbey was founded. Probably the Britons had a settlement here, and, judging from the number of coins that have been found in the part of the town called the "Oldbury" and in the neighbourhood of the Abbey, the Romans as well.

The Saxons established themselves here, and two of their nobles, Oddo and Doddo, in 715 founded the monastery, some say on the site of a chapel and dwelling erected by a recluse named Theocus.

The Danes came up the Severn on their marauding expeditions, and it is generally held that they scarped and heightened a natural protuberance on the Mythe Hill, which has long been known as the Mythe "Toot" or "Tute."[1]

The Danes so damaged the monastery that in 980 it became a cell, dependent on the Abbey of Cranbourne, in Dorset. In 1087 the patronage of the Tewkesbury monastery came into the hands of Robert Fitz-Hamon. Giraldus—who was appointed Abbot of Cranbourne by William Rufus—secured Fitz-Hamon's interest in Tewkesbury, and, with his aid, built the noble Abbey and transferred thither the monks of Cranbourne, making that Abbey in turn a cell dependent on Tewkesbury. The main part of the present Abbey is usually assigned to 1123. In 1234 the principal gateway was burnt down. The present Abbey Gateway is perpendicular work.

In 1539 came the Dissolution, and the greater portion of the monastic buildings were destroyed. The gateway, however, was preserved, as well as the "great barn next the Avon." The heavily-buttressed wall at the Victoria Pleasure Ground formed part of this "great barn," which, in 1899, was purchased by the Corporation so as to belong to the town and be kept in good repair.

Mr Davies stated that the old high road to Gloucester used to run between this wall and the river and along the site of the present Victoria Pleasure Ground.

The mill they were near, continued Mr Davies, was known as the Abbey Mill. There was one here at the time of the battle of Tewkesbury, for Holinshed states that the carnage "was terrible at a mill in the meadow fast by the town."

Mr Davies said that they were not going to visit the site of the Battle of Tewkesbury. They would recollect, however, that it was fought between Edward IV. and Margaret (Consort of Henry VI.), representing the houses of York and Lancaster, on May 4th, 1471. The Lancastrians were defeated. Margaret fled across the river, and, some say, hid for two days at Payne's Place, Bushley. Her young son, the Prince of Wales, was taken prisoner, brought before Edward IV., tradition has it, in a house in Church Street (number 102), and there stabbed to death by the Dukes of Gloucester and Clarence.

The Abbey Mill figures in "John Halifax, Gentleman"—a work that was again brought to mind by a visit to the site of a portion of the tan-yard of "Abel Fletcher."

Tanning had a lengthy history in Tewkesbury, but now the trade is extinct. There was an Abbey tannery in 1385, and by the 16th century various dependent leather industries had grown up. Tewkesbury then had its company of cordwainers and shoe-makers, besides "whittawyers," glovers, pouch-makers, and point—or shoe-lace—makers.

1 W. Johnson, in "Byways in British Archæology" (p. 70), derives "Toot" from A.S. *totian*, "to project, to peep," in allusion to the swelling or protuberance of the ground.

The original tan-yard of "John Halifax" was bought and a factory for silk-finishing built on it about 1840. After a few years it was sold to R. Bolding, who re-opened it as a boot and shoe factory, calling it the "Halifax Works." After being closed for some time it was acquired by the Tewkesbury Manufacturing Company (registered 1880), who sold it to Mr Jackson in 1886. Mr Jackson kept the Works until 1909. On 21st December, 1909, they were acquired and refloated by Mr Wilson, and in September, 1913, became the Tewkesbury Manufacturing Co., Ltd., and known as the Eagle Factory.

The early trade of the town appears to have been confined to the commerce in grain, flour and malt, which the inhabitants were enabled to carry on to great advantage by means of their fine navigable rivers. In the same year that the battle of Tewkesbury was fought it is on record that they petitioned Henry VI. to stop bands from the Forest of Dean plundering their boats on their way down the Severn to Bristol and elsewhere.

During the time of the Commonwealth, gloves were largely manufactured; worsted combing was carried on to some extent during Anne's reign, and in that of her successor the clothing business flourished. Malting and home brewing were carried on on an extensive scale for some centuries, but now, Downing & Co. are the only maltsters in the place. A cotton thread lace factory was founded at least as early as 1817, and in 1825 these works—the property of Messrs. Freeman in the Oldbury—were considered highly equipped for that date. The industry did not survive later than 1850. "Silk-throwing" was done between 1840 and 1870. In 1870 the last firm—Iliffe's—migrated to Coventry. The site of Iliffe's factory is now occupied by the Picture Palace.

Ropes were manufactured as late as 1832 in a long narrow space—now built upon—but still called the "Rope Walk."

Nails were made by individual master-nailers, their wives and children—where Nailers' Square and Nelson Street now stand—until about 1874, when machinery replaced handwork. For a short period two local tradesmen made pins with "superlative solid heads and improved points," and the trade enjoyed a boom; but Beard & Co., who acquired the Works in 1849, soon had to abandon them.

The chief industry in Tewkesbury during the 19th century, however, was that of stocking-frame knitting. In 1810 some 800 frames were at work; in 1819, when the trade was depressed, 559; but in 1830, between 700 and 800, giving employment to about 1,500 people—more than a fourth of the population. The industry has quite died out.

That, in most respects, excellent Cambridge County Geography—Gloucestershire (1909), dealing with Tewkesbury (p. 148), states:—

> "Its chief manufactures are nails and leather goods; there is also a small silk factory, and formerly there was much stocking-frame knitting done."

All these industries have long been dead. The principal ones now carried on are:—

INDUSTRIES IN TEWKESBURY.

1.—*Building.*—Messrs. Collins & Godfrey (general builders; speciality: large buildings and private houses, church building and restoration).

2.—*Engineering.*—(*a*) Messrs. C. W. Jones & Co., Oldbury Road (agricultural engineering, steam, oil, and gas engines repairs, implement making).

(*b*) Messrs. Thomas Walker & Sons, Oldbury Road (general engineers and contractors. Round-about manufacturers and makers of brickyard machinery).

3.—*Flour.*—Borough Flour Mills, Messrs. Healing & Sons.

4.—*Maltsters.*—Messrs. Downing & Co.

A visit was then paid to the old Baptist Meeting House in Old Baptist Chapel Yard. This was of particular interest, and Mr Davies had on exhibit a number of most interesting old books, including the Church Book. This Church Book is in its original sheepskin covers, and the first entry in it refers to a meeting at Warwick in 1655, to which the Tewkesbury Church sent its "Messengers." When persecution raged in 1663 there were 124 members, and their names are entered in cipher. The graveyard is interesting. In it is the still legible gravestone of John Cowell, who died in 1680.

The house of Mr Willis, 102, Church Street, was pointed out as that in which tradition has it the young heir to Henry VI. was murdered after the battle of Tewkesbury.

Some of the oldest houses in Tewkesbury are those near the Cross. Two made into one now constitute "Ye Olde Berkeley Arms Inn," the third is a shop. This last has a fine row of oak window-lights over the shop front in what is called "arcade work." This work was for long covered with plaster; but when this was removed the arcading was discovered and defects made good.

The Cross House—once probably the town house of the Lords of Tewkesbury—was viewed by kind permission of Mr F. W. Godfrey, and admiration was expressed at the excellent way in which the restoration and certain improvements had been carried out.

The Academy House was viewed from the garden, by kind permission of Mr C. C. Moore. It is a fine example of a house of Jacobean times. It is known as the Academy House, because from 1711 to 1719 a Presbyterian Academy was held here. The Rev. Samuel Jones was the master, and a number of pupils—such as Archbishop Secker and Dr. Butler, Bishop of Durham—attained high distinction.

EXCURSION TO DUNDRY HILL AND STANTON DREW, NEAR BRISTOL.

TUESDAY, JUNE 15th, 1915.

Directors: A. E. HUDD, F.S.A., and L. RICHARDSON.

(*Report by* W. THOMPSON.)

The second whole-day field meeting of the Club was favoured with weather almost too fine. That is to say, the Members who assembled at Temple Meads Station, Bristol, on Tuesday whilst fully appreciating the brilliant sunshine, recognised the urgent need for a break in the drought which has aroused anxiety among those engaged in agriculture and horticulture. The feeling was deepened before the day was over, for owing to the dusty condition of the roads, the ride from Bristol to Dundry Hill and Stanton Drew was robbed of much of its pleasure. This was in part due to the fact that the Hon. Secretary had failed in his attempt to obtain char-a-bancs owing to the increased needs of the Government, and as a consequence the Members had to make the journey in taxi-cabs—a novel way of covering the ground, but not to be desired as a general experience. When the party

arrived at Temple Meads for the homeward train journey they were literally covered with dust, and those wearing dark clothes looked as if they had stepped out of a flour mill. However, the excellence of the programme provided by Mr Richardson went far to compensate the party for this drawback, and the day will be remembered as one of mental profit, and, apart from the dust fiend, of physical enjoyment.

DUNDRY HILL.

The Club was fortunate in having the company of Mr A. E. Hudd, F.S.A., of Clifton. Dundry Hill is situated on the Somersetshire side of Bristol. It is both long and steep, but when the summit is attained a fine view rewards the climber. Bristol with Clifton and its Suspension Bridge, Avonmouth further west, and to the east the termination of the Cotteswolds near Bath, provide such a panorama as the eye delights to feast on, and full advantage was taken of the opportunity, such time as Members remained in the vicinity of the conspicuous church.

Mr Hudd pointed out that according to Collinson the name of Dundry was derived from two Erse words, "dun" and "draegh," signifying a hill of oaks, but that this was not very convincing. The late Bishop Clifford suggested that the church tower was probably on the site of an ancient beacon for the guidance of mariners, and that the name was derived from the Saxon "Dawn-tree," from A.S. "dagian," to spread light. The fine tower acts as a landmark from the Channel and has been well-restored. In the churchyard is a beautiful cross, described and figured by Pooley, of about the same date as the tower—late 15th century. There is an interesting "dole stone," a square block of Oolite (Dundry Freestone) in the churchyard, and until comparatively recent time doles were distributed here. The Church is said to have been originally built by the Society of Merchants of Bristol.

The Members then went into the freestone quarry, near the Church.

Mr Richardson said that Dundry Hill was of considerable interest to students of the Inferior Oolite, because the lower beds of the Series here were very similar to their equivalents to the south of the Mendip Hills (and totally unlike their equivalents in the Cotteswold Hills); while the "Top Beds" were similar to their equivalents in the Doulting-Bath district and the South Cotteswolds. The Dundry Freestone—formerly so extensively worked in this quarry, and, as they had seen from the holes and irregular ground on Dundry Down, there as well—occupied a position between the Upper *Trigonia*-Grit and Upper Coral-Bed. Its geographical extent was very limited: it occurred in sufficient thickness to be workable for commercial purposes only in the neighbourhood of the Church. The Church was sufficient evidence of the excellence of this freestone.

Particular attention was drawn to the Upper Coral-Bed because it had yielded to Charles Moore—the well-known Somerset geologist—a large number of exceedingly interesting micro-fossils, and was in all respects similar to its equivalent at Midford, near Bath,[1] and at Rodborough Hill[2] and Worgan's Quarry,[3] near Stroud. Many geologists had written on the Inferior Oolite of the Dundry-Hill outlier; but it was Mr S. S. Buckman, in collaboration with the late Edward Wilson,[4] who was the first to describe the beds satisfactorily and to correlate them with their equivalents in other parts. Mr Richardson had bestowed special attention on the "Top Beds," and had published the results of his work in the Quarterly Journal of the Geological Society.[5]

1 Quart. Journ. Geol. Soc., vol. lxiii. (1907), pp. 406-408 and Table II.
2 Proc. Cotteswold Nat. F.C., vol. xvi., pt. 1 (1907), pp. 73, 74; and *id.*, vol. xvii., pt. 1 (1910), p. 135.
3 E. Witchell, "The Geology of Stroud" (1882), pp. 60-61.
4 Quart. Journ. Geol. Soc., vol. lii. (1896), pp. 669-720: Proc. Bristol Nat. Soc., vol. viii. (1897), pp. 188-231.
5 Quart. Journ. Geol. Soc., vol. lxiii. (1907), pp. 420-421.

The two botanists of the party turned out on the Down with a view of studying the flora of the district, but drew a blank.

CHEW MAGNA.

Before Stanton Drew was reached, a view of the Mendips was obtained, and on the suggestion of Mr Hudd the party halted at Chew Magna to inspect the Church and Church House. The former is interesting by reason of its south porch, which once contained a small gallery for use on special occasions, such as weddings. Here boy choristers would be installed. This is the only place in North Somerset where such a porch is to be found. There is another in the lower part of Gloucestershire, one in Monmouthshire, and a fourth at Weston Gordano, near Portishead. The Church House is a Tudor building still in use and pleasing to the eye. In the churchyard is buried John Locke.

STANTON DREW.

Stanton Drew is appropriately associated with Stonehenge and Avebury, for, to quote from the British Association leaflet of 1898 (Bristol), "The megalithic remains of Stanton Drew, though far less imposing than the great circles of Avebury and Stonehenge, are more perfect than the one, and probably more ancient than the other." Here the Rev. H. H. Winwood, F.G.S., of Bath, acted as Director, and Members of the Bath and District Branch of the Somerset Archæological and Natural History Society awaited the arrival of the Cotteswold Club. Taking up a position under the branches of a fine

Fig. 1.—Stanton Drew Circles.

(Block lent by the Bristol and Glos. Arch. Soc.)

(Reproduced from a photograph lent by Mr C. Horton)

oak tree, whence a comprehensive view of the stone circles was obtained, the company listened to a paper read by Mr Winwood, in which he reviewed the theories advanced for the presence of prehistoric remains of such importance. There are three circles at Stanton Drew, namely :—

1.—"Great Circle," diameter 368 feet, 30 stones
2.—"N.E. Circle" ,, 97 ,, 8 ,,
2.—"S.W. Circle" ,, 145 ,, 12 ,,
and the "Quoit," "Cove" and "Middle-Ham" Stones.

A short "avenue" of stones in parallel lines leads out from the Great Circle towards the E.N.E. and probably indicates a sunrise bearing on some agriculturally important day of the year.

The North-East Circle is near the Great Circle, and is thus named on account of its position in relation to that Circle. It has a diameter of 97 feet and is constituted by eight large and massive blocks of silicified breccia, one of which (if indeed it does not represent more than one) is broken and recumbent. From this circle, too, there runs a short "avenue" bearing a little south of E., in which one stone is of Inferior Oolite.

The South-West Circle lies at a distance of 237 yards to the S.W., has a diameter of 145 feet, and is constituted by twelve smaller stones, most of them of the same silicified rock; but one is of slightly altered Dolomitic Conglomerate, and one of sandstone.

Near Stanton Drew Church, about 180 yards W. by N. of the South-West Circle is a dolmen known as "The Cove," composed of the relatively unaltered breccia, one of the uprights of which is 10¼ feet high, 7¼ feet broad, and 2 feet thick.

"The Quoit" is a large recumbent sandstone megalith, situated near the road at a distance of about 618 yards to the N.E. of the "Great Circle;" and two smaller oolitic stones lie 1,100 yards N. by E. of that circle, in a field known as the Middle Ham. On Broadfield Down about 6½ miles distant is a dolmen ("The Waterstone") bearing a little N. of West.

These megalithic remains are undoubtedly very ancient, but opinions differ as to the race by whom they were placed in their present position. By some they are regarded as the work of the Neolithic Mediterranean race who were in possession of England before the Celtic incursion. By others they are ascribed to these later Bronze folk invaders.

As to their purpose, by some they are regarded as temples. Others look upon them as burial places. The view, however, that is gaining ground is that they are connected with astronomical observations of guiding value to a people whose practical interests were agricultural.

In this connection it will be convenient to give the dimensions, distances between centres, probable number of constituent stones, and compass bearings, as recorded in the able monograph on Stanton Drew, by C. W. Dymond, Esq., F.S.A.

Bearings and distances:—

Great Circle to	N.E. Circle	N.54°15′E.,	398 ft.
,, ,,	S.W. ,,	S.21°40′W.,	712 ft.
,, ,,	Cove	S.53°45′W.,	988 ft.
,, ,,	Quoit	N.19°30′E.,	1856 ft.
,, ,,	Middle Ham	N.83°15′W.,	3305 ft.
S.W. Circle	Cove	N.81°45′W.,	542 ft.
Axis of Great Circle Avenue		N.70°E.	
,, N.E. ,,	,,	S.79°E.	

It may be noted:—

1.—That the centre of the Great Circle, that of the S.W. circle and that of the quoit, are nearly in the same straight line. (Angle 177° 50′.)

2.—That the Cove, the centre of the great circle, and that of the N.E. circle, are nearly in the same straight line. (Angle 179° 30′.)

3.—That the line joining the centre of the S.W. circle with the Cove is nearly parallel with that joining the centre of the great circle and the Middle Ham Stones. (Angle 1° 30′.)[1]

1 These notes on the Stanton Drew Circles are derived from Prof. C. Lloyd Morgan's contributions to the programme of the Annual Summer Meeting of the Bristol and Gloucestershire Archæological Society at Wells and Glastonbury, June 3rd-5th, 1913, and "Excursions," British Association, Bristol, 1898.

Leaving the Circles, the Members proceeded to the Church, where the Rev. W. W. Warren, who has recently taken up residence as Vicar, furnished some particulars. The font is the oldest part of the Church, being early Norman, and there are fragments of Norman work at the base of pillars and elsewhere. The building has been thoroughly restored, and the gallery at the west end renewed.

MAES KNOLL AND THE WANSDYKE.

After tea the party motored to Maes Knoll, where Mr Hudd again contributed some interesting observations on the Wansdyke, which begins at Maes Knoll—a well-preserved earthwork on a hill which bears a striking resemblance to Haresfield Beacon. Standing on the Knoll it was easy to create a picture of the land situated on the Standish side of Haresfield Beacon, and the general contour was strongly reminiscent of that locality.

Mr Hudd has devoted special study to the Wansdyke, which extends from North Somerset to the borders of Hampshire. There can be no doubt that the name by which the dyke is now known is of Saxon origin, nor that to that people we may attribute the finest portions of the monument, for instance, the portion near English Combe and that on the Wiltshire Downs from Shepherd's Shore to St. Anne's Hill, but it is quite possible that there was an earlier dyke partially following the same course, connecting the prehistoric earthworks at Maes Knoll, Stantonbury, Hampton Down, etc. It is also possible that this earlier dyke may have been one of the "Belgic ditches" described by several authorities. The late Dr. John Beddoe also attributed "the gigantic earth fortress called Maes Knoll" and the Wansdyke to the Belgæ, erected as a barrier against the Dobuni of Gloucestershire, but this was written before the excavation of the dyke by General Pitt-Rivers. It seems probable that Maes Knoll also is of post-Roman date. There is at present no trace of the Wansdyke west of Maes Knoll, and notwithstanding the account given by Collinson, it is very doubtful whether the dyke ever extended further west than it does now. Mr Hudd examined, many years ago, the remains in "Yanley Lane" and in other places mentioned by Collinson and others, and came to the conclusion that the traces of earthworks there had nothing to do with the dyke. From Maes Knoll the dyke starts from the north-east corner of the camp in the direction of Stantonbury, where it joins the north-west vallum of the prehistoric camp there, and may be traced in many places between Stantonbury and Hampton Camp. Since the exploration twenty years ago, much of the dyke has been destroyed, especially in Prior Park, Bath, where it was well-marked, but can now hardly be seen. The vallum varies from a few inches above the bottom of the foss to about 30 feet on St. Anne's or Tanhill. The ditch is always on the north side of the mound, which indicates its use as a protection by the dwellers south of the Dyke. It has been suggested that the mound and ditch were only intended to prevent cattle straying, but the huge mound and the ditch carefully cut in the chalk rock on the Wiltshire Downs seem to indicate something more, possibly a tribal boundary.

The ascent of Maes Knoll was not the least pleasant part of the day's programme, for not only did Members get respite from the blinding clouds of dust, but they were also favoured with fine views of Dundry Hill with its prominent Church tower, the familiar line of the Cotteswolds; while the diversified features of the landscape created an agreeable impression of this part of Somersetshire.

One again the Honorary Secretary had succeeded in ministering to the tastes of all.

The Members of the Club who were present included:—The Rev. H. H. Winwood (Vice-President), Messrs. L. Richardson (Hon. Secretary), F. H. Bretherton, G. M. Currie, E. W. Fyffe, F. Hannam-Clark, W. Margetson, A. S. Montgomrey, A. E. Smith, F. W. Smith, E. C. Sewell, A. J. Stephens, W. Thompson, C. Upton, and E. Northam Witchell.

EXCURSION TO MAY HILL, Near GLOUCESTER.

Saturday, June 26th, 1915.

Director : C. I. GARDINER, M.A., F.G.S.

(*Report by the Director.*)

On Saturday, June 26th, a party of the Club, including Mr. W. R. Carles, C.M.G., and C. Upton (Vice-Presidents), Lieut.-Col. J. C. Duke, the Rev. J. J. D. Cooke, Surgeon-Major I. Newton, Messrs. F. H. Bretherton, G. M. Currie, M. Bellows, E. W. Fyffe, C. I. Gardiner, T. S. Ellis, A. S. Montgomrey, F. Hannam-Clark, A. J. Stephens, etc., visited May Hill.

Owing to pressure of work the Honorary Secretary was unable to be present, and Mr Gardiner acted as Secretary and Director. The majority of the Members motored from Gloucester and met the cyclists at Huntley.

By the roadside at Huntley two quarries were seen, the one in New Red Sandstone, and a few yards further on one in a hard green and purple fine sandy grit. This latter rock is considered by Dr. Callaway to be of Pre-Cambrian age ; the beds are folded up sharply into a vertical position, and at one place are slightly overfolded. Between the two quarries is, in a north and south direction, one of the most important faults in England, which, coming down the east side of the Malvern Hills, runs down to Huntley. Movement along this line probably began in Coal-Measure times, and can hardly be said to have ceased yet, for the earthquake of some twenty years ago seems to have been a tremor caused by a small displacement along this old line of dislocation.

Proceeding up to Dursley Cross the party walked up May Hill, noting on the way the two types of Llandovery rocks which occur in this district—the lower a coarse red sandstone with large fragments of well-rounded felsite and quartz grains of considerable size in it ; the upper, a fine yellow sandstone.

Fossils in the former are very scarce and very fragmentary, while the upper bed is frequently full of brachiopods and corals.

From the summit of May Hill a wide and interesting view was obtained. The geology of the immediate neighbourhood was discussed and attention was called to the parallel ridges formed of Carboniferous, Old Red Sandstone, and hard Silurian rocks.

The descent was made to Rock Farm, where a quarry in the Wenlock Limestone was visited, in which fossils were found. At Longhope tea was obtained, and afterwards Mr Gardiner spoke of the work done in the middle of the 19th century by Sedgwick and Murchison in North and South Wales, and of the great geologic storms which raged in those days round May Hill. Murchison classed the May Hill Sandstone as the equivalent of the Caradoc Sandstone of Horderley, which is of Bala age, while Sedgwick claimed its fossils as showing that it was of later date. Eventually the Survey re-investigated the May Hill Sandstone of the Llandovery district, and found Sedgwick's conclusions were right. They then called this deposit Llandovery Sandstone, and it is now known to be of a higher horizon than the Caradoc Sandstone, which is nowhere seen in the May Hill district.

On the journey back quarries near Blaisdon were inspected, which are in the upper part of the Wenlock Limestone and in the Lower-Ludlow Beds.

EXCURSION TO AVEBURY AND DISTRICT.

Tuesday, July 6th.

Owing to the impossibility of obtaining motors or brakes—on account of the War—this excursion had to be abandoned.

EXCURSION TO HAYLES.

THURSDAY, SEPTEMBER 16th, 1915.

Director : ST. CLAIR BADDELEY.

(*Report by* L. RICHARDSON.)

The Members, who included Messrs. H. W. Bruton, F. H. Bretherton, W. R. Carles, F. J. Cullis, J. M. Dixon, T. S. Ellis, F. W. Fyffe, H. H. Knight, E. P. Little, F. J. Mylius, L. Richardson, C. Upton, Lieut.-Col. J. C. Duke, Surg.-Major I. Newton, etc., met at Hayles Church.

A few, including the Director, walked to Hayles from Toddington Station (where they arrived at 1.2) *via* Didbrook.

In Didbrook the warm brown colour of the local building-stone, the "Guiting Stone," attracted attention, and reminded those who had visited Ham Hill, near Yeovil, of that famous West of England building-stone.

In times past, the Guiting Stone was extensively worked by Messrs. Groves Bros. at the "Tally Ho" Quarry, near the Naunton Inn on the Stow Road, and at the "Yellow Guiting Stone" Quarry, Temple Guiting. In 1901 The Taynton and Guiting Quarries, Ltd., acquired the "Tally Ho," Quarry and the "Yellow" and "White Guiting Stone" Quarries at Temple Guiting, and continued to work all three until 1905. In that year the "Tally Ho" Quarry was closed, and the plant removed to the then recently-opened Coscombe Quarry. As the company specialize in the "Yellow Stone," the "White Guiting Stone" Quarry in Oat Hill Wood was only worked when required, and in 1909 work ceased at the "Yellow Guiting Stone" Quarry altogether in order to concentrate at Coscombe.

The "Guiting Stone" is of a warm brown—in trade circles "orange"—colour and possesses remarkably good weathering properties. The colour has no tendency to fade, but rather to attain a warmer shade with age. Guiting Grange shows the colour to perfection.

"Guiting Stone" is a very free-working stone, hardens on exposure, and is not affected by frost, even when the quarry sap is still in it. In the stone now quarried there are no soft layers, as was the case in some of that formerly quarried. Blocks 6 to 7 feet in depth and any reasonable size can be obtained. When freshly-drawn the stone averages 14 cubic feet to the ton.

The mansions, farm-houses, churches, and buildings generally in the immediate neighbourhood of the "Guiting Stone" Quarries are a standing testimonial to the merits of the stone—the sharpness of all angles, and the clean, square and upright appearance of the buildings being particularly noticeable. This is especially to be noted at Temple Guiting Church, the chisel-marks being as plain as when the stone left the masons' hands. The dates of erection are :—Tower, about 15th century ; nave, about 14th century ; and chancel, about 12th century. Amongst other buildings where "Guiting Stone" has been used may be mentioned Toddington House, Fosse House (Stow-on-the-Wold), Farnham Castle, Tewkesbury Abbey, etc. Evesham Bell Tower, about 800 years old, is said to have been built of this stone.

From Didbrook the Members traced the Salt-way (which ran from Lechlade to Droitwich, through Salperton, Hayles and Didbrook) to Hayles.

At Hayles additional Members joined the party.

First Hayles Church was visited. It was built long before the Abbey.

In the reign of Stephen, Ralph de Worcester took possession of Hayles, fortified a Castle and built a Church. Earthworks in the meadow now alone indicate the site of the Castle, but part of the original Norman Church still remains. In 1248 the Monks of the Abbey became possessed of the Church. In the 14th century they inserted decorated windows and a priest's doorway in the walls of the chancel and raised the roof with half-timber work. In

the 15th century they inserted a perpendicular east window and altered the Norman Chancel to its present form. There is a campanile for two bells at the west end and the remains of a sanctus bell-turret over the chancel arch.

"Until a few years ago the altar stood table-wise in the middle of the chancel, with seats for the communicants on every side of it; a Puritan arrangement similar to that which formerly existed at Leonard Stanley and Deerhurst."

From the Church the Members went to view the ruins of the Abbey, which have been so carefully studied by Mr St. Clair Baddeley[1] and Canon Bazeley and railed in by the owner, Mr Andrews, of Toddington.

Hayles Abbey was a Cistercian Abbey, and was founded by Richard Earl of Cornwall. It was dedicated on November 5th, 1251, in the presence of Henry III., Queen Eleanour, twelve Bishops, Barons, Knights and Esquires.

Richard had been driven on to the Scilly Isles by a gale in 1242, and, being saved, vowed that he would found an Abbey for Cistercians in his Manor of Hayles. He colonised it with twenty monks from Beaulieu, and his son, in 1270, presented it with its famous relic—some of the Blood of Christ. To house the relic suitably, the east wall of the church was taken down and a fine-sided apse with semi-octagonal chapels was thrown out beyond. In the midst was set up a magnificent jewelled shrine for the relic. This work was completed by 1277. Pilgrims flocked to the sacred relic, and the Abbey became very wealthy. Edward I. visited it in 1300, when his cousin Edmund, Earl of Cornwall, was buried here. Late in the 15th century the cloisters were rebuilt and the Chapter House re-floored with beautiful tiles. In 1539, however, came the Dissolution, and the Abbey and all its possessions were surrendered to Henry VIII.'s commissioners by Stephen Sagar, the last Abbot.

The Abbey at its prime was a large one, its precinct-wall including the entire present field, and perhaps the Parish Church as well, which latter may have been used as a Gate-House Chapel. The Gate-House probably stood just beyond the present one that gives access to the Abbey-field.

It appears that when the cloisters were re-built late in the 15th century, the west walk—three inner arches of which are still standing—was allocated to the lay brothers, and later to the Abbot for lodgings. After the Dissolution these portions were converted into the Mansion of the Hobys, Stratfords and Tracys. As their residence, until 1683, it was figured in Atkyns, and by Buckler and Lysons. In 1899 were found six heraldic bosses—bearing the arms of Huddleston, Percy, Evesham Abbey and Compton—dating from Henry VII.

The Abbots of Hayles had a summer residence on the hill-side at Coscombe, and to the last Abbot, Sagar (of Whalley), Coscombe House and a pension of £100 was granted by his friend, Thomas Cromwell, in 1539. Meantime, Church, chapter-house, dormitory, infirmary, warming-parlour and refectory (or frater) were used as a quarry; while the lead from their roofs was transferred to the Ordnance Department.

In the south walk of the cloister is still to be seen the (mended) 15th century lavatory, also the entrances to the Refectory, warming-parlour, and stairs of dormitory (south-east corner). The fine refectory door of 1246 was ill-treated in the 16th century, and shows degenerate insertions. From the lavatory the monks went to the refectory, and from the latter—after the mid-day meal—to the "Capitulum," or chapter-house, where business transactions and the regulations of the Monastery were daily recited in the presence of the Abbot and Prior, and disciplines for misconduct were pronounced and administered.

The excellent little Museum was visited, after which Mr Carles thanked Mr Baddeley on behalf of the Club for the very fascinating manner in which he had described the Church and Abbey and pictured to them monastic life in this part of Gloucestershire.

1 "A Cotteswold Shrine" (1908). J. Bellows, Gloucester.

EXCURSION TO TETBURY WATERWORKS.

SATURDAY, SEPTEMBER 25th, 1915.

Director : L. RICHARDSON.

(*Report by* L. RICHARDSON.)

In view of the interest attaching to the deep boring that is in progress at the Tetbury Waterworks, a special excursion of the Club was organised on September 25th. Some of the Members journeyed to Tetbury by train, others motored there, and all met at the site of the boring (fig. 1).

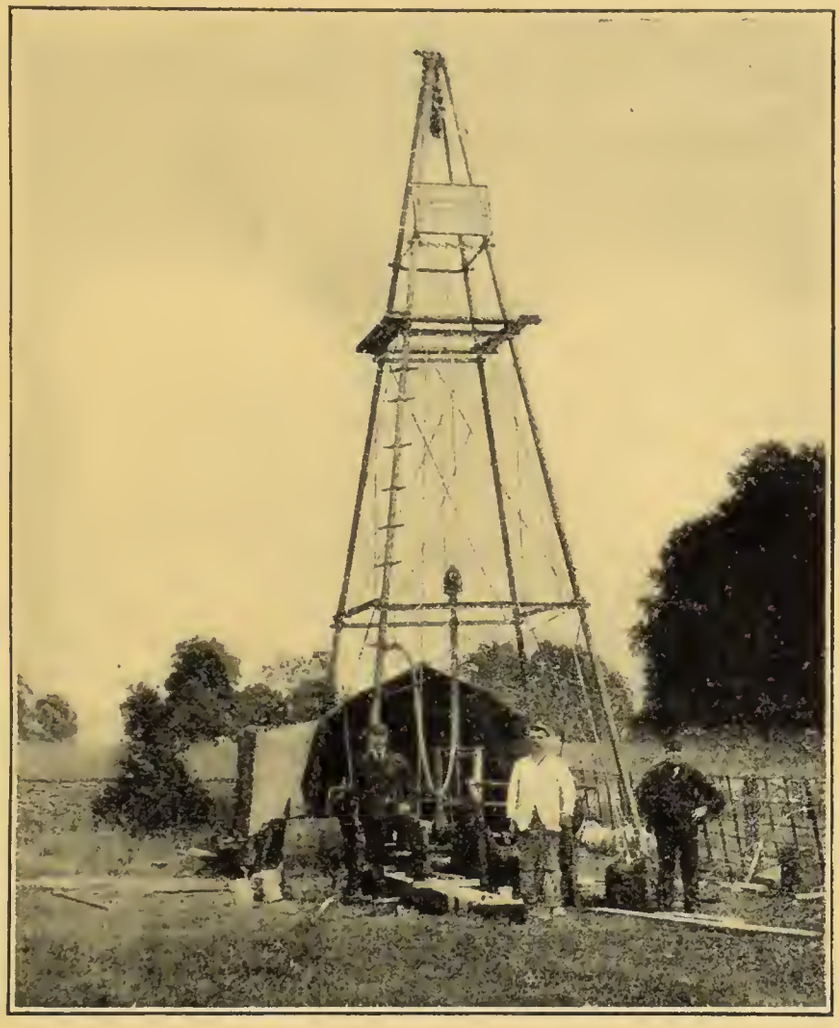

Photo by N. Baker.

Fig. 1.—Derrick and Rotary-Drill Outfit at the Tetbury Waterworks Boring.

Mr Richardson—who acted as Director—said that for a long time Tetbury had required an additional supply of water. At first it was contemplated sinking a well in the valley immediately to the south of the road between the Church of England Schools, Tetbury, and Charlton, but it was thought that the water so obtained might be liable to pollution. A site to the north was suggested, and, after careful consideration, a place in the bottom of the valley at Veizey's Quarry was decided upon. As he would explain to them later in the afternoon—when they visited the locality in question—a well was sunk, but an insufficient supply of water was found. Therefore it had been decided

to sink an 18-inch bore-hole close to the existing waterworks. It was purposed boring into the Upper Lias. At the time of the visit the bore-hole was 150 feet deep, having passed through the Forest Marble and Great Oolite, and penetrated 25 feet into the "Passage Beds." Mr Richardson said that in the Kemble bore-hole,[1] between the yellowish portions of the Great Oolite and the Inferior Oolite, were beds 121 feet thick characterised by a prevalent grey tint. The upper 48 feet he had denominated "Passage Beds": the lower 73 feet included typical Fullers' Earth. At the present time the bore-hole at Tetbury was about half way through these "Passage Beds." A massive core of very hard, light-grey stone between 146 feet 6 inches and 153 feet down attracted particular attention. It was inquired if it were on the horizon of the Fullers' Earth Rock of Somerset. Mr Richardson said he did not think so. He was of opinion that these "Passage Beds"—of which the massive bed was a portion—passed horizontally into the Stonesfield-Slate series of the Cotteswold country to the north. The Fullers' Earth Rock was characterised by an abundance of specimens of *Ornithella ornithocephala*, and the furthest point north at which he had noticed typical Fullers' Earth Rock so characterised was at the head of the little combe east of Dyrham Wood and distant about a mile from Dyrham in a southerly direction.[2] The core was carefully examined, and a 9-inch bed of "Dagham Stone," with its cavities filled with yellow ochreous material, was pointed out in the Great Oolite at 101 feet 3 inches down. Attention was also drawn to the fact that there were numerous thin, more or less vertical, fissures in the Great Oolite limestone, filled with crystalline carbonate of lime (calcite).

At the existing Waterworks is a brick-lined circular well, 9 feet 10 inches deep and 6 feet 9 inches in diameter, from the bottom of which is a 7-inch bore-hole 290 feet 2 inches deep. The top of the Inferior Oolite was reached at 252 feet down, so that this bore-hole leaves off 48 feet down in the Inferior Oolite.[3] On March 23rd, 1912, the water-level stood at 99 feet below the level of the engine-room floor, which is 447 feet above ordnance-datum.

From the Waterworks the Members went to Veizey's Quarry, which was opened to obtain stone for building Westonbirt House. On their way there they saw, cropping out in the lane joining the Tetbury Upton and Chavenage roads, a bed with a pitted surface, very similar to one between 51 feet 6 inches and 53 feet down in the bore-hole. Here Mr Richardson made some remarks on the stone known as "Dagham Stone." He said that two beds of Dagham Stone, separated by two to four feet of limestone, are seen in the Aldgrove Cutting on the M. and S.W.J. Rly. to the south of Foss Cross Station.[4] This stone is found over a large area in the Tetbury-Cirencester district. It has been considerably used for rustic rock or rockeries, and derives its name from Dagham or Daglingworth Downs to the north of Cirencester, where it forms the substratum of a large extent of (formerly) down-land. Several suggestions have been made as to the origin of the irregular holes in the stone. Thus Lycett attributed them "to the forcible escape of gases from beneath while the stratum was of a soft or pasty consistence";[5] Prof. Allen Harker to the action of humic acid;[6] Edwin Witchell to calcareous matter being deposited "round soft substances which have been dissolved or otherwise removed, and through the labours of boring animals when the surface of the limestone was the floor of the sea";[7] and the late H. B. Woodward to the calcareous mud

1 Proc. Cotteswold Nat. F.C., vol. xviii., pt. 2 (1913), pp. 185-189.
2 *Id.*, vol. xvii., pt. 1 (1910), p. 78.
3 The well at the Tetbury Brewery, formerly Cooks, but purchased by the Stroud Brewery Co. Ltd., in 1913, is 90 feet deep, 6 feet in diameter, in rock all the way down, and "stained" for the first 12 feet. From the bottom of the well is a bore-hole 200 feet deep and 6 inches in diameter. During a test in 1914, 85,000 gallons per 24 hours were pumped continuously for three days. The water entered the well mainly through one noticeable fissure at the bottom. The Brewery is situated on the Forest Marble, the clays of which hold up the water in the Brewery pond.
4 Proc. Geol. Assoc., vol. xxii. (1911), p. 107.
5 Quart. Journ. Geol. Soc., vol. iv., p. 185.
6 Proc. Cotteswold Nat. F.C., vol. ix., p. 316.
7 "Geology of Stroud," p. 78.

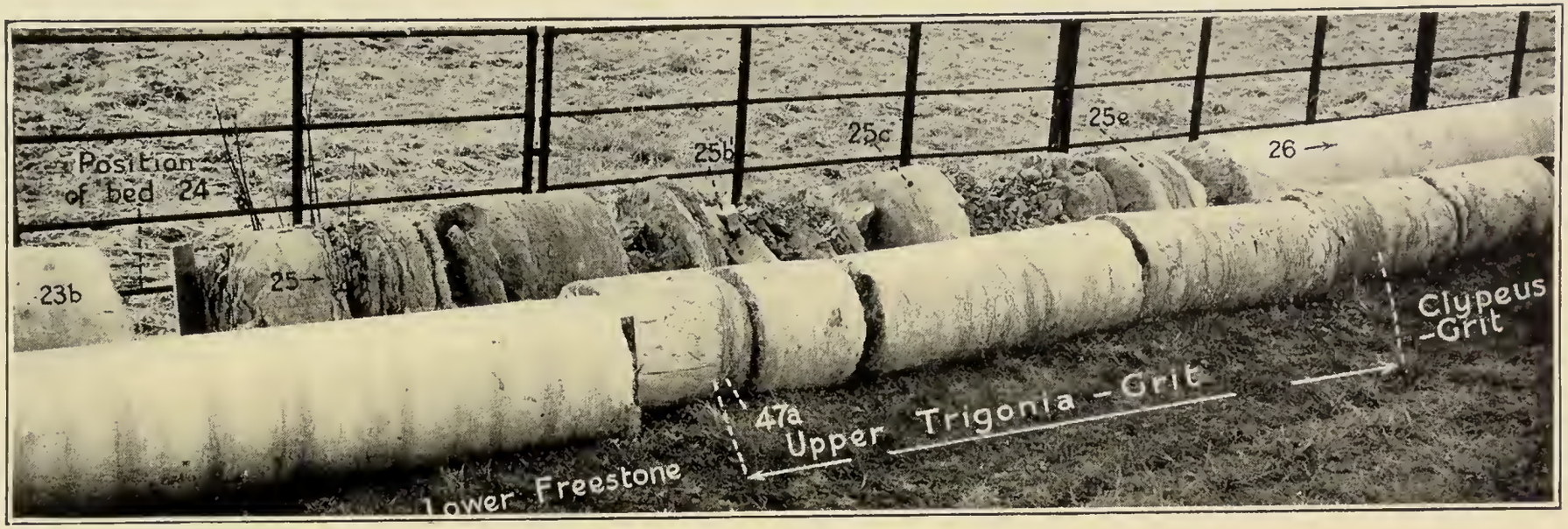

Photo. J. Henry Thomas.

Fig. 1.—Portions of the core (1) from bed 23*b* to 26 of the "Passage Beds"; and (2) the Clypeus-Grit, Upper Trigonia-Grit and upper portion of the Lower Freestone subdivisions of the Inferior Oolite Series.

Photo. J. Henry Thomas.

Fig. 2.—The core from bed 26 of the "Passage Beds" to the *Clypeus*-Grit of the Inferior Oolite.
The Fullers' Earth proper comprises beds 29 to 43 (incl.)

being "penetrated by burrowing organisms, which have left no other traces of their former presence in the now indurated deposit, than the irregular lines of weakness caused by their burrows. These have been subsequently acted upon both superficially and underground, by acidulated waters."[1] Mr Richardson did not consider that any of these suggestions satisfactorily explained the phenomena. He did not think the irregular cavities were formed by boring organisms. As they had seen in the piece of the bed drawn from deep down in the Tetbury bore-hole, the rock was similar to the pieces found at or near the surface with the exception that the cavities were filled with the yellow ochreous material, and had not been enlarged nor their sides worn by percolating waters. He was inclined to attribute the nature of the stone to its formation under certain special conditions which required further consideration.

From the causeway leading into Veizey's Quarry the "dry" valley and site of the well sunk in search of water were pointed out. Mr Richardson said that when the Club visited the spot last year he had told them of the Rev. E. C. Spicer's views with respect to the origin of "dry" valleys in the Glyme Area of Oxfordshire.[2] Spicer suggested that the dry valleys in that area were due to "solution"—to underground waters gradually dissolving the superincumbent limestone. As the limestone in the neighbourhood of the subterranean waters was slowly dissolved, settlement of superincumbent rock would gradually take place, and eventually the once subterranean stream would appear growing headwards. He found that the water was very hard, and that carbonate of lime had been deposited abundantly from it round roots, and, after flooding, upon the herbage.

Applying this theory here, Mr Richardson said they might have expected an underground stream, and that as the valley was excavated some depth in the Great Oolite, the Fullers' Earth would be reached by a well less deep than one sunk on the neighbouring higher ground, whereas—at the bore-hole—the Forest Marble and the whole of the Great Oolite had to be penetrated before the Fullers' Earth was reached.

A well was accordingly sunk near the causeway and the black shale, grey, and often indurated marls and impure limestones of the "Passage Beds," such as commence at 133 feet down in the bore-hole were reached at 56 feet below ground-level (369 feet above ordnance-datum). The details of the beds passed through by this well are as follows:—

WELL SUNK AT VEIZEY'S QUARRY IN 1915.

Ground-level: 369 feet above ordnance-datum.

			Thickness in ft.	ins.
Soil		Reddish clayey soil, with numerous fragments of Forest Marble and Great-Oolite limestone: about	8	0
Great Oolite	lower part of 22[4]	Limestone, yellowish, oolitic. Very little water comes out of the rock, the most from a horizon about 16 feet above the base ..	47	0[3]
"Passage Beds."	and 23 of the "P.-Beds"	Limestone, hard, bluish-grey, with conspicuous (and in places irregularly-scattered) oolite-granules	1	0
	24, 25	Marls, grey, indurated, slightly sandy in places; *Pseudomonotis echinata* (Sow.) ..	14	0
	Top of 26	Limestone, hard, grey, very fine-grained, slightly sandy: occasional crinoid-ossicles: seen	2	0

1 "Jurassic Rocks of Britain," vol. iv.—"Lower Oolitic Rocks of Britain," 1894, pp. 286-287.
2 Quart. Journ. Geol. Soc., vol. lxiv (1908), pp. 335-344.
3 Of this amount, the lowest 7 feet belongs to the "Passage Beds."
4 These numbers connect the beds with their equivalents in the Tetbury Bore-hole.

A very disappointing quantity of water was found, so disappointing that the site was abandoned.[1] But what was most interesting in connection with the "solution" theory of the origin of dry valleys was that here at all events the sequence was perfectly normal: the bottom-beds of limestone above the impervious beds were present and not dissolved away. For the first 8 feet the shaft passed through reddish clayey soil with subangular fragments of limestone from the Forest Marble and Great Oolite. Mr Richardson held that in this case the "solution" was the most active near the surface, and reminded them of the thin vertical fissures filled with crystalline carbonate of lime as seen in the core of Great-Oolite limestones from the bore-hole—more especially in the beds between 62 feet and 101 feet 3 inches down, which suggested the introducing of the carbonate of lime from percolating waters mainly descending from above. Mr J. M. Collett, F.C.S., pointed out that the considerable amount of stalactitic matter on the faces of the joints, etc., near the top of the quarry, and, in one place (south-eastern side) the fluffy white carbonate of lime on the surfaces of the rocks supported the opinion that solution of the limestone was proceeding more rapidly near the surface than deeper down; while a little lower down the quarry face (and therefore valley side) to the right, the rock was much more broken up, and the pieces (most of which—to some depth—were sub-angular owing to the action of percolating waters from the surface) well separated by cavities.

To sum up, Mr Richardson considered that the line of this valley was established when the Forest-Marble beds were continuous over the district, that as the stream lowered its valley the more pervious beds of the Great Oolite were laid bare, that the dissolution of the Great-Oolite beds nearest the surface then proceeded actively, and that the even downward grade of the valley had been effected in the wet seasons by means of the streamlet of the occasional presence of which they had evidence in the culvert under the road and the gutter down the field. The 8 feet of reddish loam he regarded as being made up of in part residual earth, in part sediment brought down by the streamlet and mainly derived from the clay-beds of the Forest Marble, and in part aggraded matter from the sides of the valley. In answer to a question as to whether it was likely that the excavation of any of the valleys could be attributed to work during the Glacial Period, Mr Richardson said that he expected the process known as "nivation" had assisted in lowering hollows, and, of course, the action of the waters from the melting snows in closing Glacial times must have had their effect.

The Rev. H. H. Winwood thanked the Secretary on his own behalf, and on that of those present, for a very instructive afternoon.

1 A well at the house close by called "The Folly" is 80 feet deep.

ON THE CONTROL OF RIVER CHANNELS.

By T. S. ELLIS

A great geographer has said that "When man attempts to meddle with Nature he can only succeed in permanently modifying her aspects by studying the constant laws of her phenomena and by making his work conform to them."[1] Rivers, and the laws which govern them in their course, would seem to be a fitting subject for discussion by a Naturalists' Field Club, and not the less so if taken in relation to the control of their channels. In doing this we shall be acting in accordance with the expression of Professor Lapworth that "The Economic Geology, as such, is as much the province of the Geologist, and demands as respectful a treatment, as the stratigraphical details of a country." He quotes the advice of Sir Michael Foster that no branch of Science should be neglected "though it be conspicuously, and even glaringly, useful."[2] I hope, too, that no apology will be needed if suggestions be offered to those whose province it is to "meddle" with the aspects of Nature and whose endeavours to "roll obedient rivers through the land" are not always successful.

My own interest in the Natural History of Rivers has been stimulated as I have felt, more and more, the importance of the subject from the utilitarian point of view.[3] I have always somewhat realized this: thirty-three years ago I wrote that "the real cause (of river curves in alluvial plains) would seem to have a bearing on the formation of warths (a local name for new lands) and the maintenance of navigation channels."[4] Of these, which are identical with the low-water channels, I am going to speak. The purpose of my paper is to show that they can be controlled and fixed in the intended line. As to floods, I am not concerned with them, but only with that which

1 Reclus, "The Earth," p. 261.
2 Hist. Geol. Soc. (Woodward), p. 240 and Geol. Mag., 1899, p. 519.
3 "The idealistic motive becomes the realistic purpose."—Prof. Schuster, President's Address Brit. Assoc. Manchester, 1915.
4 Formation of Severn Valley. Gloucester, 1882.

I regard as the first thing to be done in regulating the course of rivers, the fixing of the low-water channels. This being done, the river may still overflow and inundate the district, but, as the flood subsides, it will again restrict itself to the proper channel.

I may not now discuss at length the development of rivers. Enough to say, first, that I cannot concur in accepting the generally-accepted theory of "primary consequent, of subsequent and of obsequent streams," and, secondly, that to me a river system, a principal stream having tributaries flowing in on either side, is the outcome of a process of evolution. It has been evolved out of a network of channels. In this, water, at any point, would have alternative routes of possible flow. These routes may, for a time, be equally free; but one or other of the streams will, sooner or later, cut down its channel more deeply then any other, and this one will be adopted, although its course may not be the most direct, and even although it be so circuitous as to require the stream to go back upon itself and reverse its course. The disused routes, no longer cut down by water flowing through them, may be effaced or may remain as valleys, drained in opposite directions, with a stream at each end. These valleys serve as passes between river systems: they have often been utilized for roads, canals and railways.

Rivers generally have a winding course. "In serpent error rivers flow;" and, sometimes they seem to be capricious in their ways. I, however, hold firmly to the faith that rivers are always under the influence of the constant laws which govern the flow of water. Foremost among these is one that, when flowing to a relatively lower level, it always has a tendency to flow in a straight line, in accordance with the force of gravity. Rivers have no "natural tendency to wander": the direction of the flow, at every part of a winding course, is a resultant between the effect of diverting influences and the tendency to flow in a straight line. A river may be diverted by a change in the slope of the land, when the force of gravity will operate in a new line: it may be pushed aside by an obstruction, or it may be drawn aside by the attracting influence of another stream. This last cause is not generally

recognised, but I may call attention to the fact that if two streams flow down a smooth surface, as of glass, gently and evenly inclined longitudinally but perfectly level from side to side, they will flow in parallel lines, in accordance with the force of gravity. If, however, one of the two streams be diverted so as to touch the other, there will be a momentary hesitation before the two coalesce : the surface-tension must be overcome ; but when they have coalesced they will flow on together. The cohesion of the water is such that they will not separate although the force of gravity is in operation just as before. The diverted stream flows on in the line of the one which it has joined. So, too, if the main stream of a river come in contact with a smaller one or tributary as, at flood time, it will do, the larger stream may adopt the channel of the smaller one and the two flow on together, the channel of the larger one remaining only as a backwater. In fact, tributaries are often seen to be flowing into a river on the convexity of a curve while the remains of an old channel can be traced along the line of the arc of the curve.

If a river have been diverted from a straight line and the object be to compel it to return, and to remain in that line, continuous guiding or training walls are not necessary ; there is no need for treating the river as if it were a herd of cattle, from which one or more of them might at any point go astray. A number of fixed points which the river must pass will be sufficient. In Fig. 1 a series of low-water groynes are indicated, each of them coming to an imaginary line on either side of the river. How near together these must be will depend not only on the number and the character of the diverting influences, but, also, on the size of the river. One which required a large space in which to turn would, of course, be unable to deviate from its line unless the interval between the fixed points were wider than would be sufficient in the case of a smaller one. Thus fewer groynes would be needed.

If the object be to compel the river to follow a curved line, as shown in Fig. 2, similar groynes will suffice, the number corresponding to the number of curves. Here the river turns aside before it comes to any obstruction at all : it flows for a short distance in a direction transverse to the downward line.

It does not continue in this direction, but turns downwards, and, in doing so, it describes a wide curve as it passes the end of the groyne. But, according to the well-known law of Newton, a body moving in a straight line would continue in that line unless compelled by some external force to change it. The force of gravity tends to keep the river in the downward line and so to prevent deviation further than the groyne compels ; and this influence is very much promoted by the traction of the stream lower down the line. In passing round the end of the groyne, a curve is necessary : a river cannot flow smoothly along a series of straight lines joining each other at an angle. In order to have a flowing line there must be a curve, the extent of which is stated, on authority, to vary in proportion to the width of the river. This is not quite correct : a narrow stream may describe a broad curve, but a wide stream cannot describe a narrow one. Every river has its minimum of curve. Assuming this to be correctly shown as regards Fig. 2, the river is taking the shortest possible route round the end of the groyne.

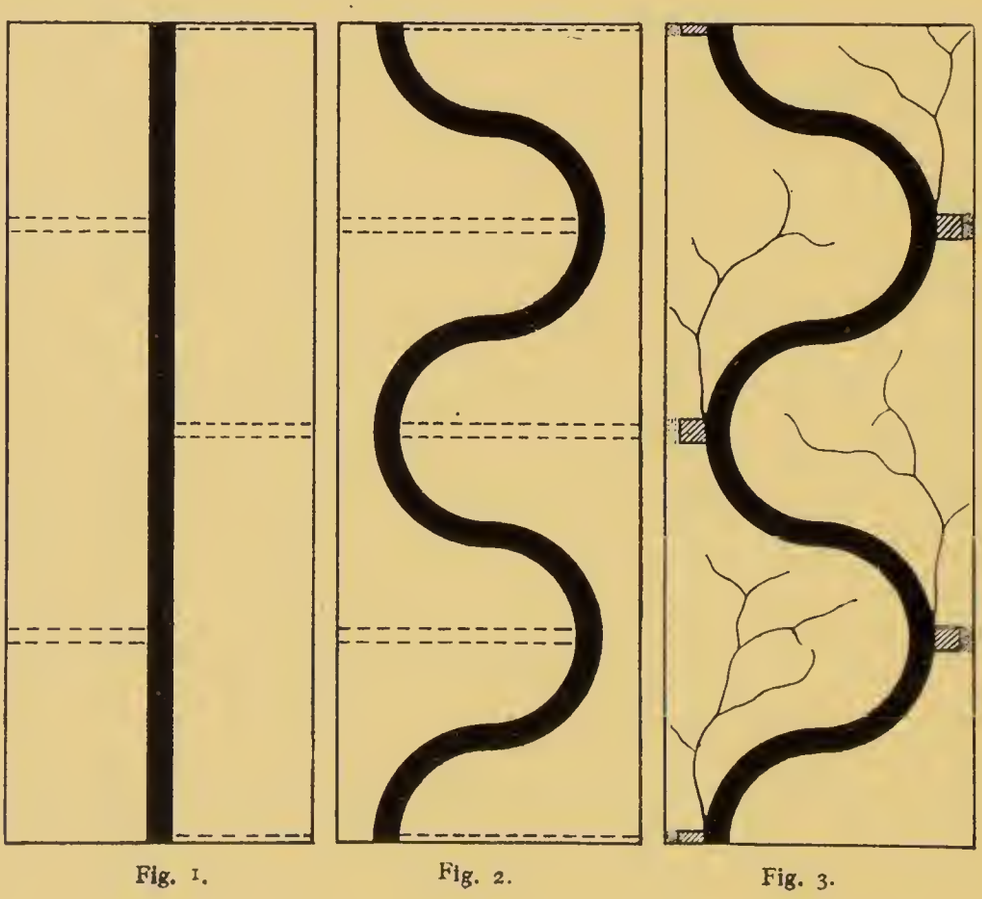

Fig. 1. Fig. 2. Fig. 3.

In Figs. 1 and 2 the river is shown as having been pushed into the desired line: in Fig. 3 it is shown as having been drawn into the same line of curve as that in Fig. 2. This is done by the influence of tributary streams, of which I have spoken as having an important diverting influence. They are a serious cause of trouble in the management of rivers; but, on the other hand, if by their agency, rivers are brought to points beyond which it is impossible to go, the cause of trouble may become an important advantage, because it is a means of forming those fixed points, which, as I contend, are all that is necessary in the fixing of the low-water channels. Piers at the points of junction, as shown in Fig. 3, may or may not be necessary, according to the character of the soil or other circumstances; and if the current in the river be such as to cut a channel across the curve, a short groyne to deflect the stream toward the intended line may be necessary. I am not suggesting that curves such as those shown in Figs. 2 and 3, would ever be constructed, unless it were for purposes of experiment or of ornament.

Here the question arises, which is the more useful, a river flowing in a straight line or one that has a winding course? I prefer the latter—a river that swings from one side to the other in wide curves, as shown in Fig. 4. This, as compared to a straight line, slightly increases the length of the stream, but it has important advantages. There is no need to have a back-water on both sides; the river bank is drained, as it always should be, in a direction away from the river, so as to keep the bank unbroken, excepting only at the fixed points where the tributaries join the river on the convexities of the curves. Here they fall in at a tangent with the river line, thus avoiding disturbance of the stream at the point of junction. There is no need to guide the lateral stream to a middle line, where fixed points would have to be constructed. Landing stages can be placed at the fixed points, so as to afford means of communication between the two sides of the river, with beacons on the land to indicate the line of the channel when the river area is covered with water. If the river be used for boating, the oblique lines are better adapted for tacking than a straight one. Finally, there is a reason which specially commends

itself to me ; it is strictly in accord with Nature. The suggestion that I should adopt it as a model was given me by the Thames at Marlow. It is very prettily illustrated, on a small scale, in the Teme, a few miles below Tenbury. Sometimes it is seen where one would least expect it ; in estuaries and even in the beds of large rivers where the channels form a network, braided rivers as the American writers call them, there is a suggestion of a swing from side to side. An instance of this is seen in the Indus.

Fig. 4.

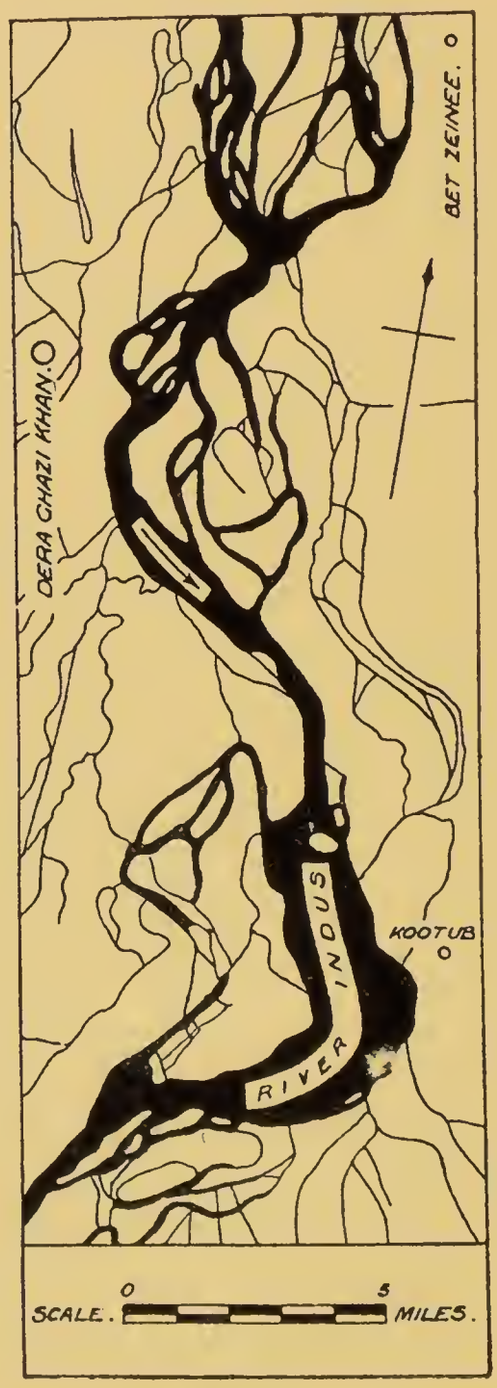

Fig. 5.

Fig. 5 shows the Indus by Dera Ghazi Kan—the swing from side to side indicates clearly the position where fixed points might be placed. The romantic story of this town I have told elsewhere.[1] It was founded four hundred years ago by Ghazi Khan, who afterwards dreamt that the Indus, then miles away, would ultimately destroy it. He therefore "laid his tomb" in the hills. In 1910 his dream was fulfilled: the town was destroyed by encroachments of the Indus, in spite of an expenditure of more than £100,000 in protective works.[2] Why did the river so persistently deviate in one direction? One is quite safe in predicting that where the tributary streams on one side are much larger or more numerous than they are on the other, the deviation will be greater on that side. The Sulaiman mountains are fifty miles distant from the right bank of the Indus and send down large quantities of water into it, while the river Chenab is only thirteen miles from the left bank and shares in the drainage of the intervening area. The numerous openings in the river banks for purposes of irrigation must weaken the banks very much; but this applies to both sides of the river. The protective works, so far as I can ascertain, were all of the nature of piling or of training walls and these either at right angles to, or parallel with, the river bank. Why they were not oblique in relation to it so as to deflect the stream towards the opposite bank, I do not know. The current, as appears, always found a way between the protective works and the land; this, I venture to say, ought not to occur. The river, at the point in question, has a low-water depth of eight or ten feet, so that a pier could easily be sunk into the bed of the river, carried up to the low-water level, or a little above it, and continued into the bank. This would prevent any undermining or lateral erosion at a low level. From this pier, and continuous with it, a groyne or firmly constructed path might be continued inland so far that the end would be outside the flood area. This would prevent any cutting vertically downwards from the surface. Nor would such cutting be likely, as the groyne or path being coincident with the surface of the ground, the flood water would

1 "Engineer," 15th Dec., 1911. Fig. 5 is used with permission of the Editor. For the drawing and for other assistance, I am indebted to Mr W. E. James, A.M.I.C.E.

2 E. S. Bellasis Punjaub Rivers and Works.

freely flow over it. This, I think, would make the bank perfectly safe for some distance and, if a similar structure were placed farther down the stream, the interval would be protected too. Supposing the river to have passed the first pier and that it must pass the second, I do not see how any important deviation between the two could occur. Inundation there might be, but no undermining. I am not concerned with the prevention of flooding ; that is a different matter. Protection for a low-water channel must be at the edge of the channel. Any means for limiting the extent of the flooding must be at the line of the intended limit of flood. I do not see how any one structure can fulfil the double purpose.

The fate of Dera Ghazi Khan is a striking comment on a statement attributed to Gibbon, that "The servitude of rivers is the noblest and most important victory which man has obtained over the licentiousness of Nature." Here is an instance of failure which, as I think, ought not to have occurred. The great bridge over the Ganges, recently built, is a magnificent success, but the Engineer, in his preliminary report, made this admission. "The difficulty lies not in the actual building of the bridge but in the training of the river so that it will not desert the bridge when built."[1] There is a very old book which contains an injunction to "force not the course of the river."[2] And, indeed, any attempt to force a great river to take a prescribed course, *in flood time,* may be expected to fail. But if the river be taken when in a gentler mood, the low-water stream may be led to the line intended for it. In this line it may be fixed : to this it will again restrict itself even though, in the "licentiousness" of flood, there have been an apparent desertion. The low-water channel will remain the deepest and the foundation, so to speak, although it have been for a time, entirely effaced. If I may offer advice, it will be to fix the low-water channels and guard against erosion by the stream at a level a little above that of low water ; this is the time when undermining is done.

I am fully conscious that the great rivers of India are very different from those in England, but I have a firm faith in

1 "Indian and Eastern Engineer," July, 1911. Mr Arthur Sisson kindly drew my attention to this and to other interesting work done on Indian rivers.

2 Ecclesiasticus IV., 26.

general principles, common to all. More than ten years ago, the late Mr Vernon Harcourt, with whom I had been in communication, kindly invited me to be present at the reading (before the Institution of Civil Engineers) of his paper on the Hooghly or to write some comments on a printer's proof of the paper. I felt sure that his charts had been prepared without regard to the influence of tributaries, and I boldly ventured to write my opinion, though I had no knowledge as to the fact, that tributaries flowed into the river opposite the James and Mary shoal (shown at the bottom of Fig. 7), although none appeared on his chart. This shoal is always regarded as exceedingly dangerous: Sir Frederick Treves speaks of it as "the most villainous of all shoals in this evil river." My reasoning on it was that shoals do not occur in a river unless the bed be too wide for the requirements of low water; nor would it be in mid-stream without some need for a channel on both sides. The one on the left bank is not in the line of the stream, nor in that of the tide; both would find a better flowing line on the western side, as affording a better curve round Hooghly Point. That the tide does sweep round in this line is shown by the tongue-like depressions left in the mud, *tongues of the early tide*, as I have called them. Nothing but tributaries would account for the eastern channel, and this view was strikingly supported by the fact that, in the dry season, the channel becomes shallow. In this season the tributaries are not in operation, so that in suggesting that they should be diverted and brought in lower down, by Hospital Point, I did but suggest that the channel should be closed by making it to be unnecessary; by perpetuating the conditions under which it does tend to close. The purport of my letter is reported in the Proceedings,[1] where the author of the paper remarks that "Mr Ellis had to assume the existence of tributaries which did not appear on the charts." I was justified in assuming this: an Admiralty chart,[2] published soon afterwards, confirmed my prediction. Figs. 6 and 7 are taken from it.

A careful examination of these charts will, I think, supply abundant evidence of the close association between the presence

1 Proc. Inst. Civil Engineers, vol. clx. (1904-5), Part ii., pp. 172, 202.
2 Hooghly, No. 136, A and B.

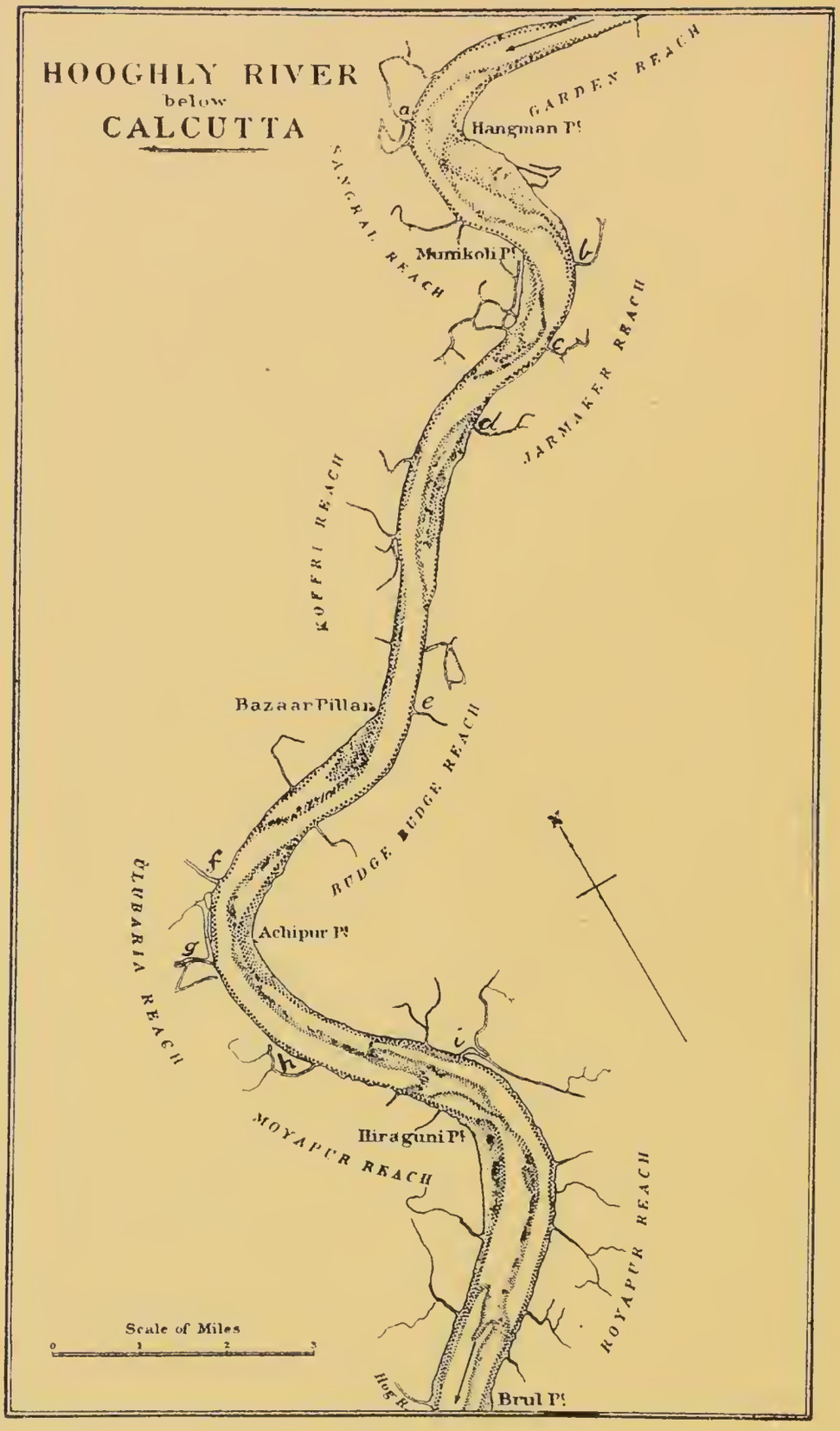

Fig. 6.

a. Sursuthee Khall
b. Murmekhalle K.
c. Meerpur K.
d. Goom Khall
e. Cherrial Khall
f. Canal from Rajapur Jhee
g. Bahirtuffa Khall
h. Champee K.
i. Royapur K.

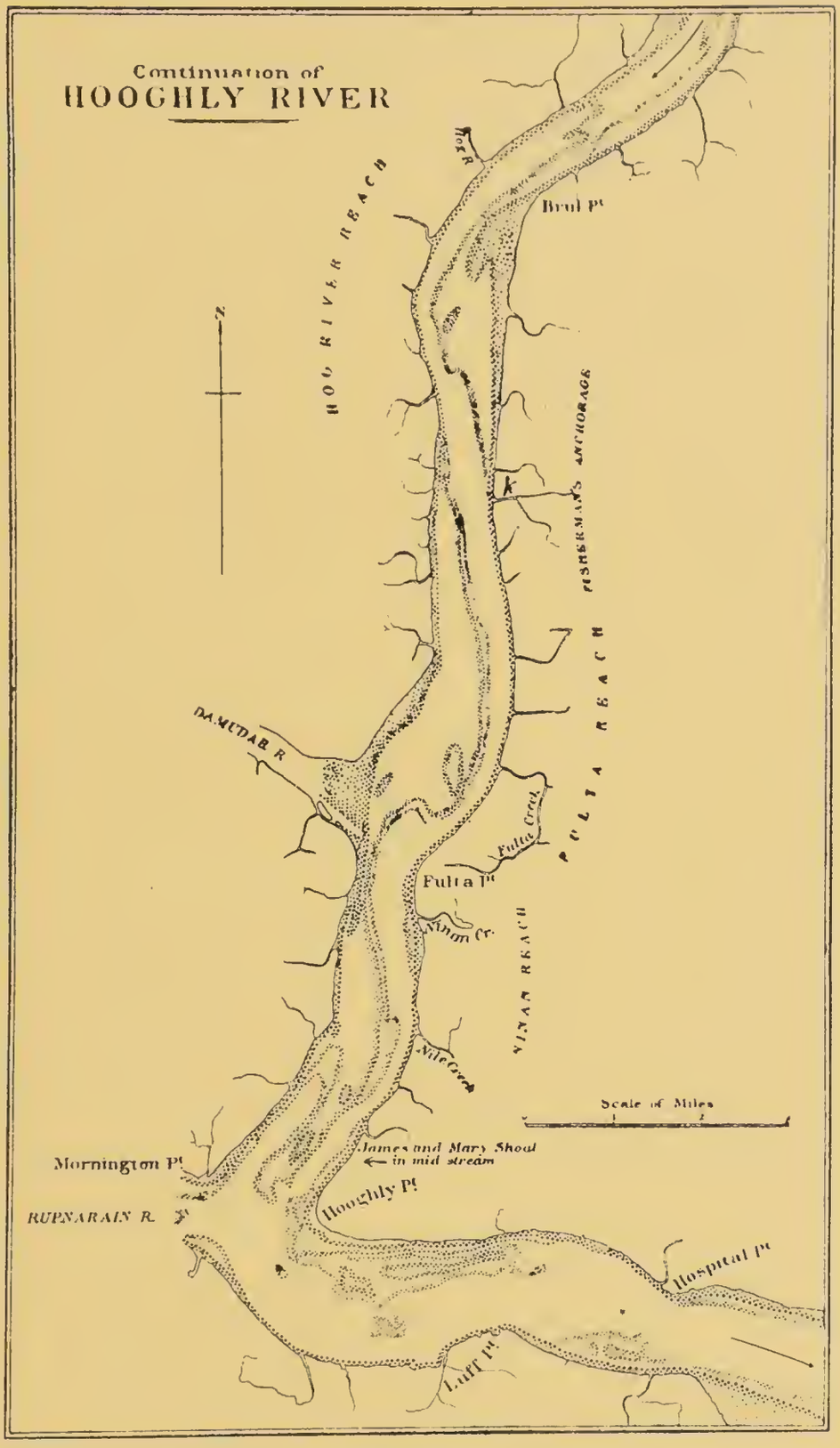

Fig. 7.

k. Chowgarra Khall

of tributaries and the course of the river. At the top of Fig. 6 is seen a straight reach of river with no tributary on either side, the Garden Reach. These are conditions essentially the same as those in the Severn at the Upper Parting, two miles from Gloucester. Just below the latter, there are tributary streams on both sides and an island, the Island of Alney, between them. This is an essentially similar feature to the James and Mary shoal. A little farther down there is a tributary on one side only, with the channel on that side, just as it is at Hangman Point, below Garden Reach. The two great causes of trouble in that part of the Hooghly shown on the charts (other than the James and Mary shoal) are the Moyapur and the Royapur Crossings. In these cases the shoals extend across the river ; no through-channel is shown on the charts. Here tributaries are seen on both sides in each case, and I feel sure that these troublesome " crossings " are due to the competition as to the side on which the channel shall be, with the resulting absence of a good one anywhere.

The conditions call for careful examination with the aid of the Admiralty chart, where numerous soundings are given. Opposite Achipur Point the channel is, as usual, on the convex side, and is manifestly kept there by three tributaries, marked f, g, and h, Fig. 6 ; the bank on the concave, or left side, being for a long distance, unbroken. The channel is continued downwards as far as some unnamed opening into the river and just a little farther, but the stream is not strong enough to keep all the channel on that side. Two streams, one of them marked i, call for a channel on the other side, up which the tide flows for a long distance, overlapping the ebb, or, as I prefer to call it, the stream channel, by f, g and h. Between the two is a longitudinal shoal, as shown on the chart, Fig. 6. This is the " crossing ; " it gives a depth of 14 feet at the upper end, 13 in the middle, and 14 at the lower end, whereas all down the line of the river the depth is always more, and generally much more, than 20, ranging up to 60 feet. The proper course would seem to be to adopt the stream channel as far as it is efficient and then to help in the necessary transfer to the other side by an oblique line of low-water groyne from a point just below the termination of the deep channel, directed

obliquely downwards so as to deflect the stream to the opposite side.

Along the Royapur Reach the general rule that the channel is on the convexity of the curve is again illustrated, and the tributaries for the most part come in on that side. The channel continues for a long distance until the influence of the tributary streams on the opposite side, including the Hog River, call for a channel there. Here again a low-water groyne directed obliquely across the shoal or " crossing " seems to be required, and to be all that is required.

I do not offer any opinion as to the material of which the groynes should be made. I assume that, starting from the bank and properly tied to it, one may be continued obliquely outwards into the river without fear that it would be undermined by the current and so caused to tilt over. Being only up to the level of low-water, the flood would readily flow over it. Given a free passage through these two " crossings," the resulting arrangement is that of a river swinging from side to side in elongated curve, receiving tributaries on its convexities at points where all back-water flow is also received. This is precisely in accord with the typical river shown in Fig. 4, which, as I think, is the ideal form and most of all others according with Nature's teaching.

In suggesting that if the tributaries opposite the James and Mary shoal were diverted, the shoal would cease to exist (of which I have no doubt), I did not mean to propose the diversion as the best remedy. There is no apparent reason why an oblique low-water groyne should not be extended from a point just below the Nile Creek obliquely downwards so as to deflect the stream into the western channel or gut, as it is called. Engineers will have no difficulty in deciding on the best remedy for the conditions existing in the Hooghly when Naturalists are agreed on a valid explanation of the cause. The facts as shown on the chart go very far, I think, to confirm the opinion which I formed more than thirty years ago, from which I have never varied, that tributary streams are the great cause of deviation in river channels.

So far as I am aware, there is no book in the world that supports my views. While I hold that a tributary stream,

by keeping open a channel on its own side which the river falls into and adopts for itself, tends to bring the river to that side ; authority, on the other hand, teaches that the effect of a tributary stream is to drive the river towards the opposite bank.[1] This was said by Mr Vernon Harcourt and other engineers to be the effect of the Damuda. I say that the main channel is against the left bank because of the influence of the Fulta Creek, the Ninan Creek and others. This much is certain : if the Damuda were bringing down much water there must be a channel by which it could pass on. The mouth of the Damuda is, on the chart, shown to be very much choked by a shoal—at two places it is four feet above low water. Between this and the eastern channel, there is a mile of shallow water nowhere more than four feet deep at low water, and in one place a shoal is three feet above it. I cannot believe that the deep channel close to the left bank has been caused by " the influence of the Damuda in pushing " it over from the other side. The low-water channels are made at low water, an elementary fact which is either unknown or ignored.

The line of the low-water channel of a river is determined by the stream : the early tide follows it as the line of least resistance, and may, to some extent, modify the line of it. If the two be not completely in accord there is the greater need for having fixed points. In Fig. 8 the estuary of the Exe shows the same tendency to swing from side to side as is seen in rivers. From Topsham on the left, the channel goes over to the right and meets the stream coming in by the canal, then it returns and receives the Clyst, afterwards going over to receive the Ken. Lower down there is the usual result of having tributary streams on both sides, shoals in the middle. The tide, however, shows a marked disposition to go straight up the line of the estuary ; Powderham Pool, a tongue of the early tide, with other similar features, shows this clearly. The importance of having gentle curves is, from this point of view, obvious.

The Chester Dee[2] gives another instance of an estuary where the channel shows a disposition to swing from side to side, a circumstance which, as I think, ought not to be

1 Marr, Scientific Study of Scenery, p. 137.
2 Ordnance Map, one inch scale, large sheet 43, price 1s 6d.

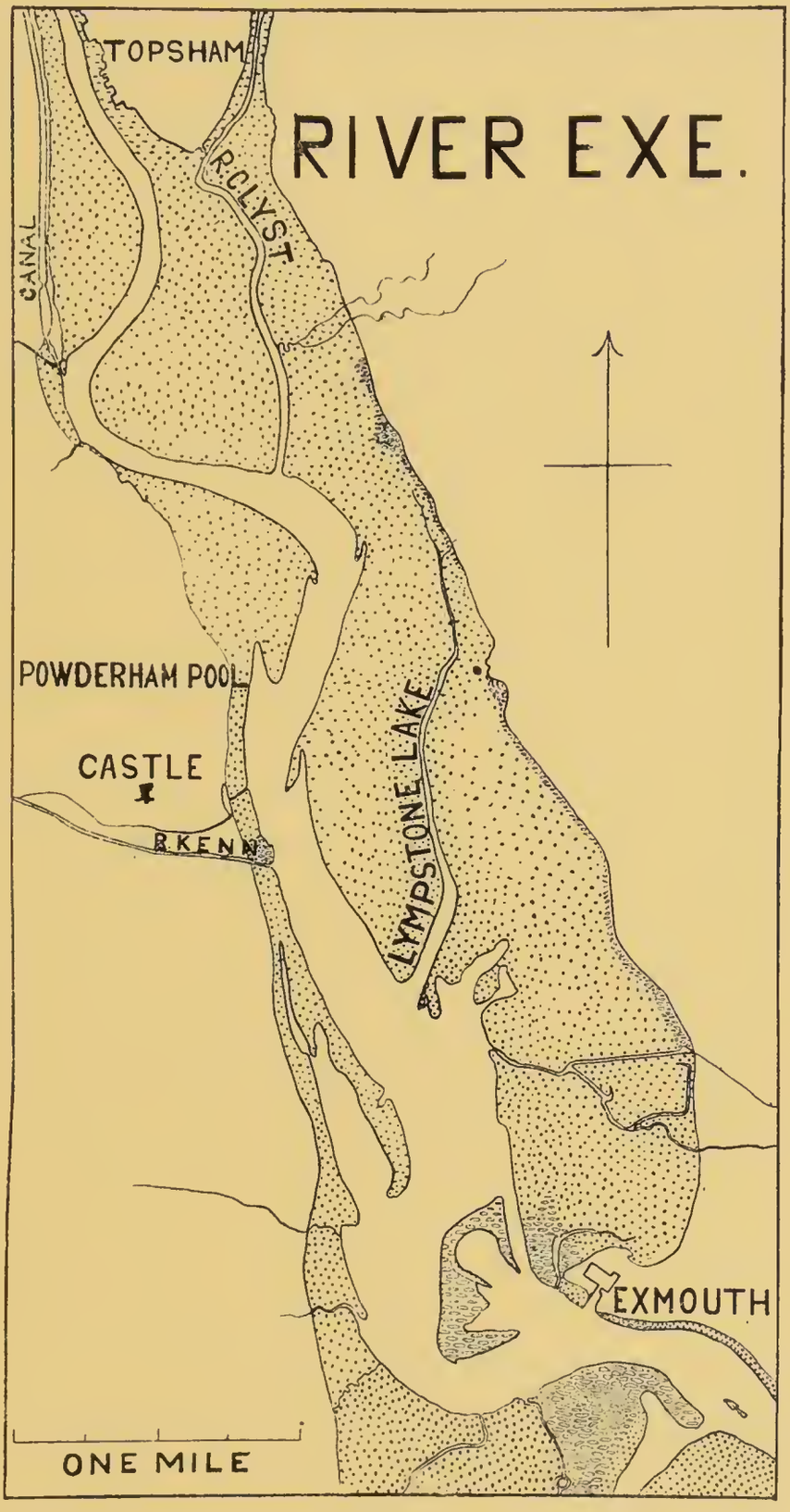
TOPSHAM
RIVER EXE.
R. CLYST
CANAL
POWDERHAM POOL
CASTLE
R. KENN
LYMPSTONE LAKE
EXMOUTH
ONE MILE

Fig. 8

disregarded in the improvement works proposed. The stream flows from the left bank at Connah's Quay obliquely across to Daw Pool, which is, presumably, a permanent feature; it then re-crosses to the left bank near Mostyn Deep. The proposal is to have a continuation of the present straight channel which now extends as far as Connah's Quay and to continue it onwards to Mostyn Deep. The construction and the maintenance of this would, of course, be very costly. If it were made there would still be need for a channel on the right side, were it only for the backwater on the Gayton sands. My suggestion is to adopt Nature's hint and to have the principal channel through Daw Pool. A low-water groyne from a point on the shore near Bagillt obliquely across towards Daw Pool, approximately parallel with the line of stream, as shown, would effectually prevent any through-passage of stream or tide on the left side of the estuary. The backwater which would flow on that side would include a little stream now flowing into the main one opposite Bagillt, and would correspond to the backwater of the right side of the estuary on the Gayton sands. The vanity of attempting to suddenly narrow the tidal area has a melancholy illustration in the Broken Wall, the line of which is seen crossing the estuary opposite Connah's Quay.

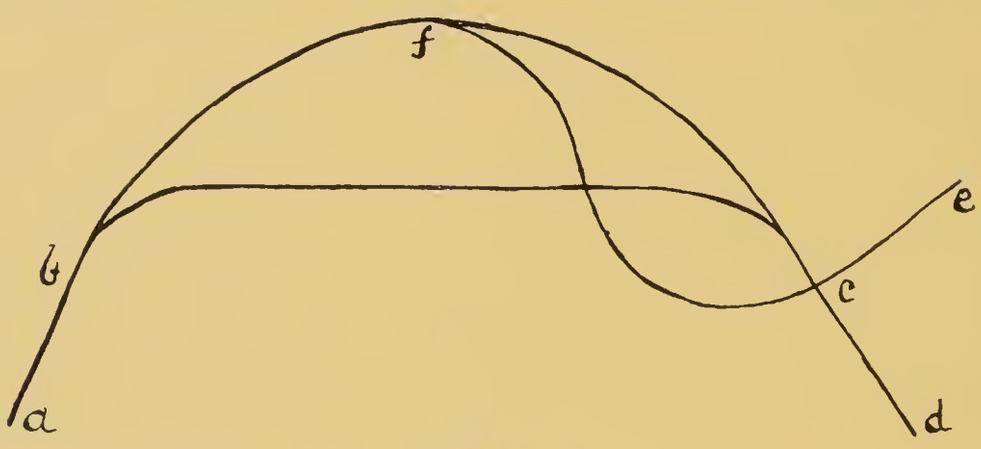

Fig. 9

The line of a river, at any point in its course, may have been decided by the line which it has taken higher up the stream, and, also, by the line which it will take lower down. This may be illustrated by a diagram, and the principle may, I think, be applied to the Humber. Fig. 9 represents a river having a settled course from a to b and from c to d, which has

been left to shape its own line between b and c. It is shown as having taken the shortest possible course from a to d, having regard to the minimum of curve. If, however, it were diverted from the line c d to that of c e, then the shortest course would be in a line farther south, as shown. Supposing that, for any reason, the river had described a great curve extending as far northward as f, there would still be a good flowing line from a to d, but the line from a to e, though the river might follow it, would require two extra curves. If the river were tidal and the tide came up the line from d to c, the course would be favourable for going on to f. But if the line of the tide were from e to c, it would tend to continue in a more southern direction towards b.

The *Yorkshire Post* of January 16th, 1911, contained a sketch map of the upper part of the Humber, with an account of some projected works which had been discussed at a meeting of the Conservators, as reported in the same paper on the 13th. I became interested in the question what were the natural conditions of a river which was supposed to require an expenditure of £132,000 for its regulation? The Humber is really an estuary common to the Ouse and to the Trent, which unite at Trent Falls. The part shown in Fig. 10 is divided into three sections.[1] The first, which is directed north-east, is expanded in the middle and encloses a large shoal, the Whitton Sands. The second is directed south-west in a single channel. The third branches from the line of the second, and is directed to the east; it encloses, with a continuation of the second section, an island, formerly a shoal—Read's Island. Thus is described a roughly-shaped figure-of-eight, bent in the middle and enclosing in the two loops the two shoals. Taken as a whole, there is an elongated double curve very similar to those shown in Fig. 5, and having, like them, tributaries flowing in on the convexities. Each section illustrates the law that when a river's bed is too wide for its requirements at low-water, a shoal will form. This may be on either bank, but if tributaries fall in on both sides in sufficient number or size to keep open a channel, the shoal will be in island form. Of the two alternative channels neither is

1 Ordnance Map, one inch scale, small sheet 80, price 1s.

likely to be quite satisfactory, or to be, permanently, the better of the two.

Both of the channels mentioned are necessary—each has to take the land drainage on its own side of the river. There is, however, no need that both should be through-channels. The question which of them may be closed at the upper end has been settled already. Although the southern channel gives the more direct route from Trent Falls to Brough, the requirements of the Weighton canal make the upper one necessary, so it must be kept open. The southern might be closed by a groyne, shown as No. 1, directed from a point a little above the sluice at Alkborough towards another point opposite the canal lock. This would perpetuate the direction of the stream against the north bank, for the protection of which the principal part of the proposed expenditure was intended. £90,000 was assigned to it. The stream is not at all likely to have caused much of the damage, but the tide, coming up in a long line from the south side of Read's Island, must impinge on this bank and would be likely to damage it. If, however, the southern channel were closed by a groyne, shown as No. 2, the change would correspond to that in the diagram (Fig. 9) made by diverting the line c d to c e. If this were done, I feel sure that the river would assume some such line as that shown in Fig. 10. I cannot suppose that the stream, having to flow in a line due east, would unnecessarily curve northwards opposite the Whitton sands. The stream decides the line of the river, and the tide follows it as the line of least resistance. I am conscious that the high tide could not be turned without a wall of enormous strength ; but let the early tide be directed, the tide which, being heavier than the fresh water, flows below the level of the surface, it will be sufficient for the time. The raising of the groyne may be left until the new channel is formed. Much good has been done by extending eastward the outlets of the Broomfleet and the Crabley drains. More than twelve years ago I wrote :— " Large sums of money have been spent in putting elements of strength into river banks. I suggest that it might be better spent in removing elements of weakness, by uniting affluent streams and bringing them, when united, into the river at fixed

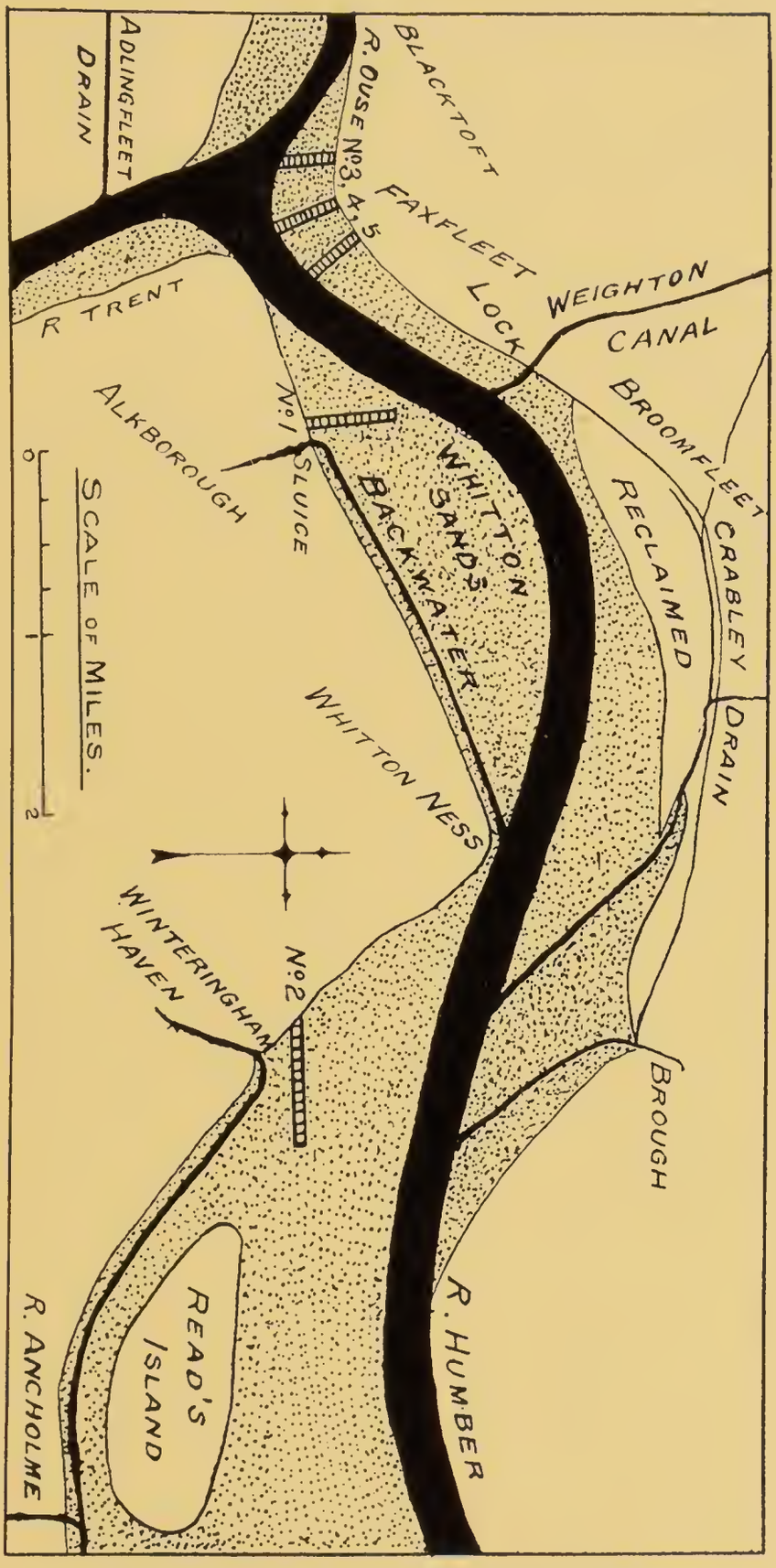

Fig. 10.—Suggested low-water line in River Humber

points, leaving between them a long unbroken front." If those drains which have been united were extended so as to come out with the one at Brough, there would be a grand illustration of "a long unbroken front" extending back for nearly four miles to the canal, a condition which would fix the line of the new channel because all diverting influences would have been removed. Then the area which could be spared for reclamation would be shown. The convenience of having the channel to touch the land on the north side opposite Read's Island on the south at Whitton Ness must be obvious. Whether it could also be made to touch at Alkborough, Adlingfleet and Blacktoft may be left an open question, but groynes to increase the curve round Faxfleet, as shown by No. 3, 4, and 5, seem to be desirable, in order that the Ouse may come into a line according with that of the Trent and of the channel directed towards the canal lock.

The control of river channels has an important relation to the means for preventing coast erosion. Mr Embrey,[1] always in sympathy with my work on rivers, has written an account of the satisfaction with which he saw an illustration of a point on which I had, as he knew, for many years insisted—that a stream at its outlet, whether it be a tributary falling into a river or a river falling into the sea, breaks the continuity of the bank, and, therefore, weakens it, thus increasing the tendency to break away, and so the liability to erosion. The river Blyth flows into the sea between Southwold and Dunwich. Both places and the intervening coast at Walberswick have been the scene of great destruction, but the authorities at Walberswick, with a view of improving the little harbour there and not for the purpose of preventing the erosion, extended the river outwards into the sea between two piers. Thus the river which formerly flowed into a bay now flows into the more open sea, at a *fixed point*, from the end of a promontory, and the erosion has been stayed. Many years ago Sir Charles Lyell[2] gave "an illustration of the effect of promontories in protecting a line of low shore," seen in Kincardineshire. Nature gives hints, the value of which is not recognized.

1 "Gloucester Journal," 9th July, 1910.
2 Principles of Geology, 12th ed., p. 512.

A DEEP BORING AT SHIPTON MOYNE, NEAR TETBURY, GLOUCESTERSHIRE.

BY

L. RICHARDSON, F.R.S.E., F.G.S.

(Read November 23rd, 1915.)

In 1914-15 a deep boring was made by the West Gloucestershire Water Company at Shipton Moyne, a village two miles due south of Tetbury. The precise site is three-quarters of a mile south-east by south of Shipton Moyne Church.

To be exact, a well was sunk to a depth of 47 feet 2 inches, then a percussion boring to 100 feet 6 inches, after which a rotary boring was made down to a depth of 286 feet 6 inches.

Samples of the rocks passed through by the well, and, as far as the method of boring permitted—by the percussion boring—were kept and labelled as to the depth from which they had been obtained by Messrs Thomas Tilley & Co.'s foreman ; but, in order to have as complete a core as possible, a bore-hole —called "No. 2 Bore-hole" on Messrs. H. Rofe & Son's plan—was put down forty feet away from the well and cores were drawn from 12 feet 6 inches (from the surface) down to 58 feet. Thus no cores were drawn from between 58 feet and 100 feet 6 inches—the latter the depth at which the rotary boring commenced at the bottom of the percussion boring.

As the site of the bore-hole is some thirteen miles from the nearest portion of the Cotteswold edge at Upper Kilcott, near Hawkesbury, is close to the main outcrop of the Cornbrash, and passed through

67 ft. 6 ins. of Forest Marble beds,
84 ft. 8 ins. of Great Oolite,
62 ft. 2 ins. of beds best described as "Passage Beds,"
and penetrated 72 ft. 2 ins. of Fullers' Earth,

it is obvious that the information obtained is of considerable use to those concerned with questions of water-supply in this part of the Cotteswolds and adjacent district to the east, and of great value to those interested in the Jurassic rocks.

The field in which the bore-hole is situated has for its sub-soil heavy clay.

DESCRIPTION OF THE ROCKS PASSED THROUGH BY THE BORE-HOLE AT SHIPTON MOYNE.

Top of Well—315 ft. above ordnance-datum.
Well.—47 ft. 2 ins. deep.
Percussion Boring—53 ft. 4 ins., and
Rotary Boring—186 ft. : *total depth*—286 ft. 6 ins.

			Thickness of rocks Ft.	Ins.	Depth Ft.	Ins.
Forest Marble	1.	Surface soil and sub-soil (heavy clay) ..	1	6	1	6
	2.	Greyish marly clay, with thin layers of very fine-grained sandy limestone covered with "tracks"	3	6	5	0
	3.	Greyish rocks with thin layers of greenish-grey clay	7	7	12	7
	4—15.	Limestones, some of typical (blue, shelly) Forest-Marble facies, frequently with "clay galls," others sandy, separated by layers of sandy marl and clay—the sandy matter predominating in the middle portion of the series	14	5	27	0
	16.	Limestone, hard, bluish, shelly—typical Forest Marble—but withont "clay galls"	3	6		
	17.	Sandy clay	0	8		
	18.	Limestone, similar to 16	3	4	34	6
	19.	Limestones, sandy, in very thin layers with fragments of wood	0	6	35	0
	20.	A variable series of deposits, including thin layers of greenish-grey marl and sandy matter alternating; bluish-grey limestones (like typical Forest Marble) and some sandy	5	3	40	3
	21.	Sandy clay	0	6	40	9
	22.	Hard, greenish-grey marl with sandy layers	3	9	44	6
	23—24.	Typical Forest Marble in two beds ..	2	6	47	0
	25.	Typical Forest Marble with occasional seams of greenish-grey clay	10	0	57	0
	26—32.	Grey shaly clay with occasional beds of sandy limestone, which are frequently covered with "tracks"	10	6	67	6
Great Oolite	33.	Light brown oolitic limestone with calcite in fissures	3	6		
	34.	"Yellow marl or clay"	1	0		
	35.	"Gritty rock"	2	0		
	36.	"Buff marl and hard gritty rock"	1	6		
	37.	"Very light-grey rock"	0	6		
	38.	"Cream-coloured and bluish-grey oolitic limestone, very hard to bore through"	1	0		
	39.	"Limestone"	1	2		
	40.	"Marl or clay"	0	6	78	8
	41.	GREAT OOLITE LIMESTONES. Yellowish oolitic limestones. (The foreman stated that the "Bath Stone" commenced at 78 ft. 8 ins. down; rotary boring at 100 ft. 6 ins.)	73	6	152	2

		Thickness of rocks Ft.	Ins.	Depth Ft.	Ins
"Passage Beds"	42. Light-grey limestone, "sparry," obscurely oolitic (spec. 42a).[1] The bottom foot or so is of a yet lighter grey tint with irregularly-distributed white oolite-granules (spec. 42b)	9	4	161	6
	43. Yellowish oolite	1	1	162	7
	44. Grey impure limestone (having films of blackish shale associated with it) and very sparsely oolitic (44)	5	11	168	6
	45. Dark-grey, sandy, shaly rock—the sandy matter and films of shale alternating irregularly (spec. 45)	2	6	171	0
	46. Dark marl, with occasional irregularly-developed limestone layers (spec. 46) in the top portion. The middle portion soon breaks up on exposure	5	3	176	3
	47. Marl, similar to 46	1	0	177	3
	48*a*. Rock and marl similar to the upper part of 46	6	0	183	3
	b. Dark, shaly, sandy marl (very similar to 45), with subordinate layers of impure limestone	5	3	188	6
	c. Very light-grey, fine-grained impure limestone, sandy to the touch (spec. 48*c*)	4	9	193	3
	49*a*. Very light-grey, fine-grained, impure limestone, sandy to the touch, with an occasional white oolite-granule, casts of lamellibranchs, and a *Rhynchonella* of the *R. concinna*-group (spec. 49*a*)	3	3	196	6
	b. Limestone, very similar, but more calcareous and therefore harder, with blackish, irregular and sporadically-distributed oolite granules; *Lima* sp. (spec. 49*b*)	4	6	201	0
	c. Marly rock	1	6	202	6
	d. Impure limestone	0	6	203	0
	50. Indurated marl	3	0	206	0
	51. Light-grey, *very coarsely oolitic*, rather softer limestone; *Entolium demissum* (Phil.)	6	0	212	0
	52. Limestone, very similar to 51, but softer and *pisolitic*	1	0	213	0
	53. Light-grey, fine-grained, slightly sandy limestone—*a conspicuous stratum* (spec. 53)	1	4	214	4
Fullers' Earth	54. Marl, black shaly, *without* fossils (spec. 54)	5	2	219	6
	55. Shelly limestone in irregular layers with intervening irregular layers of marl. Crowded with small specimens of *Ostrea acuminata* Sow., *Chlamys vagans* (J. de C. Sow), *Rhynchonella* of *R.-concinna*-group	13	2	232	8
	A hard conspicuous stratum practically composed of the valves of *Ostrea acuminata* Sow. embedded in a white matrix occurs at 224 ft. down (spec. 55).				
	56. Limestone, grey, less shelly than those beds in deposit 55	0	10	233	6

The specimens referred to in brackets have been placed in the Cheltenham Town Museum.

		Thickness of rocks Ft.	Ins.	Depth Ft.	Ins
56*b*.	Marl, shaly, greenish-grey, *relatively barren*; two sandy, ½-inch layers near the top, and *Ostrea acuminata* Sow. common in the lowest 4 inches	3	0	236	6
57.	Hard, blue, shelly limestone (similar to 59*b*), with irregular intervening layers of shaly marl; *Ostrea acuminata* Sow. common..	1	6	238	0
58.	Marl, shaly, dark in the upper portion, greenish-grey in the lower. More sandy and indurated at the top: relatively barren	10	0	248	0
59*a*.	Marl, dark at some horizons, greenish-grey and more marly at others, with occasional thin blue shelly limestones in the upper part and full of specimens of a small form of *Ostrea acuminata* Sow.; *Chlamys vagans* (J. de C. Sow.) (spec. from 248 ft. 3 ins. down)	3	5	251	5
	b. Hard, blue, shelly limestone	1	0	252	5
	c. Greenish-grey indurated marl full of shells	0	7	253	0
	d. Grey, shaly marl, *relatively barren*, only an occasional *Ostrea acuminata* Sow., *Rhynchonella* of *R.-concinna*-group	1	1	254	1
	e. Limestone, similar to *b*.	0	5	254	6
	f. Greenish-grey marl and clay, dark shaly marl, and greenish-grey indurated marl full of shell-fragments: *Ostrea acuminata* Sow. common in the soft portions	1	7	256	1
60.	Dark shaly marl, *relatively barren*, with an occasional fine-grained, grey, sandy layer	7	10	264	11
	Limestone, grey, with numerous small crinoid-ossicles	0	1	265	0
Fullers' Earth	Fullers' Earth—Greyish marl, weathering into small shaly pieces of very uniform texture, devoid of hard layers and unfossiliferous; penetrated	21	6	286	6

Forest Marble.—From the above record it will be observed that 67 feet 6 inches of rocks were penetrated before what is called the "Great Oolite" was reached. No cores were drawn from between 58 feet and 100 feet 6 inches down, and the information given is that which was supplied to me by the foreman. It may be that these beds correspond to those lettered D, E, and F by Prof. S. H. Reynolds and Dr. A. Vaughan in their account of the rocks displayed to the east of the tunnel at Acton Turville,[1] and designated by them the "Upper Great Oolite." For this reason I have associated them with the Great Oolite in the present paper. According

1 Quart. Journ. Geol. Soc., vol. lviii. (1902), p. 746.

to the foreman the unmistakable yellowish Great Oolite limestones commenced at 78 feet 8 inches down.

In the country in which are situated Great Sherston, Tetbury, Kemble, and Cirencester, the Forest Marble beds have a wide extent.

In the railway-cutting on the South-Wales Direct Line to the south of the village of Norton, some three and a half miles in a south-south-easterly direction from the Shipton Moyne bore-hole, Messrs. Reynolds and Vaughan found the Forest Marble beds to be from 80 to 87 feet thick, and to consist of :—[1]

			Thickness in feet	*Depth at which the corresponding beds occur at Shipton Moyne*
Cornbrash.				
Forest Marble	8.	Shale	20	0—12′ 7″
	7.	Hard, compact, sandy limestone, with doggers, alternating with irregular bands of loose sand, the sand predominating in the middle of the series	15	12′ 7″—27′
	6.	Shelly limestone	5	27′ to
	5.	Compact, oolitic, shelly limestone, very variable	1 to 6	34′ 6″
	4.	Shale	25	
	3.	Hard, very shelly band (typical Forest Marble)	3	34′ 6″ to 57′
	2.	Shale	10	57′—66′
	1.	Limestone, sometimes sandy, sometimes oolitic	1 to 3	66′—67′ 6″

From what these authors saw of the Forest Marble beds in the cuttings between a few yards of the eastern end of the Badminton Tunnel and Bradfield Farm to the south-east of the village of Norton, they were enabled to state :—

> "The Forest Marble maintains throughout its typical character, as beds of variable shale, alternating with compact, shelly, oolitic limestone, or hard sandy limestone with doggers. It shows great lateral variability, the limestone-bands being all lenticular deposits, not traceable for any great distance."

The Shipton Moyne bore-hole is situated three-tenths of a mile away from the outcrop of the Cornbrash. As 67 feet 6 inches of Forest Marble beds were proved, and as it is unlikely that more than 12 to 20 feet of beds occur between the highest deposit seen there and the base of the Cornbrash, it would appear that the Forest Marble beds are of about the same thickness as they are in the railway-cutting to the south of Norton.

1 Quart. Journ. Geol. Soc. vol. viii. (1902) pp. 747-749

The lithic characters of the beds proved in the bore-hole, and of those seen in the railway-cutting also appear to be very similar. Cores from a single bore-hole obviously do not afford any information with regard to the lateral variability of the beds, and my task of describing the rocks is rendered the more difficult from the facts that the softer sandy layers did not yield a core—only loose sand, and that I have only the foreman's account available as to the nature of these softer deposits.

Alongside the reproduction (page 53) of Messrs. Reynolds and Vaughan's general account of the Forest Marble beds on the line of railway, I have indicated the depths between which occur in the bore-hole the deposits *probably* on the same horizons as those groups noted by them.

The ground all around Shipton Moyne is very heavy, and there is no doubt that the beds proved down to a depth of 12 feet 7 inches belong to the lower portion of their group 8—"Shale."

The beds between 12 feet 7 inches and 27 feet no doubt correspond to their group 7. A fair-sized heap was made of the sand drawn for the most part when the boring was going through these beds. It is doubtless these beds which, when at the surface, weather to an incoherent sand-deposit with doggers and flat pieces of sandstone, many of which are fissile and have yielded "tilestone."[1]

Large brownish "clay galls" are of frequent occurrence in the hard layers in the beds between the surface and 27 feet down.

Some of the limestones in the series between 34 feet 7 inches and 57 feet are fissile.

Great Oolite.—As no cores were drawn between 58 feet and 100 feet 6 inches, I have no information to add to that given me by the foreman and recorded on page 50. The beds between 67 feet 6 inches and 100 feet 6 inches—33 feet thick—occupy the stratigraphical position of Reynolds and Vaughan's groups F, E, and D, which are about 35 feet thick.

Rotary boring commenced at 100 feet 6 inches, and nice compact cores of the familiar yellowish Great Oolite limestone were drawn from down to a depth of 152 feet 2 inches.

1 Proc. Cotteswold Nat. F.C., vol. xviii. pt 3 (1914), p. 209.

"PASSAGE BEDS."—At 152 feet 2 inches the yellowish oolitic limestones ended, and the grey and dark-grey—sometimes almost blackish—rocks commenced.

At 265 feet, Fullers' Earth—*without* any hard layers—was encountered and penetrated to a depth of 21 feet 6 inches.

Between these two horizons is a very variable series of deposits 92 feet 10 inches thick.

In the series from 152 feet 2 inches to 214 feet 4 inches—a thickness of 62 feet 2 inches—limestones (often hard and sandy) predominate over the clays: in that from 214 feet 4 inches to 265 feet, clays, shales, and marls (with an abundance of specimens of *Ostrea acuminata* Sow.) predominate over the limestones, which are usually comparatively thin, blue and shaly—the abundant fossil being again *Ostrea acuminata* Sow.

The beds from 152 feet 2 inches to 214 feet 4 inches may be designated "Passage Beds," and are thicker by 14 feet 2 inches than the similarly-designated beds at Kemble, and by 17 feet 2 inches than those proved in the Badminton Tunnel.

It is interesting to note that the rock between 105 feet 6 inches and 106 feet down at Kemble (between 2 feet and 2 feet 6 inches of the base of the "Passage Beds" there) contains little irregularly-shaped bodies; that rock with similar little bodies was obtained from the bore-hole at Lewis Lane, Cirencester; and that whilst the rock at Shipton Moyne between 206 feet and 212 feet is very coarsely oolitic, that between 212 and 213 feet—within 1 foot 4 inches of the base of the "Passage Beds" there—is also "pisolitic."

FULLERS' EARTH.—All the information that is necessary concerning these beds is given on pages 49 and 51-2; but it may be as well to emphasize the fact that the unfossiliferous nature of the marls below 265 feet was very noticeable.

I am much indebted to the late H. Rofe, M.I.C.E., the Consulting Engineer, and to Mr Henry Marten, A.M.I.C.E., for affording me every facility for examining the cores and for supplying me with any information that I required.

A DEEP BORING AT THE WATERWORKS, TETBURY, GLOUCESTERSHIRE.

BY

L. RICHARDSON, F.R.S.E., F.G.S.

[Plate IV.]

In 1915 a deep boring was made by the Tetbury Urban District Council at their Waterworks at Tetbury. The precise site is three-quarters of a mile north by west of Tetbury Church. Boring operations commenced on June 7th and ended on December 17th. To be exact, a shaft was sunk to a depth of 9 feet 6 inches, then a rotary boring made (1) with an 18-inch crown down to 153 feet, and (2) with a 13-inch crown down to 446 feet—a total depth from the surface of 446 feet.

At the existing Waterworks is a brick-lined circular well 9 ft. 10 ins. deep and 6 ft. 9 ins. in diameter, from the bottom of which is a 7-inch bore-hole 290 ft. 2 ins. deep—total 300 ft. The top of the Inferior Oolite was reached at 252 ft. down, the same depth at which it was reached in the new bore-hole. The old bore-hole, therefore leaves off 48 ft. down in the Inferior Oolite ; the new one 55 ft. down in the Cotteswold Sands.

The new bore-hole passed through

21 ft. 3 ins.	of Forest Marble beds
103 ft. 9 ins.	of Great Oolite (Kemble Beds, 31 ft. 9 ins. ; Great Oolite proper, 72 ft.)
47 ft. 6 ins.	of beds best described as " Passage Beds "
79 ft. 6 ins.	of Fullers' Earth
135 ft.	of Inferior Oolite
4 ft.	of Cephalopoda-Bed
and penetrated 55 ft.	of Upper-Lias or Cotteswold Sands.

DESCRIPTION OF THE ROCKS PASSED THROUGH BY THE BORE-HOLE AT THE WATERWORKS, TETBURY.

Ground-level.—447 feet above ordnance-datum.
Shaft.—9 ft. 6 ins. deep.
18-*inch rotary boring.*—147 ft. 3 ins.
13-*inch rotary boring.*—298 ft. 9 ins.: *total depth.*—446 ft.

			Thickness of rocks		Depth	
			ft.	ins.	ft.	ins.
Forest Marble		*In shaft:* 1. Typical Forest-Marble limestones with numerous specimens of *Ostrea sowerbyi* Lyc. and, on weathered surfaces, small gastropods, etc.	9	6	9	6
		Bore-hole: 2. Similar limestones in thin layers with partings of brown clay ..	8	3	17	9
	3.	Very similar, but less shelly limestones, with small "clay galls"	3	6	21	3
Great Oolite	4.	Limestone, brownish, oolitic	2	0	23	3
	5.	Sand—according to the foreman	2	3	25	6
	6.	Limestones, brownish-grey, coarsely oolitic, with few shells, but on the nether side of lowest bed were noticed *Ostrea sowerbyi* Lyc., *Entolium demissum* (Phil.) and echinoid-radioles. Wood in places	12	0	37	6
	7.	Marl, brown	3	0	40	6
	8.	Limestone, grey, oolitic	1	6	42	0
	9.	CLAY, tough, brown and greenish-grey ..	0	2	42	2
	10.	Limestone, brownish, oolitic, somewhat resembling certain of the browner and less shelly layers in the true Forest Marble, with occasional small flat "clay galls"	1	4	43	6
	11.	Limestone	1	9	45	3
	12.	Limestones in thin layers with clay partings	1	2	46	5
	13.	Limestone: shell fragments in places ..	1	6	47	11
	14.	Clay, brown	0	1	48	0
	15.	Limestone, similar to 13	1	6	49	6
	16.	Limestone, impure, oolitic, with which is associated a considerable amount of brownish marl, especially at the top and bottom ..	2	0	51	6
	17.	Limestone, with irregular surface, "cavernous," the cavities being occupied by brownish marl	1	6	53	0
		GREAT OOLITE LIMESTONES. 18. Limestone	1	7	54	7
	19.	Limestone, non-oolitic, cream-coloured *but with a pinkish tinge* (*Spec.* 19[1])	1	6	56	1
	20.	Limestone, yellowish, oolitic (except in places in the top portion), with more or less vertical veins of calcite	4	0	60	1
	21.	Limestone, very similar to 19	1	6	61	7
	22 *a*.	Limestones, oolitic, massive-bedded. Some of the beds have irregular nether surfaces and tough brown clay (0 to 2 ins. thick) between them. The beds are traversed by thin more or less vertical veins of calcite: about 39 ft. 3 ins	63	5	125	0
	b.	"Dagham Stone": about 9 ins.				
	c.	Limestones, oolitic massive-bedded, about 23 ft. 5 ins.				

1 The specimens referred to in brackets have been placed in the Cheltenham Town Museum.

		Thickness ft.	ins.	Depth ft.	ins.
"Passage Beds."	23*a*. Limestone, grey, oolitic, with a yellowish zone (1 ft. 7 ins.) between 2 ft. 9 ins. and 4 ft. 4 ins. down : 5 ft. 9 ins.				
	b. Limestone, grey. The upper 1 ft. 4 ins. (spec. 23*b*[1]) is light-grey and "sparry :" the lower 11 ins. (spec. 23*b*) more shelly, with some iron-pyrites : 2 ft. 3 ins.	8	0	133	0
	24. MARL, black, shaly, with shell fragments in pyritic condition, and, at the base, numerous small crinoid-ossicles	1	0	134	0
	25*a*. Marl, grey, indurated and veins of impure limestone (spec. 25*a*) ; crinoid-ossicles : 3 ft. 9 ins.				
	b. Marl, grey, unfossiliferous, with a 3 to 4-inch bed of very fine-grained sandy limestone (*b*[1]) in the middle : 1 ft.				
	c. Limestone, grey, impure and dark marl : 1 ft. 1 in...	12	6	146	6
	d. Marl, as before, with pyritized shell fragments in the lowest 9 ins. (spec. 25*d*) : 1 ft. 9 ins.				
	e. Limestone, grey, impure : 1 ft. 5 ins. ..				
	f. Marl, as before : 3 ft. 6 ins.				
	26. Limestone, very light-grey, fine-grained, for the most part sandy to the touch. The top-most portion is of a darker grey, is bored by *Lithophagi*, and to the surface oysters are attached (spec. 26). The upper 6ft. 6ins. were drawn in one massive core, but the remainder (Plate IV., fig. 1) was softer owing to the presence of marl ; while in the bottom inch—shale—were numerous little pisolites .. .. .. [13-*inch crown used from here.*]	10	3	156	9
	27. Limestone, similar to the upper part of 26, with dark granules, drawn in one nice core (spec. 27)	5	3	162	0
	27*a*. "Fullers' Earth," according to the foreman	3	0	165	0
	28. Marl, indurated, dark grey (1 ft.), passing down into light grey limestone, very similar to that of bed 27, but with dark granules (spec. 28)	7	6	172	6
Fullers' Earth	29. MARL, black, shaly, *without* fossils, except for a ½-inch layer of *Ostrea acuminata* J. Sow	7	6	180	0
	30. Limestones, greyish, impure with partings of shaly marl. The shaly marl, although dark, has a tinge of green. *Ostrea acuminata* J. Sow. common the lower portion	1	6	181	6
	31. *Ostrea*-Limestone	0	4	181	10
	32. Marl, dark, shaly ; crinoid-ossicles abundant : about	1	1	182	11
	33. Limestone, impure, shelly ; *Ostrea acuminata* J. Sow. common, crinoid-ossicles ..	1	1	184	0
	34. Marl, apparently unfossiliferous	3	6	187	6

1 The specimens referred to in brackets have been placed in the Cheltenham Town Museum.

		Thickness ft.	ins.	Depth ft.	ins.
Fullers' Earth	35. Limestone, impure practically made up of specimens of *Ostrea acuminata* J. Sow., pisolites numerous in the middle portion	3	2	190	8
	36. *Ostrea*-Limestone : 4 to 9 ins. : usually ..	0	8	191	4
	37. Limestone, similar to 35; *Pseudomonotis echinata* (J. Sow.). Small crinoid-ossicles very common in the lowest inch ..	5	2	196	6
	38. Marl, dark, shaly, *relatively barren*	4	0	200	6
	39. Limestone, similar to 37	4	6	205	0
	40. *Ostrea*-Limestone (spec. 40)	0	7	205	7
	41*a*. Marl, dark grey, breaking up into small pieces on exposure to the weather, with irregular layers and lenticular pieces of a very fine-grained sandy limestone. *Relatively barren*, but with occasional crinoid-ossicles and specimens of *Ostrea acuminata* J. Sow. .. .. about	12	5	218	0
	41*b*. Marl, darker, but otherwise similar, with *Ostrea acuminata* more abundant in the lower portion and "pisolites": about	4	6	222	6
	42. Impure limestone	1	6	224	0
	43. Marl similar to 41*a*. In the lower 3 ft. shell-fragments (*Ostrea acuminata*, *Volsella imbricata* (J. Sow.), etc., in a pyritized condition are numerous	28	0	252	0
Inferior Oolite	44. *Rubbly Beds.* Ragstone, rubbly, shelly; *Terebratula globata* auctt. (common at the top and bottom) (spec. 44), *Rhynchonella*, *Entolium demissum* (Phil.)	5	4	257	4
	45. *White Oolite.* Limestone, for the most part oolitic (spec. 45); *Clypeus* sp. (near the top), *Serpulæ*	21	7	278	11
	46. *Clypeus-Grit.* Ragstone, rubbly, shelly; *Serpulæ* (abundant), *Terebratula globata* auctt., etc.	10	5	289	4
	Non-sequence. Upper Coral-Bed and Dundry Freestone wanting.				
	47. *Upper Trigonia-Grit.* Ragstone, usual fossils. Lowest 3 inches rubbly and shaly ..	7	10	297	2
	Non-sequence. All the beds of the hemeræ *niortensis* to *bradfordensis* (incl.) wanting.				
	48. *Lower Freestone.* Top bed well bored by annelids. In the bottom 1 ft 6 ins. pentacrinoid ossicles are very abundant (spec. 48*b*) ..	19	0	316	2
	49. *Pea-Grit* (spec. 49)	36	10	353	0
	50. *Lower Limestone*	34	0	387	0
	Non-sequence. *Scissum*-Beds, etc. (see page 64) wanting.				
Upper Lias	51. *Cephalopoda-Bed* (spec. 51). Maximum thickness	4	0	391	0
	52. *Cotteswold Sands*, penetrated..	55	0	446	0

Bottom of bore-hole.—1 foot above ordnance-datum.

Forest Marble.—As is well known from the writings of Hull,[1] James Buckman,[2] and H. B. Woodward,[3] it is often difficult to know where to draw the line of division between Forest Marble and Great Oolite in the country around Tetbury and Cirencester.

Woodward has shown clearly enough where he thinks it should be drawn at Veizey's or "Vaze's" Quarry, distant half-a-mile in a west-north-westerly direction from the Waterworks. At this quarry, in the deepest part, about 15 ft. from the top, is a bed of clay (from 1 to 3 ft. thick), which Woodward obviously considered occupied the stratigraphical position of the Bradford Clay. Below it is Oolite—seen to a depth of from 20 to 24 ft.—which he called "Kemble Beds." Below these Kemble Beds, he stated, came the "White Limestone series," which, however, was not exposed.[4]

I endeavoured to identify in the cores at the Waterworks the beds equivalent to those seen in Veizey's Quarry; but was not successful. The beds down to 21 ft. 3 ins. are typical Forest Marble. Those between 17 ft. 9 ins. and 21 ft. 3 ins. contain "clay galls" similar to those seen in the hard layers between the surface and 27 ft. down in the Shipton-Moyne bore-hole.[5]

Great Oolite.—The beds 4, 6, 8, 10 to 13, and 15—brownish-grey, oolitic limestones—are very similar to each other, are *unlike* the Forest-Marble beds in that they lack the characteristic blue colour and the abundance of oysters, and would appear to be referable to the Kemble Beds. At Veizey's Quarry, however, the Kemble Beds are massive—if often false-bedded—oolitic limestones, and do not include such beds as the deposits of brown sand (5),[6] brown marl (7) and tough clay (9). The clay of bed 9 was precisely similar to the clay bed on top of the Kemble Beds at Veizey's Quarry.

1 "Geology of the Country around Cheltenham" (1857), pp. 65, 66. Mem. Geol. Surv.
2 Quart. Journ. Geol. Soc., vol. xiv. (1858), p. 113.
3 "Jurassic Rocks of Britain:" vol. iv. (1894), "The Lower Oolitic Rocks of England (Yorkshire excepted)," p. 271. Mem. Geol. Surv.
4 *Id.*, p. 276.
5 See Proc. Cotteswold Nat. F.C., vol. xix., pt. 1 (1915), p. 50.
6 Dr. P. G. H. Boswell has very kindly examined a small sample of this sand for me and reports that it contains "an abundance of shell fragments, oolitic grains, pieces of spines, etc. On treating with hydrochloric acid it goes down in bulk very much by the solution of calcareous matter, and, after warming and consequent solution of iron hydrates, etc., a very little fine-grained angular quartz sand remains. The rest of the deposit was, of course, rather large-grained. On treatment of the original sample with bromoform of density 2.83, very little residue—consisting almost entirely of authigenic mineral fragments (limonite, marcasite and ? pyrrhotite)—was obtained. These were probably in part due to organic action. Coarse ilmenite, very badly altered in parts to leucoxene of whitish colour, is very common.

Bed 18 is certainly Great Oolite : probably the top-bed of what Woodward would have called the "White Limestone series." Bed 19 is a very distinctive stratum on account of its non-oolitic nature and cream colour, but with a "pinkish" tinge. The limestones (22*c*) (23 ft. thick) below the "Dagham Stone" (22*b*) are more evenly oolitic, and therefore a better freestone, than those above (22*a*).

"Passage Beds."—At 125 ft. down the yellowish oolitic limestones ended, and the grey and dark-grey—sometimes almost blackish—rocks commenced. Those down to 172 ft. 6 ins., and therefore 47 ft. 6 ins. thick, are "Passage Beds" between the Great Oolite and Fullers' Earth.

Bed 23 is a well oolitic limestone. Its lower portion (23*b*) is shown in Fig. 1. Some geologists might feel disposed to group it with the Great Oolite, but its colour is similar to that of the "Passage Beds." It is 8 ft. thick, contains a yellowish zone—reminding one of bed 43 at Shipton Moyne—between 2 ft. 9 ins. and 4 ft. 4 ins. down, while the portion between 5 ft. 9 ins. and 6 ft. 9 ins. is "sparry"—just like the main portion of bed 42 at Shipton Moyne.

Bed 24—the marl composing which soon crumbled to pieces (hence the gap in the core—Fig. 1)—shows that the "Great Oolite limestones" have been left. The impure limestones associated with the marls of bed 25, with their small white crinoid-ossicles, are similar to each other, with the exception of one bed (25*b*[1]), which is a very fine-grained limestone, sandy to the touch and 3 to 4 ins. thick.

At 144 ft. a very massive bed (26) of a very light-grey, fine-grained limestone, sandy to the touch, was encountered, and one solid core 6 ft. 6 ins. long was drawn. It was this portion of the core that attracted the special attention of certain members of the Club on the occasion of their visit on September 25th, 1915.[1] The top of the bed is waterworn and pitted with the crypts of *Lithophagi*. The lower 3 ft. 9 ins. (Fig. 2) is less pure limestone owing to an admixture of marl, and did not draw in one piece. In the bottom inch, which is shaly, small "pisolites" were abundant.

1 Proc. Cotteswold Nat. F.C., vol. xix., pt. 1 (1915), p. 26.

At 156 ft. 9 ins. a 13-inch crown was substituted for the 18-inch one, and from between that depth and 162 ft. a nice core of rock (bed 27)—similar to that of the upper part of bed 26—was drawn. Then came a gap in the core, where —according to the foreman—a 3 ft. bed of "Fullers' Earth" (27*a*) occurred. The next bed (28), which commenced (1 ft.) as somewhat dark impure limestone, soon passed into rock similar to that composing bed 27, but it was more oolitic (coarsely so) and shelly—the shells, however, being only fragments. At Shipton Moyne, bed 51, between 8 ft. 4 ins. and 2 ft. 4 ins. from the bottom of the "Passage Beds," was also coarsely oolitic.

Fullers' Earth.—At 172 ft. 6 ins. down came a change, and dark shaly marls (29) initiated beds crowded at various horizons with specimens of *Ostrea acuminata* J. Sow. The three bands of *Ostrea*-Limestone (31, 36 and 40) were very noticeable. Beds 41 to 43 are comparable with the lower portion of bed 5 at Kemble.

The deposits grouped as Fullers' Earth at Tetbury are 79 ft. 6 ins. thick, as against 73 ft. at Kemble.

Inferior Oolite.—The Inferior-Oolite beds, viewed as a whole in the core, were of a bluish-grey colour, except (1) the greater part of the White Oolite, (2) the top 1 ft. 2 ins. of the Lower Freestone, and (3) the top portion of the Lower Limestone, which were of a lighter grey colour—more yellowish-grey.

The top portion of the Rubbly Beds was more rubbly than the lower, the beds were not typical as at Kemble, and not well separated from the White Oolite.

The White Oolite was not so typical as at Kemble, but while the large oolite-granules so characteristic of the *Clypeus*-Grit occurred in it in places, the oolitic structure one ordinarily associates with an Inferior-Oolite freestone predominated. The White Oolite appeared to be less regularly-bedded here than usual, and irregular lumps of limestone and indurated shale separated the more massive oolitic rock.

The *Clypeus*-Grit and Upper *Trigonia*-Grit—except in the matter of their colour—were quite typical, but there was no Upper Coral-Bed or representative of the Dundry Freestone

in between them. The top-portion of the *Clypeus*-Grit was very barren of fossils, and the conspicuous large oolite-granules were sparsely distributed (spec. 46). In the Upper *Trigonia*-Grit, between 6 ins. and 2 ft. from the top specimens of *Trigonia costata* J. Sow. (spec. 47) were abundant. *Acanthothyris spinosa* (Linn.) was found at 4 ins. from the bottom, above the shaly rock (47*a*) with pebbles.

The Upper *Trigonia*-Grit rests directly on the Lower Freestone, the top-stratum of which was noticeably bored (Fig. 1). The Lower Freestone is of very uniform texture and for the most part obliquely-bedded (spec. 48*a*). In the bottom 1 ft. 6 ins., however, remains of pentacrinoids were most abundant (spec. 48*b*). The Lower Freestone is thicker at Kemble than here—43 ft. 6 ins., as against 19 ft.

The Pea-Grit is of much the same thickness as at Kemble—36 ft. 10 ins., as against 35 ft. 6 ins. (at Kemble).

The top 3 ft. of rock had the appearance of a bluish-grey mudstone, practically devoid of pisolites, but the rest of the rock—right down to the Lower Limestone—was crowded with pisolites and quite typical. Black shaly matter occurred here and there and represents the soft yellow shaly matter seen in quarry faces—for example, at Crickley Hill.

The change from the pisolite to the oolitic limestone of the Lower Limestone was sudden, and therefore very noticeable. The Lower Limestone was a bluish-grey oolite with irregular, coarser-grained streaks, which, on closer inspection, proved to owe their character to innumerable fragments of isocrinoids. Sandy layers occur in the lower portion and suggest the incoming of *Scissum*-Bed conditions, but the oolitic structure was predominant to the very base (spec. 50), and there was no evidence for *Scissum*-Beds.

At Kemble the Pea-Grit rests directly on the Cephalopoda-Bed; here the Lower Limestone rests on that stratum. No *Scissum*-Beds intervene.

Upper Lias.—The Cephalopoda-Bed here is a hard brownish limestone, with brown, often pyritic granules. It is a pretty rock, and very similar to that of layer *b* of the Red

Bed at Chiselcombe Quarry, Loders Cross, near Bridport, Dorset.[1] It is full of lamellibranchs, which included *Chlamys articulata* auctt. (very abundant), *Eopecten velatus* (Goldfuss), etc. Masses of coral in a crystalline condition occurred not infrequently. The nether surface of the Cephalopoda-Bed was irregular and rested on a "hard cap" (some 3 ins. thick) to the Sands. This hard cap had a waterworn surface, and was bored by annelids.

The Sands, when dry, were grey-green in colour, but a pretty green—as at Kemble—when freshly brought up to the surface, and therefore moist.

Dr. Boswell has also kindly examined for me a sample of the Cotteswold Sands from about 395 feet down. He reports :

> "The sample has a fair quantity of calcareous cement, appearing in the sand under the microscope as abundant small cleavage rhombs of calcite—a result of the slight crushing of the sample.
>
> "I have not been able to work out the mineral composition thoroughly, but its general aspects seem to be those of the Sands from Dorset to Yorkshire, there being a remarkably similar (and distinctive as regards other formations) mineral suite over the whole of the outcrop where the beds are fairly sandy. The constancy of the mechanical composition from the coast at Bridport up to Bath and Wotton is also noteworthy, but a change sets in as Northampton is approached.
>
> "As is so often the case in borings, the sand is greyish in colour and unlike the yellowish sand at the outcrop. The average size of the grains is .125mm. diameter. Even on heating with dilute hydrochloric acid, the colour does not change appreciably, but of course the calcite rhombs dissolve. The grey-green colour does not therefore appear to be due to oxides, carbonate or sulphide of iron. The crop of density—greater than—2.8 contains a good deal of coarse glauconite. As in the case of most of the glauconite I have met, the density, instead of being 2.3, as often stated, runs rather high. This glauconite gives the grey-green colour to the sand. The grains are of diameter .2mm., and appear to belong to a different generation from that of the other heavy minerals (diameter .06mm). Of the latter, the most abundant are small angular colourless to pale brownish-red garnets (so characteristic of the Inferior Oolite everywhere), muscovite flakes (.4 to .5mm. diameter) somewhat rounded zircon prisms, blue tourmaline, abraded stumpy apatite prisms, coffee-brown to yellow-green rutile, and straw-coloured tabular anatase. Ilmenite and magnetite also occur, and possibly green hornblende and staurolite."

Between 396 feet and 406 or 408 feet down the Sands were of light grey colour and less coherent, but below, they were very similar to the portion between 391 and 396 feet, only they became more "clayey" lower down.

1 Proc. Geol. Assoc., vol. xxvi. (1915), p. 63.

In the following table the thickness of the beds as ascertained by the bore-holes at Shipton Moyne, Kemble Station, Tetbury Water Works (Blind Lane), and Chavenage, are tabulated :—

	Shipton Moyne	Kemble[1]	Tetbury[6]	Chavenage[5]
Forest Marble ..	Rem.[2] 67½ft.		Rem. 21¼ft.	Rem. 39ft.
Great Oolite ..	84⅔ ,,	Rem. 60ft.	103¾ ,,	63 ,,
"Passage-Beds"	62⅙ ,,	48 ,,	47½ ,,	56 ,,
Fullers Earth ..	Pen.[3] 72⅙ ,,	73 ,,	79½ ,,	88 ,,
Inferior Oolite ..	..	117[4] ,,	139[7] ,,	134[4] ,,
Upper Lias ..	..	Pen. 54½ ,,	Pen. 55 ,,	Pen. 5 ,,

I am very much indebted to Mr J. Henry Thomas for taking the excellent photographs that illustrate this paper, and to Mr H. J. Weaver, M.Inst.C.E.I., M.I.Mech.E., F.G.S., the Consulting Engineer for the scheme, for affording me every facility for examining the core.

1 Described, Proc. Cotteswold Nat. F.C., vol. xviii., pt. 2 (1913), pp. 185-189.
2 "Rem." = Remaining.
3 "Pen." = Penetrated.
4 This thickness includes the Cephalopoda-Bed, which, at Kemble, is 6 feet thick.
5 Described Proc. Cotteswold Nat. F.C., vol. xviii., pt. 3 (1914), pp. 243-246.
6 The particulars given in the table on p. 244 of Proc. Cotteswold Nat. F.C., vol. xviii., pt. 3 (1914) were derived from the engineer's record of the old bore-hole; those now given are derived from the new one.
7 This thickness includes the Cephalopoda-Bed, which has a maximum thickness of 4 feet.

THE FLORA OF THE TETBURY DISTRICT

BY

E. M. DAY.

The country in the immediate neighbourhood of Tetbury, consisting largely of arable and grazing land, is rather monotonous, and frequently of little botanical interest ; but where it is intersected by valleys, as in the neighbourhood of Avening and Cherrington, many rare plants occur. The soil is principally limestone, and the average elevation between 400 and 500 feet above sea-level. There is little water, and the only marshy ground of any extent is situated about a mile south-west of Avening.

Here grow *Menyanthes trifoliata* (Bog-bean), *Galium uliginosum*, *Pedicularis palustris* (the large Red-rattle), *Juncus subnodulosus*, *Triglochin palustre* (Arrow-grass), *Scirpus sylvaticus*, *Carex paniculata*, *C. echinata*, and *Molinia cærulea*.

In the woods between this marshy ground and Nailsworth may be found *Aquilegia vulgaris* (Wild Columbine), *Hypericum humifusum*, *Rosa micrantha*, *Chrysosplenium alternifolium* (the Large Golden Saxifrage), *Monotropa hypopitys* (Yellow Bird's-nest), *Atropa Belladonna* (Deadly Night-shade), *Daphne Laureola* (Spurge Laurel), *Neottia nidus-avis* (Bird's-nest Orchis), *Helleborine media*, *Colchicum autumnale* (Meadow-Saffron), *Paris quadrifolia* (Herb Paris), *Phegopteris Robertiana*, and *Equisetum maximum* (the great Horse-tail).

There is an interesting piece of country between Rodmarton and the County-boundary, near the Cirencester road. *Adonis autumnalis* (Pheasant's Eye) and *Anagallis cærulea* (Blue Pimpernel) grow in the cornfields here. Among other plants to be noted here are *Arenaria tenuifolia*, *Ononis spinosa* (Spiny Rest-harrow), *Astragalus danicus*, *Genista tinctoria* (Dyer's Green-weed), *Erigeron acre*, *Serratula tinctoria* (Saw-wort), *Pedicularis sylvatica*, *Thesium humifusum*, *Ophrys apifera* (Bee Orchis), *Sieglingia decumbens*.

Among other plants, the following may be noted :— *Clematis Vitalba* (Traveller's Joy) is common in hedges and *Ranunculus parviflorus* is abundant on banks about Cherrington. *Nymphæa lutea* (Yellow Water-lily) is plentiful in the stream at Brokenborough. *Erysimum cheiranthoides* grows on old walls about Tetbury, and *Sisymbrium thalianum* is plentiful on walls between Tetbury and Avening. *Polygala calcarea*, a rare species of Milkwort, grows on hill-slopes near Avening.

Cerastium arvense is frequent on cultivated land ; *Arenaria tenuifolia* is plentiful about railway embankments ; *Geranium rotundifolium* occurs on a bank by Culkerton Station ; *G. pratense* (the Large Blue Wild Geranium) is frequent in hedges ; and *G. pyrenaicum* grows near Long Newton.

Spiræa filipendula (Dropwort) is a common plant in this district, and *Cotyledon umbilicus* (Navelwort) grows plentifully on old walls in many places. *Hippuris vulgaris* (Marestail) grows near Avening, and *Dipsacus pilosus* (the Small Teasel) in coppices at Cherrington. *Kentranthus ruber* (the Red Valerian) is a great ornament to the old walls about Tetbury. *Anthemis arvensis* (Corn-chamomile) is not uncommon, and *Senescio viscosus* occurs near Culkerton Station.

Carduus eriophorus (the great Woolly-headed Thistle) is a frequent and conspicuous plant in this neighbourhood, *Cichorium intybus* (Wild Chicory) grows in fields around Cherrington, *Campanula glomerata* (Clustered Bell-flower) frequently on hill sides, *Monotropa hypopitys* (Yellow Bird's-nest) in beech-woods at Culkerton and near Nailsworth, *Hyoscyamus niger* (Henbane) in an old quarry near Avening, *Verbascum nigrum* (Black Mullein) is rather common. *Calamintha montana* (Calamint) occurs near Cherrington, and *Salvia verbenaca* (Wild Clary) on a bank near Tetbury railway station, along with *Verbena officinalis* (Vervain). *Elodea Canadensis* (Water-Thyme) may be found, as well as *Sagittaria sagittifolia* (Arrow-head) in the stream at Brokenborough.

Neottia nidus-avis (Bird's-nest Orchis) and *Cephalanthera grandiflora* (White Helleborine) are found not unfrequently in beech-woods, and *Ophrys apifera* (Bee Orchis) on open pastures. *Orchis incarnata* (Marsh Orchis) grows near

pauciflorus and *S. compressus*, as well as *Carex inflata*, which Cherrington and Avening. At Cherrington also occur *Scirpus* is abundant by the margin of the pond. *Poa compressa* is a rather common grass on old walls, *Festuca sciuroides* grows in similar situations around Tetbury and Beverston, *Agropyron caninum* in hedges between Cherrington and Rodmarton.

Ferns do not abound in this district, but *Ceterach officinarum* (Scaly Spleenwort) grows on walls at Tetbury, Brokenborough and Shipton Moyne, as also *Asplenium trichomanes* (Common Spleenwort) and *A. ruta-muraria* (Wall-rue). *Ophioglossum vulgatum* (Adder's-tongue) is found in a wood between Tetbury and Cherrington, and also at Estcourt, while *Phegopteris Robertiana* occurs in Hazel Wood, near Nailsworth.

NOTES ON THE CODLING MOTH

(*Carpocapsa pomonella* Linn.)

BY

C. GRANVILLE CLUTTERBUCK, F.E.S.

(Read 23rd November, 1915).

The Codling Moth, like all butterflies and moths, goes through four stages of existence—the ovum, or egg, the larva, or caterpillar, the pupa, or chrysalis, and the imago, or perfect insect stages. Most people have probably noticed on biting some apple that it is occupied by a pinkish grub. The apple is in fact the home of the larva of this very beautiful little moth. The moth belongs to the Tortricina, a group of the Lepidoptera.

Miss Ormerod, in the Board of Agriculture leaflet No. 30, has described this moth and its ravages upon apples. In my own garden, the King Pippin and Dutch Mignonne suffer severely—far more so than Warner's King.

The egg is laid by the female singly on the young apple in June or July, the caterpillar hatches in a few days, eats into the apple, devours the pips, bores its way out and into another ; is full fed in September, leaves the apple, hides either on or near the tree, or in the apple store in almost any crevice, where it hybernates in a cocoon of spun silk, changing to a chrysalis in April or May.

In addition to the remedies set out in the Leaflet No. 30, it may be noted that Mr C. G. Barrett, F.E.S., in his "British Lepidoptera," vol. xi., p. 155, says :— "Since the larva passes from one apple to another, eating only the pips, it has been found that by examining the young apples on standard trees, and removing those the skin of which is pierced only on one side, the larva may be secured and destroyed, and thus a portion of the crop

saved." Except for a casual specimen taken in my house in 1898 and another one also found indoors on the 2nd July, 1905, I do not appear to have met with this species in any numbers until July, 1906. I was then staying in Swanage, and whilst there noticed the moths quite commonly buzzing up and down the plate-glass window of a greengrocer's shop; evidenly the larvæ had escaped from apples brought to the shop during the previous autumn, had pupated in some of the chinks of the woodwork, and were emerging freely during the first 3 weeks of July. The shopkeeper obligingly allowed me to box a few specimens on the 3rd and 9th July.

In 1908 I captured single specimens on the 24th and 31st May, and 14th June.

I netted a specimen on the 13th June, and found another at rest on the window of the apple store-room both on the 2nd and 12th July, 1909.

In 1910 specimens were captured on 21st and 27th May, 7th, 15th and 24th June, and 2nd, 5th and 12th July. I reared a specimen on 8th June from a larva found the previous autumn.

In the very fine and hot season of 1911 I found a specimen in the house on the 27th May, and captured others in my garden on the 4th, 11th, 20th and 24th June, and the 8th, 14th, and 23rd July. The following year, 1912, was just the opposite—very wet and cold—but specimens were taken in my garden on the 9th and 11th May, 30th June, and 8th July.

In 1913 I found a specimen in my house on 30th May, five specimens on the 17th June, another on the 18th, two on the 21st, and one on the 24th of the same month. I found single specimens on the store-room window on the 7th, 8th, 11th, 12th and 13th July.

In 1914, the first specimen appeared in my store-room on the 8th May, others on the 14th and 26th May, the 2nd, 7th and 8th June. In 1915, two specimens emerged on the 6th June, four on the 13th June, three on the 15th, two on the 16th, three on the 17th, three on the 19th, three on the 22nd, four on the 27th, four on the 2nd July, three on the 4th, one on the 7th, and one on my return from North Devon on the 14th August.

My earliest date appears to be the 8th May, and the latest the 14th August. These dates are interesting, as showing the much extended period of emergence of the imago. The majority of my specimens have been captured in my garden in the evening in a butterfly net with a handle about three feet long. At the end of May, throughout June and the first half of July, the imagos fly round the tops of my apple and pear trees on fine calm evenings, just as the sun is going down between 6.30 and 8.30 p.m. The flight is a buzzing one, and the insects occasionally settle on the leaves or fruit. They are very active on the wing and difficult to catch because they keep about 15 to 20 feet from the ground.

I have frequently noticed tom-tits in the autumn and winter very busily hopping about the branches of a King of the Pippin apple tree in my garden, examining every nook and cranny, and I feel sure that they devour large quantities of the larva of the Codling Moth. When it is remembered that each female lays about 100 eggs, and each larva is capable of spoiling three or four apples, the value of the services of these beautiful little birds in checking the insects cannot be over-estimated.

Mr W. B. Davis, of Stroud, says that the moth is rare in his district, and that he has never met with it away from cultivation or seen any signs of it among the wild crab in the woods and hedgerows. Apparently the species does not like the hills, or the limestone does not suit it. The four other species of the genus found in this country are *Carpocapsa splendana* (larva on acorns), *C. grossana* (larva on beech mast), *C. juliana* (larva on acorns and edible chestnuts) and *C. nimbana* (larva on beech nuts). The larva in the jumping beans exhibited in shop windows in Gloucester some years ago was the larva of a foreign species of the genus called *Carpocapsa saltitans*. Mr V. R. Perkins, F.E.S., in his List of Gloucestershire Lepidoptera (unpublished), says :—"In gardens and orchards generally distributed but not often common—Gloucester, Merrin, Clutterbuck; Painswick, Watkins." I have taken *C. splendana* and *C. grossana*, but have no personal knowledge of *C. juliana* and *C. nimbana*.

This is one of the species which has retained the name originally given it in 1776 by Linnæus, the great Swedish Naturalist, who invented the bi-nomial system of nomenclature, which is still in use.

Previous to 1915, I had no personal knowledge of any parasites upon the species, and there is no mention of any in the Government leaflet. In the volume on Pests to Agriculture in Mexico, published in 1904, S. Mokrzecki describes a new dipterous parasite *Thryptocera* (*Gymnopareia*) *pomonellæ* bred from its pupæ. Mr Claude Morley, F.E.S. (author of British Ichneumonidæ) tells me that *Glyphicnemis brevis* (*cf.* Miss Ormerod's Report 1896, p. 9) ; *Ephialtes carbonarius* (a very effectual check in California), and *Pristomerus vulnerator* (Ich. Brit., vol. v., p. 223) are the only Ichneumonidæ, recorded from it in Europe. *Pimplon heliophila* was first described from this pest in 1905 in Cape Colony, and is also known from Rhodesia and the Transvaal. Ratzeburg has also recorded *Campoplex pomorum* from it with considerable doubt in Germany in 1852. Doubtless there are also members of the other families of parasitic Hymenoptera that prey upon *C. pomonella*, but further observations are desirable because it is possible that by importing or encouraging a parasite its ravages may be checked.

In a paper on the Codling Moth in North Western Pennsylvania by A. G. Hammar, published in 1910 by United States Department of Agriculture, he says :—

"A small black-beetle (*Tenebrioides corticalis* Melsh.) and its very slender larva were found during August to late October, 1909, under the burlap bands on apple trees. Dead and partly devoured Codling Moth larvæ were frequently found attacked by both beetles and larvæ of this species. Another black-beetle, *Dromius piceus* Dej. was also found quite frequently. *Platynus obsoletus* Say was taken on several occasions, and a few specimens of the larger ground beetle (*Galerita janus* Fab.) were also collected under the bands. The following species of ants . . . . were found to attack the larva of the Codling Moth under the bands :—*Camponotus pennsylvanianis* (Dej.) Mayr., *Formica subsericea* Say, *Cremastogaster lineolata* Say and *Myrmica lobicornis* Nyl.

"A centipede, *Geophilus rubens* Say . . . . was taken several times beneath the bands in the act of feeding on larvæ of the Codling Moth.

"A hymenopterous parasite (*Ascogaster Carpocapsæ Viu.*) . . . . . issued in the cages from band material of the two broods of the Codling Moth, and proved to be quite common."

In another paper by S. W. Foster, also published in 1910 by the U.S.D.A., an interesting account of the nut-feeding

habits of the larva of this species is given. He says that on October 2nd, 1909, he found a large walnut tree on the ranch of Mr George Whitman, near Concord, California, with over 50 per cent. of the nuts infested by larvæ of the Codling Moth in all stages of growth. He mentions that the species has frequently been found in peaches and plums. It has also been reared from chestnuts. He states that the specimens were identified by Mr August Busck, who says that the European *Carpocapsa putaminana* Standinger, recorded as feeding on walnuts in Europe, is now regarded as a variety of *C. pomonella*.

There is also a paper by the same author, published in 1911, on the Life History of the Codling Moth and its Control on Pears in California. From this it appears that there are practically two full broods of larvæ in the pear growing districts of the interior Counties of California. The subject is dealt with exhaustively in 51 pages.

Last winter I had two larvæ of this species in a box, and in April when examined it transpired that both had been stung by a parasite. The larvæ of the parasite had consumed the Pomonella larvæ, leaving only the skins, and had formed small brown cocoons. Shortly afterwards, these produced specimens of a Dipteron, or two-winged fly. I sent one of the flies to Mr Claude Morley, who identified it as the Tachinid fly, *Blepharidea vulgaris*, so common a parasite on the Gooseberry Moth (*Abraxas grossulariata*). We have here apparently an interesting case of a parasite infesting alternately two different species of Lepidoptera. As far as I know this parasite has not been recorded from *C. pomonella* before.

JOHN SAWYER

BORN 1849; DIED 1915.

Obituary Notice

JOHN SAWYER, J.P.

Born in 1849 at Cirencester, where his boyhood was spent, he came to Gloucester to learn printing in the office of the late Mr John Bellows, and afterwards joined the staff of the "Gloucester Journal," as a reporter. How much the tastes and interests of his after life were influenced by early familiarity with these historic towns he could hardly know himself. Certainly, he always retained a very warm affection for both of them, and a keen interest in their history and archæology. Still, as the present writer well remembers, he was one of those who not only attended the ordinary lectures, but eagerly joined a special class for the study of Geology, formed by Mr Embrey, then (forty years ago) Head Master of the Science School. Members of the class became, like himself, members of the Cotteswold Club, and some of them still remain so. Thus he showed, even in those early days, that he had wide and varied interests. Those who knew him well must have felt sure of a willing listener to anything of interest which they had to tell.

While still young, he left Gloucester and went to Cheltenham as part proprietor, with the late Mr Norman, of the "Cheltenham Examiner." Having taken a full part in the literary and scientific interests of the town, he became, on the establishment of County Councils, one of the representatives, and continued to be so up to the time of his death; his great services to the cause of education having been recognised by promotion from Councillor to Alderman. He was also placed in the Commission of the Peace. An excellent History of Gloucestershire, written for school purposes, fittingly records his love for the district he knew so well. In *every part* of the county he seemed to have some special interest—his wife was

a native of the Forest of Dean—and, indeed, had studied it from various points of view. They who knew him well might have felt sure that he would not write a History of a district without including an account of its physical geology. He gives an interesting account of the successive strata of the hills on either side of the Severn Valley which form a "scientific frontier," as the writer once heard him call it—he was quoting from a recent expression of Lord Beaconsfield relating to India. To him were of much interest visible features that, like the outcrop of the marlstone, explain why denudation has left particular outlines; just as he would feel if some feature in a building were explained by an older arrangement revealed by remains of it discovered behind or below the structure as now seen.

"Cheltenham Parish Church: Its History and Its Architecture" would be a remarkable book if only as the work of a very pronounced nonconformist. It is really an admirable account of a church which has a long and very interesting history, and serves to illustrate, in a very striking manner, the development of architectural styles as seen in church windows. The numerous records cited well illustrate the relations between the life of the church and that of the people. Among the many commendations which the book has received is a very cordial one from the rector.

Politically a strong Liberal, he was held in high esteem by a very large circle of friends without distinction of party. In family life his higher qualities were shown by devotion to the happiness of Mrs Sawyer, afflicted for many years with blindness.

In addition to other writings, he contributed three papers to the *Proceedings* of the Club (*see* Index to vols. i.-xviii., p. 16); on "The Early Man of the Cotteswolds" and "Pre-Domesday Cheltenham" to the *Proceedings of the Cheltenham Natural Science Society;* on "Gloucester, and Gloucestershire Worthies" to *Memorials of Old Gloucestershire* (1911); and "On Ancient Roads on the Cotteswolds" to the *Transactions of the Bristol and Gloucestershire Archæological Society* (xx., 247-254).

T. S. E.

The objects of the Club are to promote the systematic investigation of the Natural History and Antiquities of the County; to make excursions in the County and to other parts; to facilitate intercourse on scientific matters, and to aid in obtaining more general attention for the objects of Science.

Members are elected on a Certificate of Recommendation, signed by two Members, one of whom must have personal knowledge of the Candidate. The Admission Fee is £1; and the Annual Subscription is 15/-.

Winter Meetings are held at Gloucester, and there are frequent Field Meetings. Proceedings are published annually.

Forms of proposal for Membership and any further information may be obtained on application to the Acting Hon. Secretary.

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*** The Publication Committee's decision as to the publication of any paper is final, and the Committee will not be able to consider any paper unless it is placed in the Secretary's hands within a month of its being read.

[*The Editor of the Proceedings of the Cotteswold Naturalists' Field Club is directed to make it known to the Public that the Authors alone are responsible for the facts and opinions contained in their respective Papers.*]

S-ES-G
[Gloucesters

VOL. XIX. PART II.

PROCEEDINGS

OF THE

Cotteswold Naturalists'

FIELD CLUB

FOR

1916

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The Library of the Club is at the Public Library, Gloucester, and is open daily.

CORRESPONDENCE

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Subscriptions (15s, due 1st January each year) should be sent to the Honorary Treasurer, J. H. Jones, Eldon Chambers, Gloucester.

PUBLICATIONS

The Publications of the Club can be obtained by Members on application to the Acting Honorary Secretary. Particulars of these will be found on the inside page of the wrapper of Part 1., Vol. XIX, of the "Proceedings."

Lists of past Presidents and Honorary Secretaries, of Members for 1915, Societies exchanging Publications, Transactions, &c. in the Club's Library, and the Rules of the Club, will be found on pp. iv—xii, of Part I., Vol. XIX. of the "Proceedings."

PROCEEDINGS

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COTTESWOLD NATURALISTS'

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VOL. XIX. PART II.

1916

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Elected January 18th, 1916

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W. St. Clair Baddeley.

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Christopher Bowly, F.R.A.I.
M. W. Colchester-Wemyss
Rev. Walter Butt, M.A.
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J. M. Dixon, B.A., LL.B.
F. H. Bretherton

Hon. Secretary:

L. Richardson, F.R.S.E., F.G.S.

Acting Hon. Secretary:

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PROCEEDINGS

OF THE

COTTESWOLD NATURALISTS' FIELD CLUB

AT THE

SIXTY-EIGHTH ANNUAL GENERAL MEETING

JANUARY 18TH, 1916.

The Hon. Secretary announced that the President, Captain J. R. Ainsworth-Davis, was away on War Service, and had written expressing his inability to be present at the Annual Meeting.

In the absence of the President, the Rev. Walter Butt, Vice-President, was requested to take the chair.

The Minutes of the sixty-seventh Annual Meeting, held on Tuesday, January 19th, 1915, were read, confirmed, and signed by the Chairman.

The Chairman explained that he would be obliged to leave early, and therefore asked permission to read, before the business of the meeting was taken, a report (see Appendix)[1] from the Rev. H. J. Riddelsdell on the progress of the County Flora and the botanical work accomplished during the previous two years. Mr Butt mentioned that Mr Riddelsdell had sent a collection of violets obtained in Gloucestershire to Mrs Gregory, of Cambridge, the authority on this flower, with the result that twelve new varieties were established for the County, including, it was believed, *Viola rupestris*, Schmidt, the rarest violet in Great Britain, hitherto found only in Teesdale. Their member, Mr Charles Bailey, had examined the list, and described it as "amazing," and had sent to the meeting a collection of eighteen foreign varieties of *Viola* to enable comparison to be made.

The thanks of the Club were accorded to Mr Riddelsdell for his report and to Mr Bailey for his exhibit. Mr Butt then vacated the chair, which was taken by Mr G. M. Currie.

Mr J. W. Gray, the Club's delegate to the Manchester meeting of the British Association, presented the following report and was thanked for the same :—

"I beg to report that I attended the Manchester meeting of the British Association as delegate of the Club.

"After the formal business of the Conference of Delegates had been transacted on September 18th, the Chairman, Prof. Sir T. H. Holland, delivered his Presidential Address on 'The Organisation of Scientific Societies,' and Dr. W. E. Hoyle read a paper on 'Local Museums.'

1 Pp. 101-102 following.

"At the Conference on September 19th a resolution was proposed that papers read before scientific societies should be sent, before publication in their Proceedings or local journals, for the approval of some central authority, such as the Royal Society, in order to establish uniformity in their scientific value.

"In the discussion on the resolution, attention was called to several objections, among which it was submitted by Mr Henry N. Davies that as no notice had been given, no vote should be taken until the proposal had been submitted to the Societies represented at the Conference. Mr Davies proposed that a copy of the resolution should be sent to each of the affiliated Societies with a request that delegates should be instructed how to vote if the resolution were again brought forward. This was passed by a large majority.

"The following paper was then read :—

'COLOUR STANDARDS

(By J. Ramsbottom, M.A.)

"'In many branches of natural science it has long been felt that there is great need of uniformity in colour description, and that some definite colour standard should be adopted. Many schemes have been proposed at different times by naturalists. The commonest method, and the oldest, is to give an idea of the colour by mentioning some well-known object. The other method is to have a scale of colour samples, which may be named or merely numbered. Recent attempts at colour standards on this basis have each something against their general adoption. Except for horticulturists, mycologists, and possibly ornithologists, they are much too full. It would seem best to have a well-arranged list of, say, two hundred well-named colours for ordinary use, which colour scheme could be amplified in those branches of science where needed. Similar amplified standard schemes might also be used in those trades or arts where stress is laid upon colour.'

J. W. GRAY.

"Bournemouth, December 15th, 1915.'"

The Hon. Secretary (Mr L. Richardson) read the following Report, which shows that in spite of difficulties created by the War, interest and activity in the work of the Club during the year were maintained.

REPORT FOR THE YEAR 1915

As the majority of the Members are doubtless aware the Royal Agricultural College at Cirencester was closed at the end of the summer term of 1915, the majority of the students having obtained commissions in the Army. Prof. Ainsworth-Davis, the Principal, our President, obtained a captaincy in the Army, and for this reason he has been unable to preside over the last few meetings of the Club. Unfortunately, he now feels compelled to resign his membership. He has asked me to convey to you his best thanks for conferring on him a distinction which he values highly.

During 1915 the Club has lost by death an Honorary Member, Dr. Charles Callaway, and four Ordinary Members—Deputy Surg.-Gen. G. W. Watson, Mr Croom-Johnson, Mr John Sawyer and Mr Nash Skillicorne. Everyone in the County interested in archæology, I think I may confidently say, misses Mr Sawyer, who was always so ready to assist in any movement that had for its object the popularization of archæology or natural history. He was born on October 17th, 1848, and died on March 1st, 1915.

By the death of Dr. Charles Callaway the Club has lost a former President and an eminent Honorary Member. I had the privilege of contributing to the "Geological Magazine" an account of the doctor's useful work in the cause of geology.

The number of Honorary Members at the close of 1915 was four; of Ordinary Members 113. At the end of the preceding year there were five Honorary Members and 116 Ordinary Members, so that there was a decrease of four in the membership in 1915 as compared with 1914. It is to be hoped that in these unsettled times the Members will continue to support the Club and its work. Whilst this is the sixty-eighth Annual Meeting, the Club has this year (1916) been in existence seventy years, having been founded in 1846.

During the past few years a considerable amount of research work has been done by certain Members of the Club. Some of the results have been published, but the funds at the disposal of the Club for publication purposes will not admit of all that is offered or available being accepted.

The War has naturally affected the excursions of the Club during the past year. The proposed excursion to Avebury had to be abandoned owing to the impossibility of obtaining motors, and that to the North Cotteswolds was restricted to a visit to Hailes. An additional excursion, however, was organised, namely, to Tetbury, to see the deep boring that was being made at the waterworks. As full particulars of the excursions appear in the *Proceedings*, it is unnecessary to give details of them now, but it may be stated that all were very satisfactorily attended.

During the present year I regret that I shall be unable to continue the secretarial work of the Club, which I have now done for twelve years; but, if it is your desire, Mr Roland Austin will very kindly act for me.

The Hon. Treasurer submitted the financial statement, which showed an adverse balance of £11 15s., though this would be met by the payment of subscriptions in arrear. The statement was approved.

The Chairman then proposed the election of Mr W. St. Clair Baddeley as President for the ensuing year. He had had the pleasure of knowing Mr Baddeley in connection with the Bristol and Gloucestershire Archæological Society, and the Members of the Club had already been favoured with his presence at their meetings, which had been enriched by his intimate knowledge of the County. He was sure Mr Baddeley would prove a most efficient President. Before putting the motion the Chairman said he felt sure Members would wish their thanks and appreciation conveyed to the retiring President for the services he had rendered to the Club, coupled with the hope that when more normal times returned they would have the pleasure of seeing him again at their meetings.

Mr Baddeley, in taking the chair as President, thanked the Members for the honour they had done him. He said that when he reflected on the various attractions of their County—its rivers, hills and valleys, and archæological story—and when he recalled the past history of that Club, it was easy to realise the greatness of the honour they had done him, but it was equally difficult to understand why they should have chosen him as President. He did not attribute it for a moment to anything he had been able to accomplish in the past, but it was probably due to the fact that in him they recognised one who sympathised with their main objects. He should like to congratulate them also on the way in which their studies and excursions tended to stimulate inquiry into the various subjects with which the Club was concerned. He had

evidence of this in the inquiries made directly of him concerning the movements of the Club. It so happened that they must have their forthcoming meetings and excursions under the shadow of a world-wide disaster, and whatever studies and labours might be taken in hand, they would feel when another year was at an end that at least they would have extended their knowledge and appreciation of one another.

The Vice-Presidents, Elected Members of Council, and Officers, were re-elected, the only change being the election of Mr F. H. Bretherton as a Member of Council in place of Major Wenden.

The President said that opinions varied on the question of holding field meetings during the War, and pointed out that while amusements in various forms were carried on as usual, he could not conceive how serious objection could be raised to such meetings in connection with a scientific society, and he himself was quite unable to take any narrow view of the matter. It was, however, for Members to decide. In discussion there was a unanimous feeling that while the number of meetings might be reduced, and that any arranged should be carried out as quietly as possible, the objects of the field meetings are such that no misunderstanding could arise.

The following programme was agreed to provisionally :—

May 16th—Stanley St. Leonards.

June 6th—Monmouth and Trelleck.

July 11th—Climperwell and Brimpsfield.

September 14th—Westbury-on-Severn.

The President expressed the general appreciation and sense of obligation to Mr Richardson for his unwearied attention to the direction of the Club during the twelve years he had filled the office of Honorary Secretary, and the hope that, though his work in connection with the War would prevent his being with them for the present, happier times would find him once more in their midst and conducting the affairs of the Club in the same able manner.

Mr. Richardson thanked the Members for the kind way in which his services had been referred to.

ORDINARY WINTER MEETINGS, 1916

TUESDAY, FEBRUARY 15th, 1916.

W. ST. CLAIR BADDELEY, President, in the Chair.

The Minutes of the Meeting held November 23rd, 1915, were read, confirmed and signed.

Mr F. J. Cullis exhibited a fine specimen of a Giant Puff Ball (*Lycoperdon bovista*, Linné), found beneath the floor of a house in St. Aldate Street, Gloucester, a very unusual situation; and Mr J. W. Skinner reports on "The small objects and the human skulls found in the Hal-Saflieni prehistoric Hypogeum at Casal Paula, Malta." Mr Charles Upton exhibited a specimen of palæozoic glacial drift from Bigganjargga in the North of Lapland. The age was a little uncertain, but probably the rock was of the Silurian period. The glacial drift rested upon striated quartz rock, and was capped by similar rock.

The following communication was made:—

AN ACCOUNT OF THE SILURIAN INLIER OF USK, WHERE THERE ARE EXPOSED BEDS OF LUDLOW AND WENLOCK AGE, BY C. I. GARDINER, M.A., F.G.S., WITH PALÆONTOLOGICAL APPENDIX, BY F. R. COWPER REED, M.A., F.G.S.[1]

The paper was illustrated by sectional maps, and an interesting collection of fossils from the beds described, including five new species and two new varieties.

The President expressed the interest created in the subject by the clearness with which the lecturer had presented it, and the Rev. H. H. Winwood congratulated him on the work accomplished and the records made of new species and varieties. Mr Charles Upton and Mr F. J. Cullis also joined in the discussion.

Mr Gardiner then showed a series of lantern slides illustrating glacia action in Great Britain and elsewhere, and made some observations on the glacial periods and the antiquity of man.

TUESDAY, MARCH 21st, 1916.

W. ST. CLAIR BADDELEY, President, in the Chair.

The Minutes of the Meeting held February 15th, 1916, were read and confirmed.

The following papers were read:—

1.—NOTES ON THE WINTER MOTHS.

(*a*) *Cheimatobia brumata*, L.
(*b*) *Hybernia defoliaria*, Cl.
(*c*) *Anisopteryx æscularia*, Schiff.

By C. GRANVILLE CLUTTERBUCK, F.E.S.

ABSTRACT

The distinguishing features of the Winter Moth as compared with the Codling Moth are that the former is a Geometer, flies in winter, has a semi-wingless female, which lays its ova in small groups, its larva feeds on leaves, and has only two pairs of prolegs; while the Codling Moth is a Tortrix, flies in summer, has a winged female, which lays its ova singly, its larva burrows into fruit and has five pairs of prolegs.

1 Printed pp. 129 *et sqq.*

The Winter Moth emerges from the pupa at intervals from October to February, according to the weather. I have obtained specimens commonly in Gloucester and the London District. I took a male on a gas lamp near Dean's Way, Gloucester, on the 30th November, 1915, whilst on police patrol, although 17 degrees of frost were registered two days before. This shows that the moths are not affected by severe cold. My earliest date is the 29th October, and my latest the 12th February.

The methods of control are fully set out in the Leaflet No. 4 issued by the Board of Agriculture, to which the reader is referred. They also apply equally to the other two species mentioned subsequently.

Mr W. B. Davis, of Stroud, says *in litt.* :—" The Winter Moth is common enough about here. I have usually observed the males on tree trunks or at light, where it comes regularly ; but one year, I believe in 1909, returning one calm and warm evening late in December from Park Wood, I saw the males literally in dozens gently flitting along the hedgerows and over the low bushes and herbage in the wood clearings, and I associate the time of flight with a darkness in which you flounder about pretty helplessly on rough ground. I have only occasionally seen the female, and then generally on smooth bark trees, as Beech, etc., where it is, of course, more conspicuous. The grease band used by fruit-growers, etc., is generally efficacious, but is not an absolute preventive, as the male has been known to fly about with the female when in copula. I have noted the larvæ as very abundant in 1899, and much less so in 1900. Though polyphagous as regards bushes and trees, I fancy its favourite food plants are the Rosaceæ. I know years ago I used to beat it out of hawthorn hedges in quantities, and I have often met with it curled up in the blossoms of the Crab when searching for the larvæ of the Green Pug Moth (*Eupithecia rectangulata*)."

Upon the question of parasites on the species, Mr Claude Morley, F.E.S., states that the following Ichneumonidæ have been recorded from *C. brumata* : " *Campoplex pugillator*, Linn., in Germany ; *Sagaritis zonata*, Grav., in Devon ; *Phobocampa crassiuscula*, Grav., in New Forest; *P. unicincta*, Grav., in Devon; *Agrypon flaveolatum*, Grav. (the principal parasite of this moth, cf. Ichn. of Britain, vol. v., pp. 255-6) ; *Mesochorus confusus*, Hlgr., and *M. crassimanus*, Hlgr. in New Forest ; Braconidæ : *Apanteles juniperatæ*, Bouché, and *A. immunis*, Hal., *Meteorus pulchricornis*, Wesm., *M. ictericus*, Nees, and *M. pallidus*, Nees."

One of these, *Mesochorus confusus*, has also been recorded as a parasite on the Gipsy Moth (*Porthetria dispar*).

These parasites work in the following manner: The female fly usually lays one or more eggs upon the moth caterpillar, known as the host, from which larvæ hatch out in a few days. These larvæ burrow through the skin of the host and feed upon the juices and tissue of its body, avoiding at first the vital parts by instinct. The host stung in this way never arrives at maturity, being eventually entirely devoured by the fly larvæ, which then emerge, form their pupæ on the skin of the host or on some neighbouring object and in due course produce the flies.

Experiments have been carried out in the United States in order to control various injurious species of Lepidoptera. The Winter Moth does not apparently occur there, but a most interesting account of the importation of the parasites of the Gipsy Moth (*Porthetria dispar.*) and the Brown Tail Moth (*Euproctis chrysorrhœa*) was published by the United States Dept. of Agriculture in 1912.

The authors, L. O. Howard and W. F. Fiske, point out that the study of parasitic insects dates back to 1602, but that the earliest suggestion regarding the artificial handling of beneficial insects was printed in Kirby and Spence's " Entomology," published in 1816. The authors claim considerable success, and express hopes of being able to control the pests.

The Mottled Umber or Great Winter Moth (*Hybernia defoliaria*) is about twice as large as the Winter Moth. The male has the fore wings pale brown or brown-yellow, each with two dark bands. The hind wings are paler, and have a brown spot near their middle. All the wings are sprinkled with small dots. This is a most variable species, and hardly two specimens are identical. The wings of the female are practically abortive.

I have often found the caterpillar, but have very seldom succeeded in rearing the moth. It seems to be very delicate in confinement. Mr Davis says *in litt.*:—"They seem unable to withstand the ill treatment of an artificial existence." Specimens have been taken by me in Gloucester on various occasions.

My earliest date appears to be the 7th November, and my latest the 20th December.

Mr Morley records the following Ichneumonidæ from this species:—*Platylabus pedatorius*, Fab., on the Continent; *Microcryptus nigrocinctus*, Fab., in Devon; *Casinaria moesta*, Grav., in Britain; *Anilasta clausa*, Brisch., in Devon; *Agrypon flaveolatum*, Grav., in Germany; *Paniscus virgatus*, Fourc., in London. Braconidæ: *Apanteles solitarius*, Ratz and *A. salebrosus*, Marsh.

The authors of the previously mentioned work on parasites record *Blepharidea vulgaris*, Fall. as having been reared from this species. They also mention 48 other species which have been recorded as the host of this fly. I have reared it myself from *Carpocapsa pomonella*, so that it is apparently parasitic on no less than 50 species of Lepidoptera.

Mr Davis says *in litt.*:—"I have taken *H. defoliaria* freely at light here, where it is melanic to a more or less degree—at least, the prevailing form is much darker than the specimen first figured in Newman. My notes of the larvæ are: Not uncommon on sloe, oak, and hawthorn in 1899. Beaten freely from oak in 1900."

The March Moth (*Anisopteryx æscularia*) has a brownish head. The fore wings are brown or yellow-brown with transverse bands; the hind wings are pale greyish-white, with a darker zig-zag line running across them. The moth measures about three-quarters of an inch in length and up to one-and-a-half inch in spread of wings. The female is wingless, brownish yellow, and has a pencil or tuft of hairs at the tail. The March moths appear typically, as the name indicates, in March, but they may be found earlier.

My earliest date for finding the imago is the 10th February and the latest the 27th April. The male has a curious resting habit. It folds its fore wings over its body and assumes a triangular shape. Its favourite position in the day time is clinging to a wooden fence, amongst the splashes of mud, to which it bears a wonderful resemblance. I have frequently found it in such a situation.

Mr Davis tells me that it occurs not uncommonly at light in the Stroud district. He has found it as difficult to rear from the larva as the previous species. Mr Morley informs me that the following Ichneumonidæ have been recorded from it: "*Sagaritis incisa*, Bridg., in Britain; *Cymodusa cruentata*, Grav. in Devon, *Labrorhychus tenuicornis*, Grav., in Devon, and the following Bracon: *Meteorus pulchricornis*, Wesm.

REFERENCES.

Stainton's Manual (1859), vol. ii., pp. 71, 76; Newman's "Butterflies and Moths" (1869-71), pp. 104-106; Meyrick's "Handbook of British Lepidoptera" (1895), pp. 222, 252, 275; and Barrett's "British Lepidoptera" (1907), vol. vii., pp. 231, 247, and vol. viii., p. 388.

2.—THE FLORA OF THE GLOUCESTER DOCKS.[1] By J. W. HAINES.

1 Printed pp. 119-124 following.

TUESDAY, NOVEMBER 21ST, 1916.

In the unavoidable absence of the President, Mr. G. M. CURRIE was requested to take the Chair.

The Minutes of the Meeting held March 21st were read and confirmed.

Messrs J. Fairlie Muir, Crofton Lodge, Cheltenham, and Wilfred Killigrew Wait (Major), of Brimpsfield House, Gloucestershire, were proposed for membership.

Mr T. S. Ellis read a paper on "The Natural History of the Human Foot," which he illustrated by lantern views.

Mr Charles Upton read notes on, and exhibited some additions to, the land and fresh-water Mollusca of Gloucestershire.

Mr C. G. Clutterbuck exhibited the pupa and cocoon of the Death's Head Moth, *Acherontia* (*Manduca*) *atropos*,—and a coloured drawing of wild Gladioli found at Whitminster which he had not been able to get identified.

TUESDAY, DECEMBER 19TH, 1916.

W. ST. CLAIR BADDELEY, President, in the Chair.

The Minutes of the Meeting held November 21st, were read and confirmed.

The candidates proposed for membership at the previous Meeting were balloted for and declared duly elected.

The President spoke of the proposal of the Council that some of the Meetings of the Club should be of an informal nature, and expressed the hope that Members generally would endeavour to carry out the objects in view by bringing forward for discussion subjects of interest to the Club, and in other ways help to maintain its activity and work.

The President exhibited slides illustrating Roman Britain; Mr William Bellows slides showing Russian scenery; and Mr C. I. Gardiner slides illustrating various forms of Rock Structure in Kerry, Skye, and elsewhere.

Mr. L. Richardson communicated an abstract of notes on "Additional Deep Borings at Shipton Moyne, Gloucestershire."

The Members present expressed approval of the room at Northgate Mansions which had been engaged for the winter meetings.

EXCURSIONS, 1916

(*Reports by* ROLAND AUSTIN and W. THOMPSON)

EXCURSION TO STANLEY ST. LEONARD.

TUESDAY, MAY 16th, 1916.

(*Director :* W. ST. CLAIR BADDELEY, President)

The first of the Field Meetings arranged for the year was favoured with fine weather, and though the attendance of Members was less than usual those who met at Stanley St. Leonard Church were rewarded by the interesting way in which the President described its history and that of the conventual buildings still remaining. The Members present were: The President, Charles Upton (Vice-President), Roland Austin (Acting Hon. Secretary), T. S. Ellis, J. C. Frith, E. W. Fyffe, H. H. Knight, E. P. Little, A. S. Montgomrey, J. W. Skinner, W. Thompson, and visitors.

Before conducting the Members to the Church, the President expressed the regret all felt that owing to indisposition the Vicar, the Rev. Charles Swynnerton, F.S.A., was unable to be present. Their thanks were due to him for the care with which he was carrying out the restoration of the Church, and those interested in the archæology of the County were indebted to him for the discoveries he had made. The Vicar had undertaken to give an account of the Church, but now asked him to do so.

The President gave an outline of the history of the Manor, and of the Priory, presenting many new facts which he had gathered from records, and then conducted the party first to the conventual buildings and the smaller Church—the original Parish Church of the village—and afterwards to the Priory Church, pointing out in a very clear way the features of interest to be noted. The information thus imparted is embodied in the paper, supplemented by plans, printed (pp. 103-114) in this number of the *Proceedings*.

During the restoration of the Nave, some interesting discoveries have been made. In a paper in the *Church Builder* for July, 1915, the Rev. C. Swynnerton states that on taking down the matchwood ceiling it was seen that the roof was of oak of the fourteenth century. The eastern cloister processional door was found and from the built-up space were recovered most of the external carvings, consisting of chevrons and pellet mouldings, with portions of shafts and a Norman capital and base. Stripping the plaster revealed the doorway of a staircase in the thickness of the south wall of the Nave, leading up to another doorway, which opened on to a screen. The staircase was lighted by a small perpendicular window looking into the nave. It was also found that the jambs of the recess in which is built the west window were carried upwards in the masonry, showing that when the roof was lowered in the fourteenth century the arch had also been lowered from above, where possibly it may have covered one or more Norman windows in the original design. A very fine aumbry was found in the north wall of the Presbytery, vaulted, with a Norman ribbon moulding over it similar to the string courses of the north and south walls.

On leaving the Church the Members passed into the grounds attached to the Manor House, and then on to the Schoolroom, where arrangements for tea had kindly been made by Mrs Swynnerton.

REFERENCES.

Stanley St. Leonards. The College of Canons and Collegiate Church. By J. Henry Middleton. *Trans. Bristol & Gloucs. Arch. Soc.* (1881), v., 119-132, with plates and plans.

The Church of St. Swithin, Leonard Stanley. By L. W. Barnard. *Gloucester Diocesan Magazine* (1909), iv., 151-153, with views and plan.

Stanley S. Leonard, Gloucestershire. By Rev. Charles Swynnerton, F.S.A., Vicar. *Church Builder*, July, 1915, pp. 84-91, with views, plate, and plan.

The President's paper, printed pp. 103-114 following.

EXCURSION TO MONMOUTH AND TRELLECH

TUESDAY, JUNE 6th, 1916.

(*Directors :* Mr THOMAS MARTIN SKINNER and REV. T. DAVIES)

The programme for the second Field Meeting included ground already familiar to the Club—Monmouth having been visited in 1893 and 1910. Trellech proved a district new to most, and by general consent the day was one of full interest. Owing to a long-standing engagement in London, the President was unable to accompany the Members, who met at Gloucester Station and travelled to Monmouth (May Hill), where they arrived at 11.7. Those present were Charles Upton (Vice-President), Roland Austin (Acting Hon. Secretary), F. H. Bretherton, J. M. Collett, Rev. J. J. D. Cooke, F. J. Cullis, Lieut. Col. J. C. Duke, T. S. Ellis, E. W. Fyffe, J. W. Haines, F. Hannam-Clark, E. P. Little, A. S. Montgomrey, J. W. Skinner, T. M. Skinner (guest), and W. Thompson. The party were met at May Hill Station by Mr T. M. Skinner, who has been so long resident in Monmouth, and possesses such intimate acquaintance with its history and antiquities that he proved a delightful guide in every way.

Monmouth has been (without sufficient grounds) identified with the Roman *Blestium*. The original Welsh name is Aberfynwy (modernised as Trefynwy), meaning "the Monnow mouth." That part of the town bounded by the river Monnow on one side, and Clawdd-dhu (the Black Dyke), a wide ditch, on the other, was, and is now, known as "Over Monnow."

On leaving the station Mr Skinner drew attention to the Bridge over the Wye, built in 1643, and mentioned the trade borne by the river between Chepstow and Monmouth in earlier days. The Grammar School, on the town side of the Bridge, was founded in 1614 by William Jones, a wealthy Hamburgh merchant, who is said to have been born at Newland—to which place he was also a benefactor—or Monmouth.

As the Members made their way to the Church the sites of the fosse and the several gates of the fortified town were pointed out. The chief point of interest in the remains of the Benedictine Priory, founded in the eleventh century by Wihenoc de Monmouth, Lord of the Manor, is the Oriel Window, known as "Geoffrey's Window," a reminder of Geoffrey of Monmouth, a reputed native of the town, who became Archdeacon of Monmouth, and whose *History of the Britons*—a work consisting largely of myth, legend and

tradition—enjoyed great popularity in Norman days. His inventions were adopted as facts by Alfred of Beverley, and were translated by Gaimar and Wace into French verse. Green, the historian, states that "out of Geoffrey's creation grew little by little the poem of the Table Round."

The Parish Church has been much restored, but contains interesting work of Norman date, a Saxon font, a cresset stone discovered during the restoration, and a good collection of old tiles placed so that they are secured from defacement. There is a fine chancel screen by Street. Henry V. is credited with having brought the bells from Calais, tradition saying that when he was about to sail for England after the battle of Agincourt, the people of Calais rang a peal of joy, whereupon the King took possession of the bells, and had them hung in his native town.

The party then proceeded to the Castle, of which little remains to indicate its former strength and importance. Its date is uncertain, though Camden attributes it to John of Monmouth, and it was certainly standing in the time of Henry III. A favourite residence of John of Gaunt and of Henry IV., it was here that Henry V. was born, to whose memory a statue is placed in the Market Square. A narrow window, with remains of some tracery, is still pointed out as marking the room where his birth took place. In the Record Office is a mandate from Henry VI. to his steward of Monmouth to repair "a certain tower of our Castle of Monmouth, where our very dear Father of famous memory was born, called the Gatehouse, which is very weak and ruinous."

Near the Castle ruins is the old Dower House of the Beauforts, now used as the headquarters of the Monmouthshire Regiment, and by the courtesy of Colonel Morgan Lindsay the Members were invited to see the officers' mess room, in which is a very remarkable ceiling of plaster ornamentation, believed to be the work of an Italian. It is in perfect preservation, and there can be few finer specimens of such decoration. As it chanced, Lord Raglan, grandson of Field-Marshal Lord Raglan, Commander of the Forces in the Crimea, was in the building at the time, and he very kindly gave information as to its associations.

On leaving the Castle, Mr Skinner conducted the Members to the garden adjoining the Capital and Counties Bank, with which he was connected for many years, where they were able to see a portion of the town wall, with its bastion and sally port, and also a chair in which Lord Nelson is said to have sat when he visited Monmouth on August 19th, 1802.

On the way to the "Beaufort Arms," where lunch was taken, Members saw the striking statue by Sir Goscombe John erected in the Market Square to the memory of the Hon. C. S. Rolls, son of Lord Llangattock, well known as a pioneer in the use of the automobile and one of the first Englishmen to take up aviation. He was killed while making a flight at Bournemouth, July 12th, 1910.

At 1.15 the Members entered the brakes which were in readiness for the drive to Trellech, and after passing under the Bridge Gate on Monnow Bridge, stopped to visit the Norman Church of St. Thomas-over-Monnow. Mr T. M. Skinner mentioned that until the eleventh century Monmouth was in the diocese of Llandaff and from then until 1843 in that of Hereford, at that date being restored to Llandaff.

The Church of St Thomas stands in what was formerly known as "Cappers Town," or Overmonnow—a place distinct from Monmouth—owing its name to the industry of "cap-making" formerly carried on there. The following notes are condensed from an account prepared by Mr P. Potter for the visit of the Cambrian Archæological Association in 1885:—

The west door is modern, old inhabitants remembering the Church with a blank west-end wall used at times for games of base-ball! Prior to 1830

the Church was almost a ruin, but was then restored by Mr Thomas Wyatt, of Troy, the west doorway built in brick and cement, and other work carried out. The present west doorway was built in 1880, following closely the pattern of the earlier one. At the same time the original jambs of the north doorway were replaced, their design being copied. The arch is considered original. The chancel door seems to be original work, except the pediment, which in 1874-1875 was replaced in Forest of Dean stone instead of sandstone. At the same time the walls of the chancel were stripped of the plaster which covered them, and windows added on the south side and one on the east wall. Those on the north are of early date. The chancel-arch is Norman work. The windows of the nave are modern. Other interesting features are the hagioscope and an aumbry on the south side of the sacrarium.

The drive was continued, the rising road to Trellech (modernised as Trelleck), which lies some 800 feet above sea level, giving opportunity for extensive views over the surrounding country towards the Welsh Hills.

Reaching Trellech Church about 2.30, the party was met by the Vicar, Rev. T. Davies, who had received the suggestion of the visit with the utmost cordiality. Before entering the Church the Vicar spoke of the meaning of the place-name, which is generally held to be derived from the Welsh "Tre-llech," or "Tri-llech"—the three stones—referring to the upright stones standing in a meadow near the Church. The second form occurs as early as the seventh century, being written so in a grant of that date recorded in *Liber Landavensis*.

The Church is of stately proportions, apparently for the most part an early example of the Decorated period, the arch at the western end being especially fine. Entering, the Vicar pointed out the features worth attention, these being the Laudian sanctuary rails, with twisted columns, continued on three sides round the altar; the old altar now used as a credence; the pulpit dated 1640; the south door dated 1595; and the west window, of the same period and design as some of the windows at Tintern. The piscina has some interesting carving. Amongst some of the old stone work arranged near the western entrance are two querns, a double piscina, and the greater part of an old font with an octagonal shaft.

The Church possesses two pieces of plate of great interest. One is an Elizabethan chalice inscribed "T.L. 1576," which has a belt of intersecting foliated strap ornament round the bowl. The other, a pewter flagon, with lid, thumb piece and handle, 14 inches high and weighing over 5 lbs., bears the date 1620 on the lid. It is peculiar for the rows of numerals engraved on the handle, the meaning of which has baffled all inquiry.

Near the south doorway has been placed an old stone sundial dated 1689, on the pedestal of which are represented the chief objects of interest in Trellech. This was formerly in the school-yard, but removed into the Church for preservation. The dial was given by Lady Magdalen Probert, who was evidently greatly interested in the antiquities of the parish. The inscription HORA DIEM DEPASCIT EUNDO is lettered round the four sides of the dial. On the first panel of the pedestal are the words

MAGNA MOLE

with a representation of the mound, or tumulus, near the church, and under this

O QUOT HIC SEPULTI

in reference to the men supposed to have been slain in battle here.

On the next panel is

MAIOR SAXIS

under which are carved the three stones, marked 8, 10, 14, respectively—their approximate heights—and under them

HIC FUIT VICTOR HARALD

another allusion to the supposed combat.

On the third side is cut

MAXIMA FONTE

and a carving of the famous drinking well of Trellech, and two cups, under which is the inscription

DOM. MAGD. PROBERT OSTENDIT

The Vicar's reading of the various inscriptions is that the Parish was held to be great in regard to its tumulus, greater on account of its monolithic stones, but greatest of all for its well, which was prized for the healing power of its waters.

Leaving the Church, the Vicar drew attention to the remaining portions of a cross, consisting of the base standing on five steps and part of the shaft, and near this is a very massive stone, some eight feet long, resting on two upright stones, about which nothing seems to be known.

Near the Church is "The Mound," formerly considered the burial place (as the inscription on the sundial records) of men slain in battle when Harold was victorious, and by some held to have druidical associations, but well-known Welsh archæologists have pronounced it to be a good specimen of a moated mound. It is 17 yards in diameter, and has been well preserved. Coxe, in his *History of Monmouthshire* (1801) states that a castle was erected here by one of the Clares. In the Patent Rolls (Henry III., 1258-66, p. 242) is the following entry:—

> Feb. 4, 1263. Mandate issued to Humphrey de Bohun Earl of Hereford, of the lands late of Richard de Clare, Earl of Gloucester, who died in 1262, to deliver to Maud, Countess of Gloucester, the manor of Usk, the manor of Trellech, with the fortalice, conveyed to her in dower.

Before leaving the earth-work, Mr. T. S. Ellis referred to Mr Buckman's suggestion (*Proceedings*, vol. xiii., p. 32) that in the process of time the stream flowing at Trellech might cut back to the Wye, and, having diverted the course of that river, leave the Chepstow Gorge in much the same condition as that of Cheddar. He pointed out the difficulties which would have to be overcome to make such a change.

Time did not permit close inspection of the "Three Stones," though these were well seen from the farmyard below "The Mound." They are monoliths of red sandstone conglomerate, or "pudding-stone," their measurements being given by Colonel Bradney as 8 ft. 10 in., 10 ft. 4 in., and 14 ft. 2 in. respectively. The space between the first and the second is fifteen feet, and between the second and the third, eighteen feet. They have been claimed as druidical and said to have formed part of a stone circle, but no definite conclusions have been arrived at. Locally they are known as "Harold's Stones," in allusion to the battle supposed to have been fought by Harold, but the tradition cannot be traced earlier than the carving on Lady Probert's sundial.

Another tradition, cited by Miss Eyre (*Folk-Lore*, xvi., 164), is that the stones were flung from the top of Trellech Beacon by "Jacky Kent," and the Devil. The distance is just under one mile, but that appears to have been a trifle to Jacky—"he were always a-flinging stones."

About half-a-mile from the Church, in a meadow bounding the road to Tintern, are the Wells, known as "St. Anne's Well" and "The Virtuous Well," and to these the Members walked. The Chalybeate Well is enclosed

in a walled area but not covered over, and the central spring has an arched recess, from which there is a flow of water, which leaves a highly-coloured ferruginous deposit. This was tasted by one adventurous Member, but from his description of it there was no urgent desire on the part of others to do so. On each side of the arch and opposite to it are springs of ordinary water.

Miss Eyre has gathered some interesting folk-lore associated with the wells. It is said there were once nine, each of which was supposed to cure different diseases. The centre well was used as a "wishing" well, it being the custom to drop pebbles into the water as the wish was made. If bubbles came freely to the surface the wish would be realised, if few, there might be delay in obtaining it, while if none came it would not be granted. There was also the tradition that fairies danced by the wells, drinking water from the harebells which next morning would be found scattered on the ground. The owner of the land, a surly farmer, stopped up all the wells but one, which he kept for his own use. As the result the water on his land gave out, and on going to the well he found a little old man sitting on the edge, who said there would be no more water until the farmer thought more of his neighbours' wants. The wells were cleared, the drought ceased, and the waters ran once more. Thus legend!

Nathan Rogers in his *Memoirs of Monmouthshire* (1708) says that "Treleg Wells, which of late years have been much frequented, and have been found very medicinal, are of the nature of Tunbridge waters, flowing from an iron-oar (*sic*) mineral."

While assembled round the wells, Mr Charles Upton took the opportunity of thanking the Vicar very warmly on behalf of the Members for his kind reception of them and giving them so much information concerning the antiquities of Trellech. He also thanked Mr T. M. Skinner (who accompanied them) for making their visit to Monmouth so interesting.

A large tract of peaty ground some little distance beyond Trellech was searched by the botanists of the party, who secured some of the various bog plants. On this was growing large quantities of feathery cotton grass.

Shortly after 4 o'clock the brakes started for Tintern, where Members took tea, and then returned to Gloucester by train.

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Burial Mounds in Monmouthshire. By M. E. and W. Bagnall-Oakeley. 1889. Pp. 13-15, plates v.-vi.

The Folk-Lore of the Wye Valley. By Margaret Eyre *Folk-Lore* (1905), xvi., 163-166, plate of sun-dial at Trellech.

Proceedings of the Cambrian Archæological Association at Trellech 1908. *Archæologia Cambrensis* (1909), Series 6, ix., pp. 67-71, with illustration.

History of Monmouthshire. By J. A. Bradney. Vol. ii., pt. 2. The Hundred of Trellech. 1913.

EXCURSION TO BRIMPSFIELD AND ELKSTONE.

TUESDAY, JULY 11th, 1916.

(*Directors :* The PRESIDENT and REV. T. S. TONKINSON)

The district chosen for the third Field Meeting was almost entirely new to the Members as a Club, for Elkstone was the only place which had been visited before—as far back as 1873. Owing to the general wish of the Club that the meetings arranged should not in any way divert requirements of war service, the use of motors has been discontinued, but while horse conveyances take longer to cover the journeys from place to place there is compensation in the greater pleasure in travelling, and the better opportunity for conversation and observation of scenery. For this meeting the majority of the Members gathered at Gloucester Station (G.W.R.), and at 10.45 started in brakes for Climperwell, travelling by way of Brockworth and Cranham Woods, meeting near Foston's Ash the President and others who had cycled.

Those present were :—The President, Christopher Bowly and Charles Upton (Vice-Presidents), F. H. Bretherton, H. W. Bruton, Roland Austin (Acting Hon. Secretary), F. J. Cullis, J. M. Dixon, Lieut.-Col. Duke, T. S. Ellis, G. Embrey, E. W. Fyffe, J. W. Gray, J. W. Haines, F. Hannam-Clark, J. H. Jones, H. H. Knight, E. Lawrence, E. P. Little, Surgeon-Major I. Newton, A. S. Montgomrey, E. C. Sewell, W. Thompson, L. Wilkin and some visitors.

Soon after noon those driving reached the point near the cross roads, where the President and others were waiting. Here the President drew attention to the remains of a Round Barrow in a field on the Cranham side of the main road, and exhibited a grinding stone or "mill" and a piece of hand-made pottery taken from the Barrow during excavation in 1881 and presented to Mr Baddeley by Mr C. T. Davis, son of the late Mr Uriah Davis, of Painswick. The prehistoric hand "mill" bears traces of much ancient use. Reference was also made to the long West Tump in the wood nearer to Birdlip and to the round one in Buckholt Wood. There are also two round Tumuli at Climperwell itself, and from a wooded slope dominating the landscape in the direction of Miserden Park a view was obtained of the Long Barrow near Caudle Green.

Moving on, the carriages turned to the left and descended to Climperwell Bottom, a secluded spot which probably few except pedestrians visit. Here the President, by whose happy suggestion the visit was included in the programme, said that the place-name Climperwell had been traced back to "Clumpers"—clods on the newly ploughed ground—and the sense may be "the well among the Clumpers." The first mention of the place-name occurs in 1227, when the Manor, with part of Brimpsfield, was given to the Cistercian Abbey of Flaxley by the Giffards of Brimpsfield.

An *al fresco* lunch was then taken, after which most of the members walked through the woods, permission having been very kindly granted by Mrs Wait, on behalf of Major H. W. K. Wait, who is on service in France. On their return, the brakes proceeded up the ancient Rudgeway leading to Brimpsfield, which was reached punctually at 2.15. Here the Vicar, the Rev. P. C. W. Earée, and many of the villagers, including the parish clerk—one of the old type—were waiting to welcome the Club.

Standing near the Fosse, which is all that remains of Brimpsfield Castle, the President gave a most interesting account of the Manor and Castle, which were held by the powerful family of Giffard. Mr Baddeley said :—

That a glance at the map would show the baronial as well as the topographical significance of the Castle at Brimpsfield. They had already

been beside one ancient high road, along whose sides were constructed the prehistoric tumuli in which the locality was so rich, and Brimpsfield was situated between this and the Ermine Way, which linked Gloucester to Cirencester, *i.e.*, within a great angle formed by both of these. The great barons at the Castle could exercise control over this road, and no one could pass without paying toll if the Giffards were so disposed. To illustrate this, Mr Baddeley mentioned that in the reign of Edward II. one of these bold barons stopped the royal baggage-train as it was conveying hams and other articles of food for the king's use to Glouecster, and brought the booty into his Castle. This was followed by his being captured and taken to Gloucester, where he was hanged and quartered, and his remains were exhibited on the four gates of Gloucester.

The first of the Giffards to hold the Castle was Walter, a great baron like De Laey, who owned Painswick and Duntisbourne, and who lived in Normandy before coming to fight at Hastings. Walter Giffard (of Longueville), the first lord, was the father of the man who was there in 1086, whose name occurred in Domesday. Osberne Giffard was the son of Walter de Longueville, who was rewarded with the Manor of Brimpsfield for fighting at Hastings. When Edward the Confessor reigned, the Manor belonged to a Saxon named Dunne, who was dispossessed by the Conqueror. The little village of Stoke Gifford obtained its name from the same family, which owned another property at Oldbury-on-Severn. Probably in the reign of Henry I., between 1103 and 1121, the Castle was built by a second Walter Giffard. The barons living here occupied a powerful position, and might be said to have resembled the Roman barons of A.D. 1300, who dominated the Appian Way at Cecilia Metella's tomb, which they had converted into a castle. The speaker related the quarrel between the Sheriff of Glouecster and Sir John Giffard, ending as it did in the sheriff being brought captive to Brimpsfield Castle. Then he led his hearers onward to the Barons' War, when Simon de Montfort was in rebellion against Henry III., and Giffard was on the side of the king. Giffard surprised the then Lord of the Manor, Sir William de Monehensi, at Painswick, and Sir Baldwin Wake, and brought them to Brimpsfield. These were stirring times, but violence led to violence, and produced its own ruin. In 1280 a complaint was made at the King's Bench at Westminster by the Earl of Salisbury that his son's widow, Maud de Longespée, had been abducted from her manor by Sir John Giffard and taken to Brimpsfield, and the Earl pressed for her release. In reply, Sir John said the lady was doing very well and was content with her present position. The lady was allowed to remain, and she appeared to have been well-treated, although she only lived three years after her abduction. He was fined 300 marks. Then came the trouble with King Edward II. and his favourites the Despensers, during which time the Giffard who stole the King's provisions came to grief. A Despenser became Lord of the Manor, but only held his position for three years. Reference was made to Margaret de Syde and her connection with Brimpsfield, and to John Maltravers, of Woodchester, (both of them kinsfolk of the Giffards), whose name is also associated with the Manor, as with the murder of Edward II. Mr Baddeley said he did not think he murdered the king, because he was allowed to come back to England by Edward III. and to resume possession of his estates, including Brimpsfield.

Proceeding to the Church, the President said it was of quite unique interest.

It was a Parish Church in Norman times, and then became a small Priory or sub-Priory connected with the Benedictine Abbey of St. Etienne, near Caen. A few monks were attached to it, and it had its dormitory, refectory, and kitchen. Probably novices were there and were

trained for service in other religious houses. We have the names of nine of its Priors. The great peculiarity about the Church was its tower and the way in which it had been erected, or rather inserted after the destruction of a former, or Norman one. The chancel is not as long as it was originally, in support of which statement Mr Baddeley pointed to the absence of an east window. His theory was that a former tower collapsed, and in falling damaged the monks' choir. For reasons of economy, possibly, it was found undesirable to have a new east window, and so the chancel, during restoration, was reduced by perhaps as much as eight feet in length. The restored squints, the originals of which were intended to permit a view of the centre of the altar, no longer fulfil that ritual purpose. The present tower is of the fifteenth century. It rests on an Early English arch and the remains of a Norman arch. Mr Baddeley then explained that originally the Church was divided into three sections—(1) the Parish church, (2) monks' Church, and (3) the priests' Church or Presbytery. There are Norman pillars, Early English arches and windows, and a barrel-roof. Before leaving the building, Mr Baddeley said that in ancient times religion was regarded as a cheerful thing, and in support of this he pointed to the remains of colour on the walls. The old monks and priests, with the Byzantine traditions of Italy behind them, liked to impart a warm and pleasant appearance to their churches, and it was to be regretted that at a later date Religion in northern countries came to be connected with that which was anything but bright and cheerful. Out of the terrible war in which the world was now engaged, and out of the great problems which would have to be solved, would come, he believed, more general happiness and greater cheerfulness, for never in the whole history of 800 years since this Church was first-established had there been such a display of Christian self-sacrifice and heroism on the part of men, women and children, in the remotest villages just as faithfully as in the great towns.

Brimpsfield offered so much interest that rather more time than the programme permitted was spent there, and Members had yet to visit Elkstone, one of the most beautiful churches of the Cotswolds. Before leaving, the Vicar thanked Mr Baddeley for his most interesting address, he having learnt much that was new to him, and also expressed the pleasure it had given him to receive the Club.

The drive was then resumed to Elkstone, situated on high ground, north of the Ermine Way, the road dipping considerably down to Watercombe Bog, which gave the botanists who had gone on in advance scope for good work. Climbing up thence, the old Roman road was reached, and soon brought the party to Elkstone Church, where the Rector (Rev. T. S. Tonkinson) and one or two other Members of the Club awaited them. The Rector welcomed the Club and then pointed out the special features of the Church, dedicated to St. John the Evangelist, in the history and architecture of which he is deeply interested. Elkstone Church is undoubtedly one of the most notable of the Cotswold churches, containing, as it does, striking examples of Norman, Early English, and Perpendicular work, which give it almost a unique position in the County. The exterior of the Church was first carefully examined, the Rector and the President explaining the various points to be noticed. The fifteenth century Tower is a fine example of its period, and the quaint gargoyles on the south and north sides of the Church are alone objects of much interest.

Entering the Church by the south doorway some time was spent in studying the details of the sculptured tympanum set in the beautiful Norman doorway. The beaded chevrons surmounting the arch were much admired,

and the tympanum, with its representation of Christ seated and holding the books of judgment, gave rise to some speculation as to the possibility of what the seat is intended to imply. It bears some resemblance to the Coliseum at Rome, and Mr Baddeley said it had been suggested, some years ago, that the artist wished to convey the idea that Christ, in overcoming paganism, was now seated on its greatest symbol. He would not commit himself to an acceptance of that theory, but it was worthy of consideration. The entire door was enlarged in the 13th cent. The tympanum most probably was removed from the western door when the present door was built or enlarged.

The church is specially noted for the richly-ornamented chancel, with a beautiful little East window. Above the chancel is a large loft converted in old days into a Columbarium, and to which the original Norman stair (N. of Choir) leads. Unfortunately, time did not allow as long a stay as could be wished ; but Members interested in Architecture will no doubt find their way to Elkstone for a more leisurely inspection. The Rector has been engaged for some time in collecting material for the History of his Church, and this he hopes to publish.

An invitation to take tea at the Rectory had been extended by the Rector and Mrs Tonkinson, both of whom offered the warmest welcome to the visitors. Before dispersing the President expressed their thanks for such kind hospitality, and said how gratified he was to find the Rector so interested in the Church and so well-qualified to explain its various architectural problems.

It had been arranged to return to Gloucester by way of Crickley Hill, but the necessity of catching certain trains made this impossible, and so the shorter route down the more precipitous Birdlip Hill was taken. At the top of the Hill the house formerly known as the "Black Horse Inn," where the Club was founded on Tuesday, July 7th, 1846—the present Meeting marking the completion of its seventieth year—was pointed out. An illustration of the Inn forms the frontispiece to W. C. Lucy's *Origin of the Cotteswold Club*. The journey into Gloucester proceeded without incident, completing one more meeting which will be looked back upon with pleasure.

The following flowers and plants were collected during the day :— *Carex fulva, C. flava, C. distans, C. vulgaris, C. hirta, C. acuta, C. paniculata, C. panicea, C. glauca, C. sylvatica, C. remota, C. divulsa, Monotropa glabra, Aquilegia vulgaris, Asperula odorata, Cnicus pratensis, Eriophorum polystachion, Orchis ustulata, O. incarnata, O. latifolia, Valerian dioica, Galium uliginosum, Lotus uliginosus, Blysmus compressus, Lychnis Flos-cuculi, Vicia Cracca, Triglochin palustre, Trifolium medium, Orchis pyramidalis, Herminium monorchis, Kœleria cristata.*

During the meeting, Mr E. C. Sewell exhibited a remarkably fine specimen of a Bronze Celt found while ploughing a field situated between South Cerney and Ashton Keynes, the illustration of which he has most kindly contributed to the *Proceedings*. The following description has been furnished by the President :—

> The Celt belongs to the transitional stage dating from before the side-loop came in for passing a cord of hide so as to bind it in position to the cleft axe-handle. Therefore, though belonging to the Bronze Age, it preceded the "looped" form. The latter lasted on to the beginning of the Iron Age, though there can be no sharp demarcation between all these periods ; and it should be remembered that for the poorer folk, stone weapons lasted right through them all. We may safely put the dating of this Celt as 800 B.C., and leave it at that as the *minimum*. Its measurements are as follows :—

BRONZE CELT
Found between South Cerney and Ashton Keynes.

Total length	6⅜ inches
Width of blade	2⅞ ,,
Width at spring of blade ..	1 ,,
Length of stop-ridge	2⅝ ,,
Width of stop-ridge	⅞ ,,
Thickness at middle	1⅛ ,,

Slight spinal-projections at sides and also along centres of blade.

[ST. CLAIR BADDELEY.]

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The President's notes, *supra*.

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EXCURSION TO FLAXLEY AND WESTBURY-ON-SEVERN.

THURSDAY, SEPTEMBER 14th, 1916.

(*Directors :* Sir F. H. CRAWLEY-BOEVEY, Bart.; the PRESIDENT; AND GEORGE EMBREY.)

The fourth and last of the Field Meetings for the year was favoured by a typical autumn day, for, though a keen air prevailed, the sun shone continuously and the picturesque scenery surrounding the district visited was seen to the best advantage. Members gathered at the G.W.R. Station at Gloucester, the brakes leaving at 10.45.

Those attending the Meeting were :—The President, M. W. Colchester-Wemyss, Roland Austin (Acting Hon. Secretary), William Bellows, F. H. Bretherton, H. T. Bruton, H. W. Bruton, F. J. Cullis, Lieut.-Col. J. C. Duke, T. S. Ellis, G. Embrey, J. C. Frith, E. W. Fyffe, Ernest Hartland, J. N. Hobbs, A. E. Hurry, J. H. Jones, W. Thompson, E. Lawrence, A. S. Montgomrey, J. A. Smithin, E. P. Little, with G. McN. Rushforth, F.S.A., Col. Jeune, and Mr Lucas, visitors.

Shortly after 12 o'clock the Members arrived at Flaxley Abbey, being received by Sir Francis and Lady Crawley-Boevey. The former conducted them to the "Abbot's Room," and there expressed the gratification he felt by the visit of the Club, and the desire of the Members to learn something concerning a religious house which in its day was of some importance. His pleasure was enhanced by the fact that their President has been such a successful contributor to their knowledge on that particular subject. Flaxley is one of three Cistercian Abbeys in Gloucestershire, the others being Kingswood and Hailes. It was founded c. 1148-1154 by Roger, 2nd Earl of Hereford, in memory of his father, the famous Milo of Gloucester (first Earl), who was accidentally killed near the site when hunting on December 24th, 1143. Like another famous Gloucestershire house—Berkeley Castle—Flaxley has remained in continuous use since its foundation, though the

vicissitudes of time have shorn it of many of its original features. One block only of the domestic buildings remains, consisting of the Refectory of the Lay Brothers, about 65 feet long and 25 feet wide, and a great chamber above, known as the Abbot's Room, now used as the Library. Here Sir Francis drew attention to a model of the house and indicated the exact position of those remains of the Abbey which still exist, and showed also their structural relationship to the other parts of the house. He said that the room in which they then were was probably used as the Lay Brothers' dormitory; it was lighted by one large window on the western side, and for a long time this appeared to be the only means of obtaining light. After giving directions for some ivy to be cut away he was fortunate in discovering another large window and several smaller ones. In the fourteenth century Edward III. was in the habit of coming to Flaxley for the purpose of hunting in the Forest of Dean, perhaps, because St. Briavel's Castle (the Constable's) was too small. He made various grants to the Abbot, under whom, no doubt, this room was constructed. At the dissolution of the monasteries, Henry VIII. made over Flaxley to his favourite, Sir William Kingston, Constable of the Tower of London, and from his descendants it passed into the hands of William Boevey in 1647. There was no evidence that the Kingstons ever lived there, but at that period it was inhabited temporarily by yeoman farmers. These Kingstons chiefly resided at The Lodge, Painswick, (where Sir W. Kingston is buried), and Wishanger, and some of their effigies are in Miserden Church. William Boevey was a wealthy Dutch merchant, who was in a position to carry out improvements. In his day the main entrance was from the west. There was a terrible fire in 1777, when a part of the main section was burned down. To sum up, the architecture might be said to represent (1) monastic, (2) seventeenth century, (3) the Adam style.

The President pointed out that after the dislocating visitations of the Black Death in the fourteenth century (1349 and 1365), monasteries were no longer served by Lay Brothers, but that the whole of the wing in which they were then assembled had been originally used by them. Monasteries had to use hired labour. After that time Abbots frequently appropriated the apartments of the Lay Brothers, and it was quite probable that the Abbot of Flaxley did convert certain apartments in anticipation of the visits of the King when hunting in the Forest of Dean. Sir Francis had mentioned that under the Abbot's Room was a long chamber or passage. That was probably the necessarium. He then drew attention to a sculptured alabaster plaque of fifteenth century date, depicting the Crucifix, and suggested that it might have belonged to the monastery, but Mr G. M. Rushforth pointed out that such work was more often of Italian origin than English, and that it suggested a central panel of a reredos, which had been made up with an architectural framework. Some Dutch tapestry, some lacquered wood-work, and the portraits of the Boevey Family were afterwards examined with interest, and the Members then descended to the refectory, though before entering this a pause was made to admire a fine late twelfth century doorway which has been recently opened up by Sir Francis. The President spoke of the careful way in which this had been done, pains having been taken that the surface of the stone should not be scraped as was so often the case, and with consequent irreparable damage to the work of the early masons. That doorway was the chief entrance to the Lay Brothers' house from the cloisters, and it belonged to the very beginning of the Early English style. The refectory (now divided off for domestic purposes), is a fine example of its kind, the groining of the roof being a noticeable feature. From this the gardens were entered to see another important discovery made by Sir Francis: the principal doorway leading from the former south aisle of the Church into the cloisters. The President pointed out that through this passed the Saturday-processions, in which all the "Religious" of the Abbey took part. From the choir the procession passed, as a rule, round the whole of the domestic buildings, sprinkling each with holy water, and so renewing

the ordinance of Blessing. Placed on the grass near-by lie three stone coffin-lids of the 13th or 14th centuries from the Chapter House, and other remains of the stonework which have been found from time to time.

Before leaving the gardens the President took the opportunity of thanking Sir Francis Crawley-Boevey for the invitation he had extended to the Club, and again referred to the conservative and careful way in which he was serving the cause of Archæology in the maintaining of the Abbey. He also offered their sympathy to him and his family in the loss they had sustained by the death of his brother, Captain Crawley-Boevey, who had died from wounds received in action. Members then returned to the Abbot's Room, where the lunch which each had brought was supplemented by refreshments kindly provided by Sir Francis.

At two o'clock the brakes left for Westbury-on-Severn Church, where the Members were joined by Mr Colchester Wemyss, and Mr C. H. Backhouse, of Westbury Court, and, under their guidance, walked through the fields to Garden Cliff. The tide was a particularly high one, and there was no possibility of walking under the cliff by the foreshore until a much later hour, and so they proceeded to the northern end, where they were able to get down close to the water's edge. Here Mr Embrey described the Rhætic beds which are so well exposed, and stated that in 1843 Col. Portlock discovered the fossil *Avicula contorta* and named the beds after the fossil. Later they were called the Penarth Beds, but if there had been only one Westbury they would have been called the Westbury Beds. It was pointed out that quite at the top of the cliff there is the Lower Lias or Planorbis Bed, and a considerable period must have elapsed between the deposition of this bed and the Rhætic, which is divided into two portions—the Upper and Lower Rhætic. The Rhætics rest upon the upper beds of the Keuper Marl.

Mr Embrey referred to the exhaustive and valuable paper by Mr Richardson on the subject, which has been published in the *Proceedings*[1] of the Club, and then gave an interesting account[2] of the finding of the fossil *Ophiolepis Damesii* at the cliff. References have been made to this in the *Proceedings*,[3] but the detailed particulars have not been given before. Mr Embrey spoke also of the bone-beds and of the work of the Rev. P. B. Brodie, who was resident for some time at Westbury-on-Severn.

Dr. Ellis then made some observations on the physical aspect of the district. He said :—

> That he could not accept the explanation given by authorities as to the manner in which the Lower-Severn valley was formed—that it originated in a stream which worked its way from that which is known now as the Bristol Channel, backwards, that is to say, headwards, up the line of the present valley until it "captured" the Severn, as we now know it, which then crossed this line. He pointed out that the valley always was a line of disturbance, likely to be the line of a valley, and is continuous until it reaches the Irish Sea. Garden Cliff and the high ground behind marked a division between two main channels, into which the river, flowing on a higher plane, was formerly divided. One of these is represented by the present river, coming down from Gloucester to Framilode and along a channel, now silted up, into the broad estuary opposite Frampton, the present Hock Ditch being a relic of it. This line through the parish of Saul, as we know it, still the place of willows (M. E. *Salhe:* willow), was allowed to close, while the much longer route by Newnham was kept open. The latter is necessary to take the water from Westbury brook and that from Bullo pill. The part of the river flowing by the cliff was an arm connecting the eastern channel with the one on the western

1 Vol. xiv., pp. 154-165.
2 Printed pp. 125-128 following.
3 Vols. vi., 271 , x., 12 ; xiv., 162.

side, indicated by the long stretch of low-lying land below Westbury, in line with the present river as it flows past Newnham. Thus the area of Arlingham was an island, as the Nooze, just below, now surrounds a shoal, or island of sand. A photograph was shown of the great Moccassin Bend in the Tennessee river near Chattanooga. A similar arrangement of river and tributary streams gave to the view from Look-out Mountain a striking resemblance to that from the churchyard at Newnham. He then discussed the round form of Barrow Hill on the old island of Arlingham, seen on the opposite side of the river, contending that rain and rivers were not adequate to explain such features, of which examples were frequent all along the valley of the Severn from the Wrekin, itself an instance, downwards. Nothing short of marine, or, at least, estuarine condition would account for them. Sir Roderick Murchison believed in an "Ancient Straits of Malvern," and, as seemed to him (Mr Ellis), if a continuous valley is to be regarded as the result of denudation by water, the water itself must have been continuous.

Returning from the Cliff, Westbury Court was visited under the escort of Mr C. H. Backhouse, and the "Dutch" gardens, water "canals," and fine trees were much admired, the beautiful afternoon showing everything to its best advantage. The President observed that perhaps no more perfect example of Dutch landscape outside Hampton Court Palace could be seen. The present house is the third built upon the same site. Originally in the possession of the Baynham family, the estate passed, in 1642, to Richard Colchester, whose descendants have since held it, and it was his grandson, Maynard Colchester, who is credited with the making of the famous gardens.

The afternoon had been so fully occupied there was not sufficient time left to give adequate attention to the Church, and the remarkable construction of the wood-work in its detached tower, though the alert eye of the President discovered some tiles with important armorial bearings (Beauchamp) on the upper eastern face of the latter.

Leaving the Church, Members walked across to the Bell House, where Mr and Miss Colchester Wemyss entertained them to tea. In thanking their host and hostess, the President reminded those present that Mr Colchester Wemyss had been their President in past years, and also referred to the untiring services which he gave to the County as Chairman of the County Council, and in other ways. His kindness that afternoon had added distinctly to their pleasure and comfort. Mr Colchester Wemyss spoke of his many years' association with the Club and expressed the hope that one day he might have the leisure to return again to the studies which it promoted.

Westbury was left just before 5.30 for the return drive to Gloucester.

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The Cartulary of Flaxley Abbey. Edited by A. W. Crawley-Boevey. 1887.

Notes on the History of Flaxley Abbey. By Sir Francis H. Crawley-Boevey. 1914.

Much has been written on the Rhætic Beds at Westbury. Communications to the *Proceedings* have been made by J. Jones and W. C. Lucy, ii., 188-191, where a detailed section is given; R. Etheridge, iii., 218-34, with section; T. Wright, v., 151-154, with section; L. Richardson, xiv., 154-165, xv., 267-271.

The Peat and Forest-bed has been dealt with by various writers in vol. xiv., 15-46.

Earlier meetings of the Club are reported i., 10, ii., 188-192, x., 11-15, xiv., 181.

Westbury Court and the Gardens have been described, with illustrations, in *Country Life*, September 12, 1903, and December 19, 1908.

REPORT (No. 6) ON THE PROGRESS MADE IN CONNECTION WITH THE FLORA OF GLOUCESTERSHIRE.

By the Rev. H. J. Riddelsdell, M.A.

It is within the knowledge of some Members of the Club that there is a proposal to draw up a preliminary account of the Flora of the County, as a stage preparatory to a fuller and more worthy volume on the subject. The advantages of such a Preliminary List are, *first*, to give to workers a clear view of the actual progress accomplished, and, *secondly*, to enable us with the least possible waste of effort to fill up gaps in our knowledge, and, *thirdly*, to provide, by means of blank pages, a convenient form of record for new finds. If copies of such a list are distributed among working botanists of the county, and left in their hands for not too long a period, a great step will be taken towards securing results such as we desire.

With regard to actual progress during the past two years, certain new localities have been searched, chiefly in district 7, by means of the hard work done by such botanists as Messrs. Knight, Greenwood, Haines and Day, and myself, while others have gone on steadily gaining further knowledge of parts of the county already known in some degree. More especially, a beginning has been made in systematic study of the part of district 7 which lies close to the borders of neighbouring counties, with some most satisfactory results, especially in critical genera.

Meanwhile, the work of getting into order material for the Flora already to hand is proceeding apace. Within a year, or at the most two, if all goes well, the manuscript ought to be ready for the Preliminary List. This makes it desirable that workers should at once send in to the editor (Rev. H. J. Riddelsdell, Wigginton, Banbury) all records up to date, and all that they may add, until the Preliminary List appears. Will workers kindly note this, and will they also oblige by arranging their records in the order of the London Catalogue Ed : X ?

A few finds of interest ought to be made known to the Club before they appear in print ; and ought to be printed in Gloucestershire first rather than elsewhere. A good number of new records in brambles have been made, chiefly by Mr Day and myself. A piece of heathy ground in the parish of Todenham to which Mr Knight led me, has proved of great interest. *Rubus nemoralis*, *R. hostilis*, *R. incurvatus* and others have been found there or thereabout. A water crowfoot, *Ranunculus sphœrospermus*, Hiern, has been found in several streams in East Gloucestershire. The violets sent by me recently to Mrs Gregory have shown the neighbourhood of Tidenham, and more particularly a larchwood opposite Mr Butt's house, and belonging to him, to be extraordinarily rich in species, forms, varieties, and hybrids. *Viola canina* × *sylvestris*, and *Riviniana* × *lactea*, and *V. canina* var. *pusilla*, var. *lanceolata*, var. *crassifolia*, *V. Riviniana* var. *diversa*, and, above all, a probable *V. rupestris* var. *glabrescens* occur there ; and some of the same forms elsewhere, even in East Gloucestershire. *V. rupestris* is a species found hitherto only in Teesdale, and if Mrs Gregory's determination should, on further investigation, stand (and further and better specimens only confirm her opinion), it will serve still further to strengthen the curious link which already exists between the Flora of Gloucestershire and that of alpine and sub-alpine districts of these islands (cf. *Lycopodium complanatum*, *Stachys alpina*, etc.).

A new cotton grass has been added to East Gloucestershire—*Eriophorum latifolium*—found in a well-known bog, and observed twice in 1915. It may have been passed over in old days ; or it may be a new comer, brought by birds. The commoner *E. polystachyon* has been known there for many years. Mr Greenwood found a scarce figwort, *Scrophularia alata*, in two localities near Cheltenham. The Water dropwort, *Œnanthe silaifolia*, recorded by E. Lees from the neighbourhood of Forthampton, has been found in quantity close to Gloucester ; and its near relative, *Œn. pimpinelloides*, is exhibiting a far wider range than was expected. The grass discovered a few years ago in the old brick pit on Maisemore Ham, *Poa palustris*, extends for many miles above and below Gloucester, but has not yet been found on the true west bank of the river. A new variety of *Arabis hirsuta* has been found on Symonds Yat, a pansy only known in Kent, *Viola cantiana*, has been traced by Mr Greenwood on the Cotteswolds. Many interesting aliens—not all near Docks !—have occurred : *Echinops sphœrocephalus*, *Artemisia biennis*, *Lepidium neglectum*, are some of them. The orchid, *Epipactis atroviridis*, which I reported a year or two ago to the Club, has apparently been found in East Gloucestershire ; and Mr Butt in 1915 certainly sent me specimens of it from Monmouthshire. The dodder, *Cuscuta* × *europœa*, is turning up in a number of places ; and the hybrid Mullein, *Verbascum nigrum-Thapsus* was found near Sheepscombe. Mr Trump, of Cheltenham, sent me a broomrape from Leckhampton, which I think must be *Orobanche Picridis*. New localities for *Cerastium pumilum* (Snowhill), *Viola calcarea* (E. and W. Gloucester), *Cynoglossum montanum*, *Thymus Chamœdrys* (in E. Gloucester) and the bulrushes *Scirpus Tabernœmontani* (in E. Gloucester) and *S. maritimus* are recorded. The Filmy Fern, *Hymenophyllum tunbridgense*, has been found in nice quantity and good health near Staunton ; when first discovered there, it seemed near extinction. Other interesting points are : 1, The flora of the heathy district noticed by Mr Knight in Todenham parish. There occur the heathland furze *Ulex Gallii*, *Viola canina*, the rush *Juncus squarrosus*, Heaths and Heather, and the little willows, *Salix repens* and *S. ambigua*, etc. ; 2, The fast growing numbers of records for *Salvia pratensis*, the great blue meadow Sage, both in East and West Gloucester. Some of the specimens sent me seem, however, to be distinctly intermediate between *S. pratensis* and *S. Verbenaca*. They may eventually prove to be hybrid forms ; 3, The desirability of finding once again old recorded plants, *e.g.*, the Club Moss *Lycopodium Selago*, from Birdlip ; the Marsh Cinquefoil, *Potentilla palustris*, which may occur in the Forest of Dean ; *Drosera anglica* from the Forest ; the rare thistle *Cnicus tuberosus* from the railway near Stonehouse ; *Melittis* from Puckham Wood the western mint, *Mentha gentilis*, from near Cirencester ; and many more.

These and many like points will appear clearly in the Preliminary List.

LEONARD STANLEY, STANLEY MONACHORUM, OR STANLEY ST. LEONARD.

BY

ST. CLAIR BADDELEY, PRESIDENT.

INTRODUCTION.

The Saint whose name has thus become attached to a Gloucestershire village (with the effect of distinguishing it from its neighbour, King's Stanley) may be said to have been as popular in Saxon days in Gloucestershire as his contemporary, St. Giles, of equal and similar renown, became in London and Edinburgh. No less than six parish churches, besides one in Bristol, bore his Dedication : a large proportion, and, perhaps, due to some especially local desire for propitiation on behalf of captives, and this, again, possibly to be accounted for by the Danish invasion and occupation of both Gloucester and Cirencester towards the close of the ninth century. Nevertheless, at the Conquest, this manor of Stanley had as yet no connection with the Saint. It belonged to two Saxons, Godric and Wisnod, the former an extensive holder of land in the shire. Its T.R.E. value (namely, £5) remained the same at the Norman Survey in 1086, when it supported 25 males, and could boast that 1,680 acres out of a total of 1,690 were under cultivation, the remaining ten acres being meadow-land. At this date its possessor was Ralph de Berkeley, and its Chapel was not that of S. Leonard, but of S. Swithin. It was probably served by Bernard, the Chaplain of Berkeley, whose Prebend[1] (consisting of five hides

1 There was evidently a small prebendal, or collegiate, Church in Saxon-Norman days at Berkeley, as well as the early Nunnery destroyed by Earl Godwin. Its possessions served by the Prebends were gradually parted into three portions: to Leonard Stanley Priory, to St Augustine's at Bristol, and to Reading Abbey. The existence of these institutions, and the fact of the family (who were also Lords of Dursley) taking their name from Berkeley should point to a protective *Castellum* (not with a keep, or *turris*), being there before the days of Henry II. (1154) and Robert FitzHardinge's late Norman buildings.

of land) was made presently part of the endowment of the Convent at Stanley founded by Roger(2) de Berkeley (probably second son of Roger (1), c. 1129, and dedicated to S. Leonard.[1] He built the Priory Church and small cloister for Augustinian canons, and died before Michaelmas 1131, leaving the buildings, both here and at Berkeley, to be completed by his son Roger (3) (d., c. 1170), and he endowed it with the advowsons of the Churches of Arlingham, Slimbridge and Uley, probably portions of the Rectories therein of Dursley and Dodington,[2] and in 1156 with the Rectory of Cam ; Lorwinch was added in 1207-8.

A peculiar point of interest which attaches to the construction of this Priory and its Church is that when it thus arose the latter was builded beside, but not attached to, a small herring-bone, apsidal Chapel, the original parish Church of the vill. This it deliberately incorporated on the west side of its cloister, and but a few paces from the S.W. angle of the Priory Church. This ancient Chapel, or small Church (ecclesia minor) we shall see, continued to be restored, and even enlarged, from time to time during the existence of the later convent. But, albeit, incorporated with the Cellarer's Hall of S. Leonards, it remained essentially what it had been—a parish Chapel, and not a merely converted old building, until late Tudor days. This is shown by a valuable deed, discovered by the writer, at Gloucester (Cathedral Library), which may be safely dated c. 1260. It is witnessed to by Peter, the Prior, Robert, parson of Ozleworth, and Chaplain of Stanley,[3] and by three of the monks there.

In this document a testator, Henry, the Priest (son of Henry Cook, of Hereford) devotes an annual sum of 10 shillings,[4] derived from certain land, to the benefit of the souls of his forebears, in finding a lamp and oil for it, to burn before the "*altar of the Blessed Mary*" *in Majori Ecclesia* "*de Stanley*"—i.e., in the greater Church of Stanley.[5]

1 This was confirmed by Archbishop Theobald [1139-61].

2 In the Carta of Liber Niger, 1166, of Roger de Berkeley, the Prior of (Leonard) Stanley holds his virgate under the old feoffment of (c) 1130 (Hen. I.)

3 i.e. of the Parish Church, or Ecclesia Minor.

4 "*Quos præcipere consuevi* de Johanne de Futtwelle de terra quam idem Johannes de me emit et in extremis suis Prioratui de Stanley legavit."

5 "And if all the money be not needed for the said lamp, then it shall be expended in ornament for the Church by the hands of the said Monks." Witness—Peter, Prior of Stanley; Walter de Lemening, Thomas de Stower, Symon de Feld, Robert, Parson of Ozleworth, Chaplain of Stanley. [Seal of Henry Cook.]

It is fitting to remember, with this, that the beautiful flowing tracery of the Eastern window of the Norman Chapel must be dated but fifty years later than this document, and with this enrichment (if not earlier), took place the prolongation of the Eastern section of the Chapel, or smaller Church. and the conversion of its primitive apsis into a square head. It was evidently now called the smaller Church and regarded with great veneration, and as such it undoubtedly continued to be regarded down almost to the Dissolution of the Monastery in 1538.

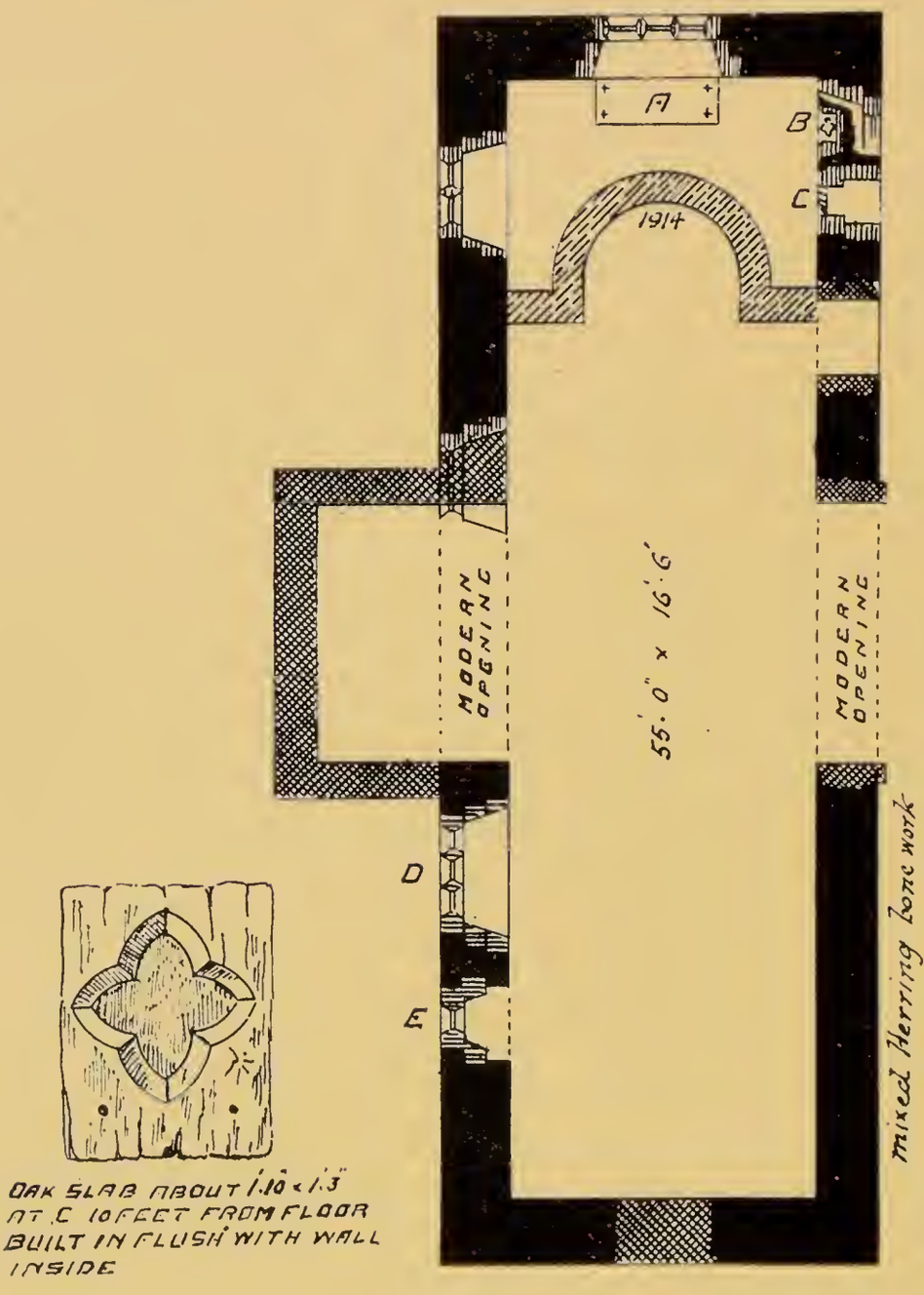
The interesting question, therefore, arises: Did the Canons, or the Benedictines from S. Peter's Abbey at Gloucester, who succeeded them here after but fifteen years' possession, ever make over to the little Parish the nave of their Church? And, if so, when, and why, did they make this important change, seeing that the inhabitants or parishioners were so few? Hitherto, it has been the custom of writers on this subject to take for granted that because the Monastic Church has been the Parish Church since the Dissolution, that it was (as, it is true, so often is the case, in the Austin-Canons' Priories), this from the first! The present writer ventures to take quite another view, which he will develop in this following section of this paper.

Part I.

There are possible two other hypotheses: (1) the early Parish Chapel, enlarged and beautified, remained the property of the parishioners *throughout*, and they had no rights whatsoever in the greater Church of the Canons; or (2) the nave of the greater, or Canons, Church, may have been made over to them, not in early days, but at the date when an elaborate rood-screen, stair, and window were, it is evident, inserted there quite late in the fifteenth century (to the sacrifice of two costly canopied tombs) in the south wall, the then population of Leonard Stanley (as evidence will suggest) having far transcended the capacities of the ancient, though enlarged, Chapel. The latter hypothesis will be found to account for much else that otherwise is enigmatical.

The first of these hypotheses, though perhaps very near the truth, may be dismissed with but little remark, seeing that

STANLEY ST. LEONARD—ST. SWITHIN'S CHAPEL



OAK SLAB ABOUT 1.10 × 1.3" AT C 10 FEET FROM FLOOR BUILT IN FLUSH WITH WALL INSIDE

A. POSITION OF ALTAR
B. PISCINA UNDER WINDOW
C. WOODEN QUATREFOIL
D. LOW SQUARE HEADED WINDOW
E. SMALL Do Do IN BLOCKED UP NORMAN DOORWAY

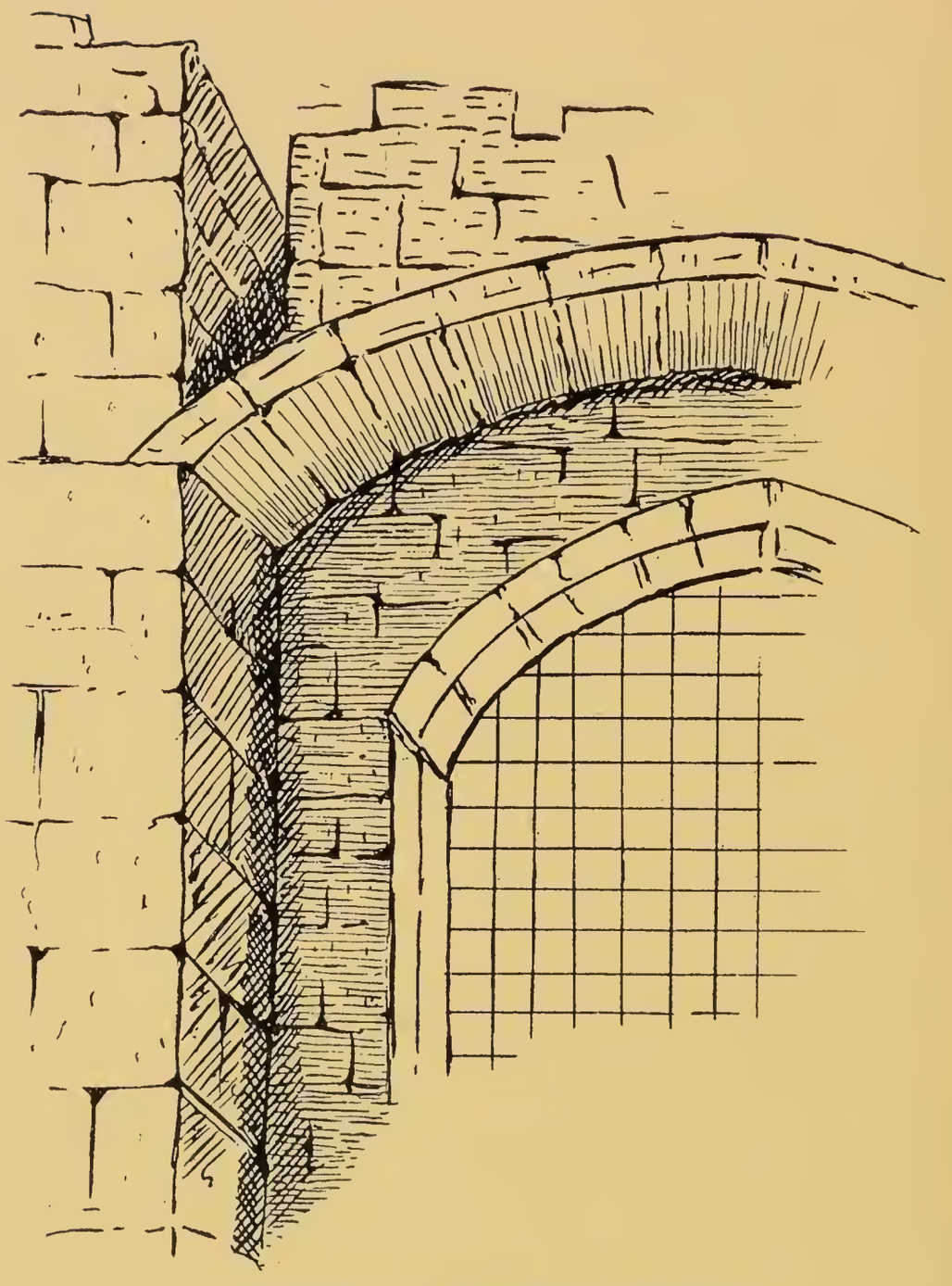
HERRING BONE
NORMAN
DECORATED
PERPENDICULAR
MODERN
when chapel was made into barn

10 5 0 10 20 30 40 FEET

had the people had no right in the nave of the Monastic Church, (or *Ecclesia Major*), (1) the Canons' Church would have been destroyed at the Dissolution, or, wholly or in part, purchased by the Parish from the Crown, neither of which alternatives, we know, were resorted to. In 1538 (Nov. 4) the parishioners did buy from William, last Abbot of Gloucester, for £—, the clock and four bells in the tower. It is evident, therefore, that their need was great, but they had not to purchase the nave. It may be remarked that, even so, it is noticeable that the Commissioners did not (as was usual), destroy the monks' Presbytery, which at no period could have belonged to the Parish. The reason for that, however, may well have been that its destruction would have involved the fall of the central tower. At any rate, the entire Church was spared, saving the apsidal Chapel of the south transept, and, of course, the monks' stalls, altars, and ornaments, whereas the ancient parish Chapel of S. Swithin, incorporate with the S. Cloister-alley has been left dismantled and derelict, and came to be used for a smaller barn, which purpose it has served probably ever since that date. We remind ourselves that the village had greatly increased in population.

Excavation in 1914 proved the Edwardian enlargement of this ancient Chapel; and the tracery, both of its window and of certain windows in the greater or Canons' Church, shews that the changes and enrichments belong to the latter part of the reign of Edward I. or early in that of Edward II. It is significant that Edward the Second's well-known badge of the three-towered castle of Castile occurred in the now-perished paintings of the larger Church's walls. Still more significant is the fact that there were living practically three Lords of the Vill of this period (1316) *Sir William de Wanton* (living 1304 and 1327), *John of Gloucester*, and *Joan de Berkeley*, heiress of Dursley. Moreover, so prosperous was then the growth of the place that Edward II. granted it a Charter for a market and two Fairs.[1] The Berkeleys, we know, had a hall there—*i.e.*, at Stanley Downton—for their residence, for the Close Roll of (a. 30 Hen. III.) 1246 already mentions the Hall (Aula sua) as then the residence of Sybil de Berkeley. It is again (probably)

1 Nov. 6 S. Leonards. July 15, S. Swithin. The Charter for these fairs was renewed in 1620.



LEONARD STANLEY CHURCH
WEST END LOWERED NORMAN ARCH (XV. CENT.)

to be identified with the messuage held by Nicholas de Berkeley at the time of his decease in 1382 (I.P.M.) and in 1485 again. It is not possible to state absolutely where that mansion was situated, but the probabilities of the locality suggest that it was at Downton Stanley, where stood a moated hall. It was certainly not the site of the present House,[1] near

1 This was still building in Rudder's day.

the Church, under which lies much unidentified old monastic work. The Whitmores, of Lower Slaughter, became owners of the latter site in the xvii. cent., and sold it to the Sandfords after 1700.

Our second hypothesis therefore, namely, that the nave of the greater Church became the Parishioners' Church very late in the fifteenth century has two features to recommend it : (1) it was then the only one suitable to the then needs of the Parish; (2) and that the work then done in it was of an expensive and drastic nature, involving the destruction, not only of two earlier canopied monuments in the south wall, and the insertion there of a rood-stair with windows looking into the Nave ; but in the opposite (or north) wall a rather larger window, as at Pucklechurch, was made in order to light the Rood itself. The latter window is now partly concealed by a modern buttress. In addition, the whole character of the west-window was, at the same period, constructionally changed by the lowering of the Norman Arch[1] to where it now is (or some five feet), and giving the earlier narrow lights a combination into one broad window having a depressed, or segmental head.

If we are not pressing the matter too far, these changes here seem of a kind so radical as to point to a complete alteration in the character of the Nave for a very definite purpose ; and they are precisely the constructional changes that would have been deemed needful for converting the Nave into a parish Church. The work was probably paid for by the parishioners and their friends, who, therefore, had little scruple in dealing with the obstructive monuments in the south wall.

It may be asked, if the Nave was not a parochial Church here until the date of these changes, why did the monks need a stone-screen at the western tower-arch to separate their Choir from the Nave ? The answer is that the Nave with its altar had been at all times in use by the lay-officials, numerous servants, pilgrims, visitors, and patrons of the Priory, and that (as elsewhere) it, no doubt, had a small rood of its own, and altars, and other, now-vanished, tombs. Merely it was not as yet Parish property.

1 Cf. Diagram sketch.

The need for the separation of the monks' choir whether that of Austin Canons, or Benedictines (both of whom in turn possessed the present Church) was always there; whether the Parish owned the Nave or did not own it. Therefore, the Canons' Church at Leonard Stanley was in no part of it originally designed for the Parish, as was that at its sister-cell, St Michael, at Ewenny.[1] It was not necessary here; and the need did not arise for some centuries after the Priory had become a Benedictine Cell to Gloucester Abbey.

It has been advanced by earlier students of the building, as evidence of an original parochial division of this Church, however, that the Norman door (with xv. cent. insertions) in the west wall of the south transept is placed there so as to allow the Canons access to their choir without going to the adjoining processional door into the nave. It has, however, not been noticed by them that there was wanting here the usual night-stair from the Dorter leading into the transept of the Church. It was, I think, for this more exposed night-access to the monks' choir that the said door was thus situated, and therefore its position was not calculated at all with regard to the Parish, but rather to the convenience of the Canons themselves. The Benedictine monks inherited from their predecessors, and did not alter its position. There were probably never more than ten monks here; seldom so many. But it is quite likely that invalids and novices from Gloucester and Ewyas Harold came here.

In this connection, then, it is noteworthy that at no time in the history of Leonard Stanley did the monks' dormitory become, as usually was the case, attached by its gable to the transept of the Church. The Norman masonry bears no traces of any opening passing into the south wall of the transept. This fact, together with the non-construction of any north aisle to the nave, shows that the Benedictines were of such few numbers here that they needed to incur little expenditure on alterations of the original, or Canons', Cloister. This, it will be obvious, again points to the fact that here at Leonard Stanley they kept, and were long able to keep, in use for the parishioners another and older Church upon which alterations

[1] Co. Glamorgan.

and expansions were done, from time to time, until it was felt to be too small, while its expansion further would have encroached inconveniently upon the Cloister and adjacent buildings.

It will thus be apparent that in dealing with the Church of Leonard Stanley we have to deal with no ordinary, or conventional, example of an Austin-Canons' Collegiate Church, and, consequently, the ordinary tests, as applied by the late Mr Micklethwaite, and, following him, by the late Professor Middleton (in so ably describing this present Church some five and twenty years ago, in Vol. v., *B. & G. A. S. Trans.*), will not avail to really enlighten us sufficiently about Leonard Stanley. The present writer, in other words, holds that the occurrence of the smaller and more ancient Church of the Parish as an isolated building here entirely invalidates the hitherto accepted reading of this Church as that of an ordinary Augustinian House; and, therefore, we have to attempt its understanding by such other ways and means as are open to us.

Part II.

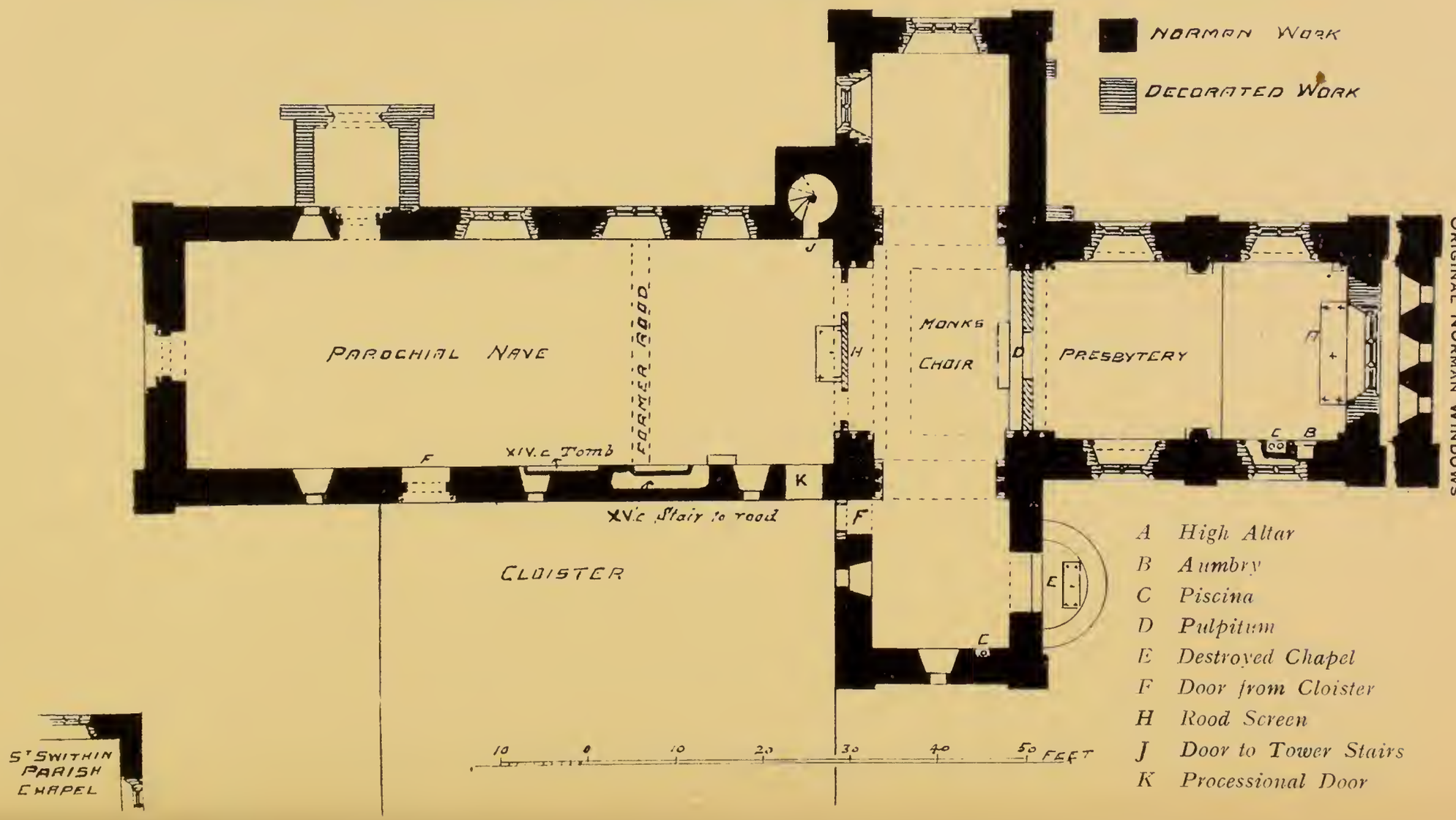
If this view of the remains be accepted, provisionally, it, of course, follows that the question arises—What became of the older and smaller Church (Prior's Chapel, so called) when, at last, the parishioners enjoyed possession of the nave of the greater, or monastic, one?

The probabilities were that the Church of S. Swithin would, upon losing its parish-services, either be restricted to private use on the part of the Prior and his servants, or it might become converted to other monastic purposes.

It therefore behoves us to examine the remains of it carefully in order to see, if possible, if they can still throw any light upon this problem.

As it openly declares to the visitor that two wide modern openings in its N. and S. sides have been made so as to convert it into a barn; further, that a modern, rather wide door on the West has obliterated the original West door, while a third opening (of the same date) occurs towards the East end of the south wall—we have to do what we can with the remainder

CHAPEL OF ST. SWITHIN AND PRIORY CHURCH OF STANLEY ST. LEONARD



only taking into account the herring-bone apsis (discovered in October 1914), the outside eastern curve of which falls some six feet short of the Norman existing wall.

This, of course, shows that the Saxon—or Norman—original Chapel was both shorter and less wide than the present building; moreover, it had an apsidal eastern termination, while this later one is square.

In the writer's view, the most striking feature to be noticed is the insertion of the two late perpendicular, or Tudor domestic windows in the North wall towards the West-end: one having a single light (set in the fitting of the Norman N. door), the other with three lights. Let us see how these struck Professor Middleton.

After describing the windows as "very domestic in style," he goes on to say: "The object of these windows, I am quite at a loss to explain; they are too far West to command a view of the altar."

Now, according to the hypothesis followed above, these windows are precisely of the date and style we should give them if this building had suffered complete, or at least considerable, domestic change or appropriation during the latest years of the Priory. They are *non-ecclesiastical* insertions, probably due to a radical alteration in the purpose of the building. It becomes clear then that the Parish Church, which was once this Chapel, was indeed no longer here, but had become transferred (as we suggested) to the larger Church during the late fifteenth century, where its regularly-appointed Chaplains[1] continued to minister.

But, although we infer this to have been the case, we lack evidence to prove that the eastern, or altar, section of the building (when the above domestic change occurred to the Western section) did not still survive as a Chapel. But this is not a very important point. The probabilities are that it did so survive, but merely as an oratory for the Prior's private use; and from this has handed down to us its traditional name of the Prior's Chapel. The lease of the Priory

1 At the Dissolution the Parish Curate received £6. In 1291 we meet with Walter de Wyking parson of Stanley (L).

to Sir William Kingston, dated 18 July, 1539, specifies "the Priorye Churche there, and the Chappellys and cloister to the said Priorye belonging." And, in it Henry VIII. and Anne Bulleyn may have prayed, side by side, when they visited Prior Rodley,[1] at Leonard Stanley from Gloucester, Aug. 6, 1535, during their happy hunting-days, spent at Prinknash Painswick, and Berkeley, but a few months before Queen, Elizabeth was born.

It was but three years later that the great change came over the scene, and we see William, the last Abbot of Gloucester, for a bargain of clear £30, granting the bells and clock of the Priory Church to the parishioners (Nov. 4, 1538), represented by the Lord of the Manor's bailiff there, John Stradling (gent., 1558), Richard Selwyn,[2] Robert Partridge, and John Towson (clothiers). Two of these bells may have been recast at Gloucester by R. Packe and William Chapman in 1678, the dedications of three of the bells are to S. Gabriel, S. Lawrence, and S. Peter. The very destructive fire in the village in 1686 did not hurt the Church.

It is probable that in the scramble for Church-properties many (besides the court-favourites and the Seymours) kept their eyes open and their pens energetic, in order to gather in the plums. A place as attractive as was Leonard Stanley with its buildings was sure of admirers; and before the summer of 1536 (March 27) we find a letter dated from Berkeley (*town*), from one Antony Budgegode to Lord Cromwell, begging that minister to let him have one of the three good *cells* in this county, especially either Deerhurst or Leonard Stanley. He complains that the farm of Hamstockes, which Cromwell gave him, has calmly been enclosed into the red-deer park at Berkeley, and that "it has already cost him £20 to sue it out of Lord Berkeley's hands." But Cromwell was deeply tying himself to the demands of Kingston, and the crafty Budgegode obtained neither cell.

1 Possibly, his predecessor, Richard Wolryge, 1516—1535.

2 Immediate ancestor of the Selwyns of Matson, who rapidly rose to some social position during the reigns of Elizabeth and James.

NOTES ON *CHIRODOTA*-SPICULES FROM THE LIAS AND INFERIOR OOLITE.

BY

CHARLES UPTON.

(Read November 23rd, 1915.)

The *Chirodota* constitute a genus of the order *Holothuroidea* of the class *Echinodermata*. The Holothurians—popularly known as "Sea Cucumbers"—have no hard external covering plates such as occur on the Sea Urchins and Star Fishes, but consist of a soft vermiform or slug-like body, without anything in the nature of calcareous protecting armour or internal skeleton. Two species at least are now living.

Some of the genera are possessed of calcareous spicules secreted by and imbedded in or attached to the integument. *Synapta* and *Chirodota* are, perhaps, the best known, plates and "anchors" of the former, and "wheels" of the latter being amongst the objects commonly found in the cabinets of microscopists.

As might have been expected, the only parts of the *Holothuroidea* capable of preservation as fossils are the spicules. No other remains are known.

Spicules of *Chirodota* have been found in most of the secondary formations of marine origin, and have been recorded from the Jurassic rocks of various places in France, Germany, and India, as well as our own country.

Of British forms Charles Moore in the British Association Report for 1872 describes one species from the Oolite, *Chirodota Carpenteri*, and refers to three Liassic forms, but without names or descriptions. The Rev. G. F. Whidborne, in the Quarterly Journal for 1883,[1] figures and describes two forms, *Chirodota convexa* and *C. gracillima*, from the Inferior Oolite of Burton Bradstock, probably—Mr Richardson thinks—from the Sponge Beds (*schlœnbachi*) of Burton Cliff. Many years ago I found a specimen in the Upper Chalk of Purley, in Surrey. Those are the only previous British records known to me.

1 Q.J.G.S., xxxix., p. 487, pl. xix., figs. 14, 15.

Messrs. Terquem and Berthelin, in the memoirs of the Geological Society of France for 1875,[1] have figured and described a number of specimens from the *Margaritatus*-Beds of the Middle Lias of D'Essey-les-Nancy under two species, *Hemisphæranthos florida* and *H. costifera*, the former having the rays flattened or petal-like, the latter with rounded rays. The generic name was apparently adopted by the authors on account of the sphericity and flower-like aspect of the spicules, but as they differ in no other respect from those of typical *Chirodota*, it appears to me to be a somewhat unnecessary refinement, and I therefore, prefer to retain the older name, especially as there is nothing pointing to generic differences in the animals themselves.

For a number of years I have washed and examined microscopically many samples of clays and marls from the Inferior Oolite and Lias, and among the numerous forms of microzoa produced I have found a number of spicules of *Chirodota*. The following is a list of the localities and deposits from which I have recorded them :—

	BED	HEMERA	LOCALITY
	INFERIOR OOLITE		
1	"Sponge Beds" .	*schlœnbachi*	Peas Hill Quarry, Shipton Gorge, Dorset, and Haselbury Mill Quarry near Crewkerne, Somerset
2	? Horizon of the White Oolite	*schlœnbachi*	Stinchcombe Hill, near Dursley, Glos.
3	Sandy Marl ..	*truellei ?*	Baggerbush Lane Quarry, Bradford Abbas, near Sherborne, Dorset
4	Upper Coral Bed .	*truellei*	Timsbury Sleight, Timsbury, near Radstock, Somerset
5	*Discites*-Bed ..	*discitæ*	Frogden Quarry, Oborne, near Sherborne, Dorset
6	Fourth Coral Bed	*murchisonæ*	Frith Quarry, near Painswick, Glos.
7	Pea Grit .. .. (lower portion)	*murchisonæ*	Steanbridge, near Stroud, Glos.
	LIAS	*falciferi*	
8	*Leptæna*-Bed ..	*oxynoti*	King Street, Stroud, Glos.
9	Blue Clay ..	*oxynoti*	Gloucester Gas Works, Bristol Road, Glos.
10	ditto		Morland's Match Works, Bristol Rd., [Glos.
11	Blue Clay, with Ammonite of *Armatum*-type	*armati ?*	Lower Tuffley, near Quedgley, Glos.

1 Memoirs Soc. Geol. de France, Ser. 2, vol. 10 (1875), p. 112, pl. xx.

The number of the rays forming the central portions of the spicules varies in my examples from 6 to 11. In some examples the ray is flat or petaloid, and in some round, as described by Messrs. Terquem and Bertelin, although as between specimens from each locality the characters are for the most part constant. These characters may point to specific differences. Except in the case of the Lower Tuffley clay, where they appear to be quite abundant, the spicules occur very sparingly.

SOME NOTES ON THE FLORA OF THE GLOUCESTER DOCKS

BY

J. W. HAINES

(Read March 21st, 1916.)

I am quite aware of the fact that to the purist many, perhaps most, of the flowering plants of the Gloucester Docks are suspect, denizens, aliens and so forth, but they are, at worst, friendly aliens and a great many have been so long naturalised that we may well give them a place in our roll of citizens. No doubt many other field botanists have for years past scoured the neighbourhood of the Docks for specimens, but, for some considerable time, the exigencies of business and the fact that I lived in the vicinity, combined to make me traverse this area more frequently than most people. This emboldens me to set out a list of the less common plants that I have met with there. The ground is very dry, and, in consequence, in hot summers the flora gets completely burnt up, with disastrous results. Again, doubtless for a like reason, the ground is more prolific in the plants of late summer and early autumn than in those of the early year. Plants, especially alien plants, have a way of luxuriating there and causing the annihilation of their tenderer brethren. To the terrible overgrowth of *Medicago arvensis* and that peppery ogre *Lepidium draba* I ascribe the loss of many more pleasing species. I am glad to say that this last year (1915) showed a considerable relaxation in the onslaught of these tyrants.

Of the Ranunculus group, *R. sceleratus*, *R. auricomus* and *R. arvensis* are usually to be found about the Docks. For a year or two the rare poppy, *Glaucium phœniceum*, a scarlet

ally of the yellow sea poppy, was to be found, but the pepperwort overwhelmed it, and I have not seen it since about 1910. Of the crucifers, *Alyssum incanum* (though not last year) *Thlaspi arvense*, the two *Senebieras*, *Erysimum cheiranthoides*, *Diplotaxis tenuifolia*, the three *Nasturtiums*, and *Draba verna* are usually to be found. *Camelina sativa* occurs most years on the walls of Llanthony Abbey (as of course does *Cheiranthus Cheiri*), and also on the waste ground beyond. *Neslia paniculata*, a bush-like plant, appeared this year; *Sisymbrium columnae* and *S. pannonicum* are annual visitors, and, on at least two occasions, the beautiful flixweed, *Sisymbrium Sophia*, has appeared also. Of the pepperworts, besides *Lepidium Draba*, *L. ruderale*, *L. neglectum*, and *L. campestre* are common, whilst, in 1911 and 1912, the much more beautiful and scarce *L. perfoliatum* occurred as well. Mr Charles Bailey has commented on the prevalence of alien crucifers at St. Anne's, and the like prevalence is notable here; further, most of these crucifers are naturalised, and not merely casuals, all, perhaps, except the *Alyssum*, the *Neslia*, and *Lepidium perfoliatum*.

Of the order Caryophyllaceæ, there are a good many species. I may note *Saponaria officinalis*, the handsome soapwort, most common with double flowers, also the rarer *S. Vaccaria*, *Silene anglica*, *Silene conica*, *Silene noctiflora* (in 1915) and *Gypsophila porrigens*. All these, except the first, are casuals. In addition, I have found unnamed, but very handsome, pink varieties of *Silene inflata*. *Lychnis Githago* has appeared on one or two occasions. *Malachium aquaticum* is ever present in one of the ditches, and in 1915 I found a small plant of the pretty little *Alsine rubra* in full bloom.

Erodium cicutarium and *Linum usitatissimum* are always to be found, the latter, considering the neighbourhood, rather infrequently. The *Pea* order is very well represented. *Lathyrus hirsutus* appeared in 1912 and 1913, and in 1912 I found a small patch of the beautiful yellow vetchling *Lathyrus Aphaca*. In 1915 I found a very beautiful vetchling with crimson flowers and a creeping growth, which is *Lathyrus tuberosus*. Of the vetches, *Vicia lutea* occurred in 1912 and also *Vicia bithynica*, both pointed out to me by Mr Stephens; *Vicia narbonensis* variety *serratifolia*, a very large handsome vetch,

with almost black flowers, grew close by, and both the last two turned up again the following year. I have seen traces of a vetch there since, but the spot is very exposed to the ravages of children, and it never came to flower. With the doubtful exception of *V. bithynica* I fear all these vetches must be classed as casuals. *Vicia hirsuta* has appeared on several occasions, and, when it does occur, is in considerable quantity. *Cicer aietinum*, a foreigner, with pretty pink flowers and rose-like leaves, appeared in 1911 and 1912, and the handsome *Coronilla varia* in 1910-11-12 and '13. The appearance of a factory destroyed the habitat of this last in 1914, but I am glad to say that it broke out last year not far from the old spot as luxuriantly as ever. It grows, I might add, in plenty, on dredgings further down the Berkeley Canal. Others of the *Pea* group appearing are *Medicago sativa* and *M. Falcata*, *Melilotus alba* (1911 and 1912) and *M. indica*, *Trifolium fragiferum* and, last year, *Trifolium arvense*, one small plant. Of these, *Medicago Falcata* is abundant and quite permanent, whilst *Melilotus indica* is becoming increasingly common. It is somewhat odd that *Trifolium fragiferum* is abundant in all the fields at the base of Churchdown Hill, but does not seem ever to climb the slopes.

Potentilla argentea grew in some plenty on one spot near the Docks in 1912, but I have not found it there since as a load of rubbish was shot over it. Of the *Willow-herbs* the following occur: *Epilobium angustifolium* variety *brachycarpum*, *E. parviflorum*, *E. roseum*, *E. montanum*, *E. hirsutum*, *E. obscurum* (probably), and more certainly the less common *E. tetragonum*. Several of these hybridise, I believe, and all are apparently permanent. *Œnothera biennis* I found once.

Sedum acre is always present at one spot, otherwise stonecrops and saxifrages are notable absentees. Of the umbelliferous plants, the most interesting are *Conium maculatum*, *Heracleum giganteum*, *Anthriscus vulgaris*, *Scandix pecten*, *Torilis nodosa*, *Apium graveolens*, *Bupleurum rotundifolium* (1912), *Caucalis daucoides* and *Caucalis latifolia* (both in 1912) and *Coriandrum sativum* (1912 and 1914). Of these I should say the *Conium* is native, the *Anthriscus* and *Apium* are both naturalised and all the others casuals. The *Bupleurum* met

with the same fate that befell the *Potentilla argentea* the first year I met with it.

Of the *Compositæ*, *Lactuca virosa* used to grow as a permanency on the site of the factory I have referred to and has, I fear, fallen a victim to it. *Cnicus arvensis* has several odd forms, including variety *mitis*, which should repay further investigation, but thistles are horrible things to handle. Last year I found *Artemisia vulgaris* variety *coarctata*, a tree-like form of the common mugwort, with exceedingly narrow leaves. The rayed form of *Senecio vulgaris* is common and *Erigeron acre* and *E. canadense* can always be found together, though I have not yet hit upon the hybrid which grows with them at Bristol. *Erigeron canadense* also grows in a yard off the barrack-square. Others of the order are *Pulicaria dysenterica*, *Chrysanthemum segetum*, the handsome *Anthemis tinctoria*, so like the last, *Grindelia squarrosa* (1910), *Achillea ptarmica*, *Achillea biennis* (1915), *Achillea tomentosa*, a beautiful yellow variety, *Centaurea cyanus*, *C. melitensis* (1912 and 1914) and a bush-growing *Centaurea*, probably a form of *paniculata*, with tiny bluish white flowers.

I found no *Centaurea* of any kind this last year (1915).

Echium vulgare and *Lithospermum vulgare* are fairly common ; less so, *Anchusa officinalis* and *A. sempervirens*. A strange foreigner, *Echinospermum Lappula*, not unlike a *Myosotis*, turned up in 1912, and two years later so did *Amsinckia lycopsioides*, again like a *Myosotis*, but with an orange-yellow corolla. *Atropa Belladonna* grows in a corner near Llanthony Abbey, and has done so for very many years ; near it is *Lycium chinense*, the Duke of Argyll's tea plant. The two *Solanums* and *Hyoscyamus niger* are regular visitors.

Linaria minor loves the railway ballast, and once *L. purpurea*, which is not uncommon in the Great Gully at Clifton, appeared here for a season.

Of the Labiates, the most conspicuous are *Lycopus europoeus* (permanent) *Salvia verticillata* (common and persistent), *Calamintha Clinopodium*, *Scutellaria galericulata* (both persistent), *Nepeta Cataria* (once only but in profusion) and *Ballota nigra*.

Anagallis cærulea is not infrequent here.

Plantago arenaria occurred in 1912, and *Amaranthus retroflexus* in 1915. There are plenty of *Chenopodiums*, such as *rubrum*, plenty of *Polygonums*, especially *lapathifolium*, also *Fagopyrum sagittatum*, but I regret that these flowers interest me but slightly.

Polygonum cuspidatum, a Japanese plant, appeared here last year. A large patch of *Euphorbia esula* has been a well-known feature for years, and *Butomus umbellatus* and *Acorus Calamus* both grow regularly in the timber pool.

In *Cyperaceæ*, the Docks themselves are not prolific, though, a few hundred yards away the withy beds give good hunting. *Carex hirta* is one of the few of the order which seem to like damp places among the timber.

In these notes I have purposely avoided dealing with the flora of the withy beds and brick pools, these places being very rich in sedges and the like but not being a part of the Docks.

The uncommon grass *Briza minor* grew near Llanthony bridge in 1914, but disappeared last year.

A patch of *Arctium* on the Docks which I noticed in 1912 (and called in my own mind "*intermedium*," simply and quite unscientifically because it was obviously neither *majus* nor *minus*) was sent last year by Mr Knight, who recognised it as a rarity, to the authorities at Cambridge. We sent specimens at various intervals throughout the year, and Dr. Moss and Mr. Evans seem confident that it is *Arctium tomentosum*. Nevertheless, they have planted some of the seed so that they may make certain next year.

It will be noticed that the Docks are peculiarly rich in certain orders such as the *Umbelliferæ*, the *Cruciferæ*, and the *Leguminosæ* and also, by my omissions, that some orders are very scantily represented. For instance I do not think I have ever seen a violet of any kind nor a rock-rose nor a milk-wort. I have found no Mallow except *Malva sylvestris* and there is a curious absence of *Hypericums* and of all but the commonest *Geraniums* such as *robertianum* and *dissectum*; and even these are not frequent. Taken as a whole such large orders as *Rosaceæ* and the *Scrophulariaceæ* are poorly exemplified.

The above list is, of course, in no way exhaustive, even of the less common species, and, to my knowledge, many flowers I have not mentioned have been found in the last few years by others. I have confined it to plants actually gathered or observed by me personally between Hempsted Bridge and the Basin, and, in all cases of doubt, their names have been confirmed for me by the Rev. H. J. Riddelsdell, or some other competent authority, except where I have expressly qualified my words.

NOTE.

[It should be borne in mind that in the paper itself "this year" means 1915.]

Owing to causes connected with the war, the Flora of the Docks became, during 1916, largely obscured from the public. I did, however, note the following:—

Anthriscus vulgaris, Papaver Argemone, Sisymbrium pannonicum, Sisymbrium columnæ, Atropa Belladonna, Lythrum Salicaria, Carduus tenuiflorus, Arctium tomentosum, Coronilla varia, Medicago Falcata, Saponaria officinalis, Malachium aquaticum, Cichorium Intybus, Salvia verticillata, Erigeron canadense, Epilobium angustifolium var. *brachycarpum, Chenopodium leptophyllum, Camelina sativa* and, not far from its old haunt, *Vicia lutea* once more. *Arctium tomentosum* came to an end that was both sharp and sudden, but I think the fruit had ripened first.

THE STORY OF *OPHIOLEPIS DAMESII.*

BY

GEORGE EMBREY.[1]

In the early summer of 1874 I accompanied a number of the students attending my geology class at the Gloucester School of Science to the Garden Cliff at Westbury-on-Severn, and while there, one of them (the late John Sawyer) picked up a piece of black shale with a faint impression upon it which puzzled him. On close examination, we came to the conclusion that it was a fossil Star-fish and on the following day I took the specimen to Dr. Wright, of Cheltenham, who informed me that in the previous February he had received a similar specimen from Herr Dames, of Berlin, and that he had named it *Ophiolepis Damesii*.[2] I asked Dr. Wright what were the characters upon which he had relied for fixing it as a new species, and he replied that the length of the rays equalled ten times the diameter of the disc, but in each of my specimens the ray had only a length equal to five times the diameter of the disc; they were therefore not the same species as the Hildesheim specimens.

During the later part of the summer, I made frequent visits to Garden Cliff and obtained a very large number of specimens. Ten of them I gave to the late W. C. Lucy, who presented several to the Museum of Geology, Jermyn Street, London; others I forwarded to the Rev. P. B. Brodie, and a few to the late Jerome Harrison, at that time Curator of the Leicester Museum. Mr Harrison informed me that he had discovered the same fossil fifteen months earlier in the Rhætic beds of Leicestershire.

1 Expanded from remarks made at Garden Cliff, Westbury-on-Severn, September 14th, 1916.

2 Dr Wright figured and described *Ophiolepis Damesii* in his "British Fossil Echinodermata of the Oolitic Formations" (Palæontographical Society, 1863-1880), vol. 2, pl. xxi., figs. 4 and 5, pp. 161-163.

It will thus be seen that the discovery of *Ophiolepis* at Garden Cliff was due to students of the Gloucester School of Science, and not to (at the time) members of the Cotteswold Club, for neither Mr Sawyer nor myself were then members, but, of course, we were deeply grateful to both Mr Lucy and Dr. Wright for their kind and generous assistance in helping us to appreciate the importance of our find.

References to *Ophiolepis Damesii* have been made from time to time in the *Proceedings*,[1] but since our visit to Westbury last September I recollected that an account of the finding of the fossil was given in 1875, only a year after the discovery, in a local publication called *The Amateur*. Copies of this magazine have become scarce, and I have therefore extracted the reports from the volume in the British Museum in order that they may be preserved in our *Proceedings*, for they possess value as the earliest record of the find at Garden Cliff.

APPENDIX.

I.

[Extracted from *The Amateur*, vol. i., 1875, No. 2, p. 20.]

GLOUCESTER SCHOOL OF SCIENCE PHILOSOPHICAL SOCIETY.

This young society of Philosophers, or "Lovers of Wisdom," originally formed by students of the Science Classes, but since joined by several gentlemen of scientific tastes, has, under the able guidance of Mr G. Embrey, already done such good work that we think some reference to its proceedings may interest our readers.

The third meeting of the session was held at the School of Science on Tuesday, the 11th of May, when Mr G. Embrey delivered a lecture on the "Giant's Causeway." The proceedings were opened by the Secretary, Mr Bird, reading the Minutes of the previous meeting, at which a lecture on "Flame" was read by Mr A. Dutton. Mr Embrey then referred to a recent visit of the geological Members of the Society to the Garden Cliff, Westbury-on-Severn, where many interesting fossils were found, the most remarkable being a Star-fish, or Brittle-star, found by Mr Sawyer in the *Avicula contorta* bed, and which was supposed to be the first of the kind ever found in England.

The Garden Cliff is an excellent example of the Rhætic series (so called from its being best represented in the Rhætian Alps, which marks a transition period between the Trias and the Lias.

The *Avicula contorta* bed is one of the beds of the Rhætic series, and has been most fully investigated, and, in fact, was named by Dr. Wright, of Cheltenham. To this gentleman the Brittle-star found was shown, and he expressed great pleasure at the discovery as a similar star had quite recently been found in the German beds, and was supposed to establish a difference between them and the English series, whereas this Westbury star now re-establishes their identity.

1 Vol. vi., p. 271; vol. x., p. 12; vol. xiv., p. 162.

It appears that a Brittle-star[1] of the same family, if not of the same species, has been found in a similar bed in Leicestershire by the Rev. P. Brodie, author of a "History of Fossil Insects," etc.

II.

[From *The Amateur*, vol. i, 1875, No. 3, p. 35.]

DISCOVERY OF A BRITTLE-STAR IN THE RHÆTIC BEDS AT WESTBURY-ON-SEVERN.

The Members of the Gloucester School of Science Philosophical Society made their first excursion of the season during the recent Easter Holidays to the Garden Cliff, Westbury, when a discovery of some importance to local geologists was made.

While examining the black shales, Mr J. Sawyer picked up a slab containing radial markings, which presented an appearance unknown to him. It was shown to Mr George Embrey, who at once pronounced it to be a Brittle-star (*Ophiura*) and expressed the opinion that it was the first which had been found in these beds. Several other specimens were found and afterwards submitted to MrW. C. Lucy and Dr. Wright; both these gentlemen confirmed the view taken by Mr Embrey as to their being the first which had been discovered here. Dr. Wright stated that they were identical with specimens which he had received a few months previously from Hildesheim, near Hanover, where the Rhætic beds are better developed than at Westbury. The name *Ophiolepis Damesii* had been previously given to these stars by Dr. Wright. Notices appeared in the *Gloucester Journal* and *Nature*, and an opinion was expressed that they were the first which had been found in this country. This brought a communication[2] from the Rev. P. B. Brodie, Vicar of Rowington, Warwickshire, to the following effect:—

> "Knowing the Westbury sections, and Rhætics there and elsewhere, I feel especially interested in your discovery of Radiates in the Cardium shales, which, though so well searched, never before yielded one of the *Ophiura*. But yours is not the first *Echinodermata* found in Rhætic, for nearly a year ago one was found in Rhætic near Leicester . . .
>
> "I do not know if yours is the same as the Leicester Radiate, which I have not yet seen . . .
>
> Although your *Ophiura* is not the *first* found, it detracts nothing from the value of it, and you are still the discoverer of the first specimens of this genus in Gloucestershire Rhætics."

Again, on May 30th, the Rev. Mr Brodie writes, after having received three specimens:—

> "I took the Ophiuras with me to Leicester last week, and, with Mr W. Harrison, who discovered the first Radiata in British Rhætics at Leicester, compared his with the one discovered by you, and neither of us can detect any difference, though I should not like to speak decisively on the point because his specimen is not so well preserved as yours . . .
>
> "They are both about the same size, yours are better preserved, shale harder and specimens more numerous—for Mr Harrison only found two, and has never found another."

The section at Westbury has been visited again by several Members, and a few days since by Mr W. C. Lucy, together with Mr Embrey, when the exact position in which the Brittle-stars are found was made out.

1 This was evidently an error, as shown by Mr Brodie's letter in following article.—G.E.
2 Letter to George Embrey, 1874.

The *Ophiolepis* zone is about 1½ to 2 inches thick; it occurs midway between the *Estheria* Limestone and the upper of the two large bone beds. The following particulars of these beds, showing the order in which they occur, will no doubt enable any of our readers to obtain a specimen :—

Thin band (bone bed) containing arsenical pyrites, very hard, ½ inch.

Fossiliferous shales (containing cardium, etc.) very soft, 1 inch.

Ophiolepis bed (apparently unfossiliferous), 1½ inches.

Fossiliferous shale (soft), 1 inch.

Arsenical pyrites (very hard), ½ inch.

On May 20th a paper on the *Ophiolepis* was read before the Members of the Cotteswold Naturalists' Field Club, by Dr. Wright, when the following interesting communication was made. (Extracted with corrections from the *Gloucester Journal* of May 22nd.)

"This discovery imparts a new interest to the Rhætic series. Doubts had arisen both on the Continent and in this country as to the conditions under which the Rhætic beds were deposited—a fresh water character having been claimed for them, such was the opinion of Edward Forbes, and until the discovery of these Ophurites there was no decisive evidence to the contrary. The presence, however, of these little Brittle-stars is decisive as to the marine character of the beds in which they were found."

Those at Hildesheim were found between the upper and lower bone beds in association with the bones of *Hybodus*.

The following is a section of the Leicester Rhætics :—

Black shales, 10 feet Gray Marl, 40 feet Red Marl (Trias)	Only one soft bone bed near the black shales very much denuded.

The above is all that is known of the *Ophiolepis Damesii*, the first important discovery of the Members of the Gloucester School of Science Philosophical Society, which bids fair to bear out the prediction of its President that "Oft mighty things from small beginnings grow."

G. Embrey,
School of Science, Gloucester.

June 16th, 1875.

THE SILURIAN INLIER OF USK

BY

C. I. GARDINER, M.A., F.G.S.

WITH A

PALÆONTOLOGICAL APPENDIX

BY

F. R. COWPER REED, M.A., D.Sc., F.G.S.

(*Read February 15th*, 1916.)

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INTRODUCTION.

The Usk Inlier lies a few miles to the North of Newport, and just to the East of the South Wales Coalfield. It is about midway between the Tortworth Silurian Inlier described by Dr. F. R. C. Reed and Prof. S. H. Reynolds[1] and the Builth area described by Miss Wood.[2]

The first description of the Inlier seems to be that by Murchison in his "Silurian System,"[3] and there are many references to it in his "Siluria." In the Survey Memoirs of 1846 De la Beche published a table of the Usk formations, and referred them to the Ludlow, Wenlock, Caradoc and Upper Llandeilo ages;[4] but Phillips, in the Memoir of 1848,[5] was the first to describe the Silurian beds of Usk in detail. From the fossil evidence he included the beds which had been called Caradoc and Llandeilo in the Wenlock series. He regarded the Old Red Sandstone beds as conformable to the Ludlow rocks.

In 1909 an account of the area appeared in the Survey Memoir which dealt with the country round Newport.[6] In this Phillips' conclusion as to the ages of the rocks was confirmed, but very few additional details about the Silurian beds were given. The fossil evidence referred to is scanty, and plenty of scope is left for further investigation in the district.

The important conclusion is arrived at in this memoir, that the beds at the base of the Old Red Sandstone, which are seen 40 miles further West, are not represented in the Usk district, so that the junction between the Old Red Sandstone and the Ludlow beds may be here an unconformable one.

Very little detailed work seems to have been done in recent years on the Silurian beds of South Wales. Prof. Sollas, in 1879, described the Silurian district near Cardiff,[7] which lies about 20 miles to the S.W. of Usk, where he found Ludlow and Wenlock beds of a total thickness of 950 feet. Miss Wood has described the Silurians near Builth, some 40 miles to the North-West, and these, with their graptolitic beds, show no analogy to the type of Silurian beds seen at Usk. The Tortworth area, some 20 miles to the East, shows about 625 feet

1 Quart. Jour. Geol. Soc., Vol. lxiv. (1908), p. 512.
2 Quart. Jour. Geol. Soc., Vol. lvi. (1900), p. 415.
3 "Silurian System" (1839), pp. 438-441.
4 Mem. Geol. Surv. (1846), Vol. i., p. 22.
5 Mem. Geol. Surv. (1848), Vol. ii., pp. 196-208.
6 "Geology of the South Wales Coalfield," pt. 1, "Country round Newport" (1909).
7 Quart. Jour. Geol. Soc., vol. xxxv. (1879), pp. 475-507.

of Wenlock beds, with perhaps a very thin layer of Ludlow rocks above them. Hence a considerably greater thickness of Ludlow and Wenlock beds is seen at Usk than in either of the neighbouring Silurian districts.

The Old Red Sandstone between the Coalfields of S. Wales and of the Forest of Dean is bent into a great arch, which has been fractured in parts and has had its crest denuded away between Panteg and Usk so that the Silurian beds have been exposed.

There are to be seen three inliers of Silurian rocks, a large one, called the USK INLIER, which measures 8½ miles from S.S.W. to N.N.E and 4 miles from W. to E. at its broadest part, and two quite small ones to the South-East in the neighbourhood of Llanfrechfa.

The Usk inlier is roughly oval in shape, and is cut through by the broad valley of the Usk river from the North and by the Berthin Brook from the East.

Near these streams there is alluvium covering the Silurian beds, and glacial drift completely hides the underlying rocks in much of the northern part of the district, and extends southwards as far as the Berthin Brook.

II. GENERAL SUCCESSION AND STRUCTURE.

The Silurian rocks seen in the Usk Inlier are as follows :—

LUDLOW BEDS. (1300 feet thick)	2. Sandstones. 1. Impure sandy shales containing thin calcareous layers, especially towards their base.
WENLOCK LIMESTONE (35-40 feet thick)	in bands with sandy partings, with two thick beds of hard massive limestone near the base.
WENLOCK SHALES (about 850 feet seen)	2. Upper shales, brown in colour, of a sandy nature with sandstone bands near their summit and with calcareous bands and nodules near their base. 1. Grey mudstones.

Detailed mapping on the six-inch scale shows that towards the South the Inlier is formed of two anticlines separated by a fault (see fig. 1). The western fold, which is the wider of the two, will be called the *Coed-y-paen Anticline*, and the narrower eastern one the *Llangibby Anticline*. If one starts in the extreme South at Llandegveth and goes northwards along the crest of

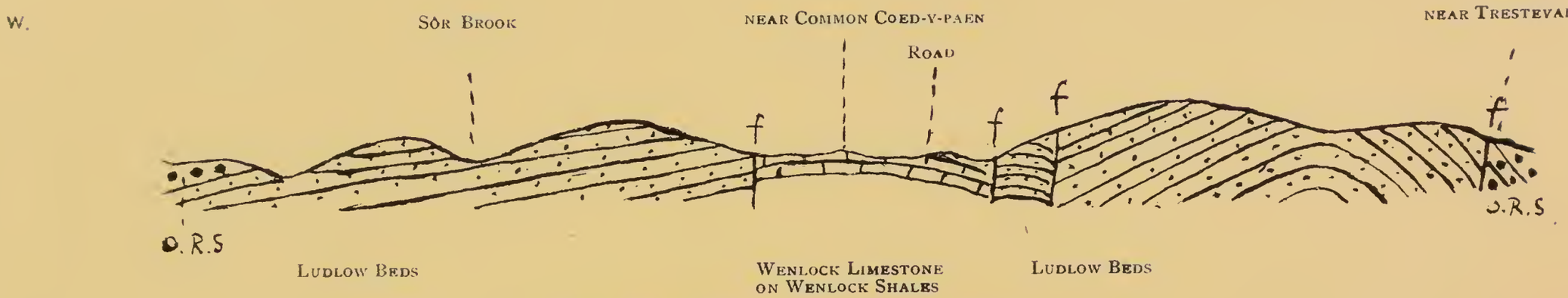


Fig. 1.—Section through the Coed-y-paen and Llangibby Anticlines.
Horiz: Scale 2″ = 1 mile. Vert: Scale 1″ = 100 ft.

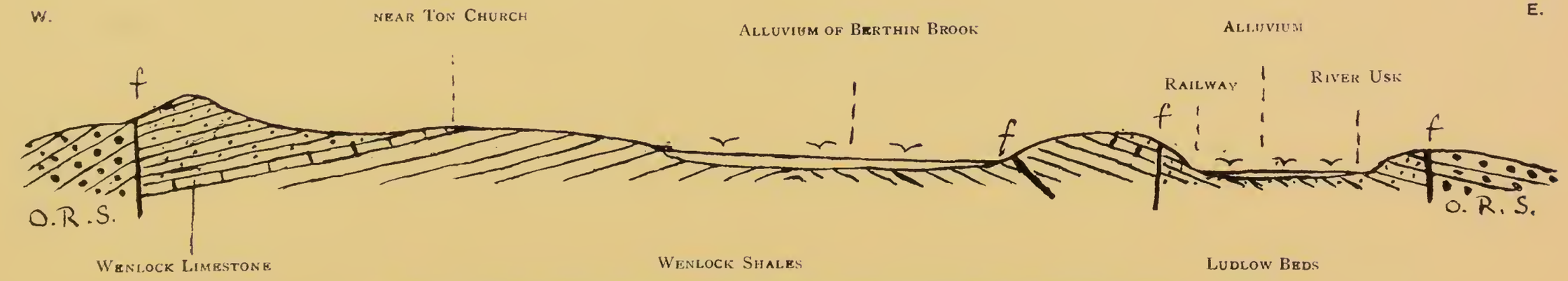


Fig. 2.—Section through the Coed-y-paen Anticline, a little to the South of the Berthin Brook.
Horiz: Scale 2″ = 1 mile. Vert: Scale 1″ = 100 ft.

the Coed-y-paen anticline one passes over Ludlow rocks on to Wenlock beds, which all show an anticlinal arrangement to the south of the Berthin Brook. Beyond, however, the Monkswood drift obscures the Silurian beds, and when these beds are once more seen, near Trostrey, the anticlinal structure is no longer clear. To the South of the Berthin Brook the Ludlow beds are almost everywhere resting conformably on Wenlock Limestone, and this rock on Wenlock shales. To the North of the river Usk, however, along the Eastern margin of the Wenlock shales is a fault which brings Ludlow beds against them, and no trace of Wenlock Limestone is to be seen, while to the West also Ludlow beds are brought against the Wenlock shales by a fault which runs close to the Chain Bridge.

The Northern limit of the Wenlock shales is entirely masked by the Bettws-Newydd drift.

The Western margin of the Silurians from Clytha in the North to the Usk railway is entirely covered by Alluvium or drift, but south of the railway a fault separates the Ludlow and Wenlock beds from the Old Red Sandstone as far as Trostra Common. Along the remainder of the boundary of the Coed-y-paen anticline, however, the junction between the Ludlow beds and the Old Red Sandstone is no longer a faulted one, and a thin bed of yellow quartzose sandstone, which is the basement bed of the Old Red Sandstone in this region, is seen at Trostra Common, at a spot South-East of Panteg, near Llanthewy Court, just below Llandegveth Church and in the road 300 yards to the North of that Church.

From Llandegveth Church the boundary of the Silurian turns North-westwards towards Graigwith House, showing that we have here passed round the nose of the Anticline.

Grey quartzose grits are seen dipping South near Graigwith House, and the Survey records similar grits in the brook East of Llandegveth Church. These, no doubt, are in the basement beds of the Old Red Sandstone, and show that here, too, there is no fault bounding the Silurian beds. The whole of the Western margin of the Coed-y-paen anticline is a fault-line which runs up from Graigwith past Tyn-y-cœau, Cefn Ila to Rhadyr, and then, passing under the Usk, is traceable along the base of Llancayo Hill, and, turning to the North-West, passes under drift near Bettws-Newydd.

The Coed-y-paen anticline is by no means a simple one, careful dip observations show that it is much faulted, and the broken nature of the outcrop of the Wenlock Limestone is found to be due to a series of faults.

The Eastern or Llangibby anticline is seen from near Llwyn-celyn in the South as far North as Cwm Dowlais, and shows Ludlow beds above and Wenlock Limestone below.

It is separated from the Coed-y-paen anticline to the West and from the Old Red Sandstone to the East by faults.

At its summit is a small syncline, which has allowed the preservation of a patch of Old Red Sandstone near Pen-y-parc, and another small area of this rock is seen a little further West as well.

To the North of Cwm Dowlais Ludlow beds are faulted down so that no Wenlock Shales are exposed to the North of the Wenlock Limestone in this Eastern part of the Inlier.

As the succession goes down to the Wenlock Shales in the Coed-y-paen anticline and the Old Red Sandstone is not separated from the Ludlow beds by a fault along much of the margin of this Western tract, the beds of this portion of the Inlier will be described first and then those occurring elsewhere.

III (A). DETAILED ACCOUNT OF THE COED-Y-PAEN AREA.

(*a*) The Wenlock Shales.

As the Wenlock Limestone is a rock which is easily recognised wherever it occurs, it will be convenient to describe the underlying Wenlock shales from the base of the limestone downwards.

To the South of the Monkswood drift area the shales are frequently exposed and are seen to be dipping at low angles, from 4 to 13 degrees below the limestone from near the railway at Tynewydd to High Cross Inn. The actual junction with the overlying limestone is never seen, but sandy shales and sandstones are exposed not far below the Limestone in all the road tracks running down from the limestone ridge towards

the railway. In the lane leading down to Upper Wern-hir from the road which runs past High Cross Inn, there is a very fossiliferous sandstone band.

In the railway cuttings near Bryn, sandy shales are seen, and similar beds occur near Prescoed farm, in Pentrewaun Wood and in Pentrewaun minor wood, to the East of Pentrewaun farm. They are well exposed by the roadside near Tyn-y-caeau farm, and are found dipping below the limestone exposures of Cil-feigan, Cefn-Ila and Rhadyr.

Lower down in the succession, thin calcareous bands and layers of calcareous nodules are found in the sandy shales, and, finally, beneath these come soft grey mudstones, which often show a concretionary structure. These are well seen by the roadside to the West of Little Cefn-Ila.

The Usk Inlier is cut through from West to East by the Berthin Brook, which flows past Little Mill and runs to the South of Monkswood to join the Usk close to Rhadyr, about a mile above the town of Usk. This stream has deposited a certain amount of Alluvium, which lies chiefly to the South of its present course, whilst the country to the North of it as far as Kemeys Commander is covered by a deposit of drift. This paper is not concerned with the origin or nature of this drift, but only with its extent, as it prevents one from telling anything about the nature and arrangement of the underlying Silurian beds. Fortunately, the river Usk has cut its way through the drift capping, and exposed Wenlock Shales at three places. These are (1) the hill-side opposite Kemeys Commander on the West side of the river, (2) the steep face of the river bank on the East side, near Trostrey, and (3) the Western bank near Craig-y-Garcyd, not far from Rhadyr.

Opposite Kemeys Commander the hill-side rises steeply from the alluvial plain near the Chain Bridge for a couple of hundred feet, and the first hundred and fifty feet are in beds of Wenlock age, while the upper part of the hill-side is covered by drift which stretches Westwards up to and beyond the Abergavenny railway.

The hill-side sloping down to the Usk is largely covered with wood, but continual small exposures show that the rock

is a soft sandy shale corresponding to the Wenlock Shale beds on the Eastern side of the river. It is not until one gets to a spot opposite Kemeys Commander that any reliable dip can be obtained, and here it is 25° N.E. The rock is a sandy shale containing a few layers of calcareous nodules, and it overlies irregular layers of limestone with sandy shales between them. More sandy shales are seen at a spot about half a mile further down the river, where the dip is 48° S.W. The exposures in the river bank near Trostrey are also in sandy shales, which contain layers of calcareous nodules and thin limestone bands and dip at low angles to the South.

Similar beds are seen round Trostrey and Little Trostrey, and to the East of Trostrey Court. Amongst them occur layers of sandstone, which, just above Little Trostrey, contain *Homalonotus Johannis*, which, according to Salter, is a typical Usk species in the Wenlock Shales[1]; while to the North-East of this exposure occur irregular limestone-layers resembling those mentioned as having been found on the West bank of the Usk opposite to Kemeys Commander.

Further to the North, a quarry close to the road leading from Bettws-Newydd to the Chain bridge proves that these sandy beds extend as far as that point.

Their lithological resemblance to the upper beds of the Wenlock Shale of the southern part of the area makes it probable that they too are high up in the Wenlock Shale beds. But although this is no doubt the case, there is no regular dip to the North amongst them, and the domical arrangement of the Usk Silurian beds so often referred to in accounts of the area is not borne out by dip observations.

Between Trostrey and Rhadyr the Usk runs up against the ridge of Craig-y-Garcyd, and has cut a fine cliff face in dark grey mudstones, which lie horizontally. These often show a concretionary structure, and are very fossiliferous.

All these exposures of Wenlock Shales serve to show that in the Usk Area these beds may be divided up into

1. Upper Shales: brown sandy shales with sandstone bands near their summit and occasional calcareous bands and nodules in their lower parts.
2. Lower Shales: grey mudstones.

1 J. W. Salter, British Trilobites, Palæont. Soc. (1864-1883), pp. 117-119.

The total thickness of the Wenlock Shales seen is about 850 feet.

In the northern part of the Inlier the relation of the Wenlock Shales to the rocks to the West of them is obscured by Alluvium, but Ludlow beds are seen in the roadside to the West of the Chain Bridge and again in the river bank above the bridge, where they are bent into shallow folds, whose axes run South-eastwards straight towards the Wenlock Shales, which are exposed not far off. Hence it seems clear that a fault separates the beds of the two ages in this region.

Further to the North there is much drift, but Ludlow beds which dip to the North are seen near Clytha. It is possible of course that Wenlock Limestone occurs beneath this drift, but it certainly is not found stretching in a great curve from Tump Farm on the Usk to the West of Bettws-Newydd to the Usk near Trostrey as represented on the 1-inch map, although it is seen at Tump Farm, as will be recorded later.

It is to be noticed that to the North of the Usk the anticlinal arrangement of the Wenlock Shales, which was so obvious to the South, no longer obtains. The dip of the beds is generally to the East or South-East, though near Bettws-Newydd it becomes North-North-East. East of Trostrey drift covers the country up to about the 300 ft. contour line, but above this are frequent exposures in Wenlock sandy shales, with occasional thin limestone layers. These beds form the crest of the hill, where they dip 15°E., and are also seen near the bottom of the valley beyond, but the far side of this valley is in Ludlow beds, which dip to the North-East, and there seems little doubt that the line of separation between the two sets of beds is a fault, and dislocations are seen in an old quarry in a field a few yards below where the road from Hill Farm crosses the stream.

The South-Eastern edge of these Wenlock Shales lies along the continuation of the big fault dividing the two anticlines in the South, which runs along the base of Llancayo Hill, Wenlock Shales with calcareous nodules being seen in the stream here and Upper Ludlow beds a short way up the hillside to the East.

(*b*) THE WENLOCK LIMESTONE

As has been mentioned above, the separate stretches of Wenlock Limestone seen in the Coed-y-paen Anticline, which are eleven in number, are to be considered as originally having been one connected band of rock. Earth movements have broken the limestone-band, and the fractured portions have been pushed in and on to the soft underlying shales which form the visible core of the Anticline.

In describing the exposures, it will be best to pass from West to East.

(1) Close to the Usk railway, East of Little Mill, there are some old workings, and here, at (68)[1], about 30 feet of bedded limestone is seen, bent sharply up against the Old Red Sandstone to the West of it.

(2) To the South of these exposures are some quarries (91), near the farm of Tynewydd. Here bedded limestone is seen to be overlaid by thin limestone-bands, with sandy shale partings, and these by sandy shales with calcareous nodules.

(3) Passing the Church, to the South-East one gets to quarries close to the road, which comes up from the railway, and also to (22), where sandy shales are seen covering 8 feet of sandy shales with calcareous nodules, and under these 30 feet of grey Limestone in layers about 4 inches in thickness. There are sometimes thin shale partings between the limestone-layers.

This stretch of Limestone extends for over a mile to the South-South-East of Glascoed, when it ends against a fault-line.

(4) A short stretch of Limestone is next found to the South-West above Greenpool Farm. It is quarried at (35), but the exposure is a poor one. Grey limestone in irregular thin layers is seen, and is full of trilobites in the stream bed.

(5) For half-a-mile to the South no Limestone is seen, but near Common Coed-y-paen exposures are common. At (51) below 11 feet of fine-grained Limestone, arranged in irregular thin layers with thin partings of sandy shale, 8 feet of a hard

1 Numbers in brackets refer to spots similarly numbered on the map.

massive Limestone are exposed. The Limestone is bent here into shallow folds so that its outcrop is very wide compared to the width seen elsewhere in the district (*v.* fig. 3).

(6) The next stretch of Limestone is seen in a large quarry near Tyn-y-caeau farm, where 12 feet of the massive Limestone is seen underlying layered limestone.

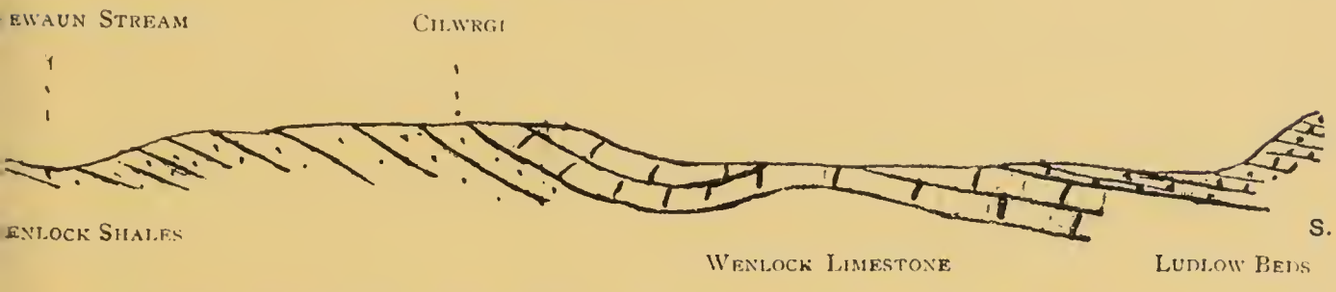


Fig. 3.—North and South Section through Cilwrgi, ½ mile East of Christchurch Common, Coed-y-paen. Horiz: Scale 6″ = 1 mile. Vert: Scale exaggerated.

(7) To the North of this, near Cilfeigan, are quarries showing sandy beds on 4 feet of sandy beds with calcareous nodules, and below these, 8 feet of compact Limestone containing many crinoid fragments.

(8) The small stretches of Limestone in the neighbourhood of Cefn-Ila are very poorly exposed, while the final extension near Rhadyr is seen in some old, much overgrown workings.

Besides occurring in the Coed-y-paen Anticline, Wenlock Limestone is also seen in the Llangibby Anticline in Cwm Dowlais. Here it is bent into an arch, and forms the lowest visible bed of the Anticline. The section here is as follows :—

Irregular Limestone bands with sandy shale partings.
10 feet of compact Limestone.
12 feet of Limestone in irregular layers with sandy shale partings.
5 feet of compact Limestone (seen at base).

From the sections now visible we may therefore say that in the Usk Inlier the Wenlock Limestone is over thirty feet thick, and though, as no complete section through it exists, its maximum thickness cannot be stated with accuracy, it is probably 35-40 feet.

It usually occurs in irregular layers, separated by thin sandy deposits, the layers of Limestone being only some 4 inches thick. But amongst this thin bedded Limestone there occur

either one or two bands of very hard massive Limestone, which is seen only towards the East and centre of the Inlier, though it may occur also to the West but not be exposed.

This massive bed is quite different in appearance to the thin bedded Limestone. It is a rock chiefly formed of fragments of Crinoids and shells, the whole cemented together by calcium carbonate.

The fossils found in the various exposures of the Limestone are mentioned below; the localities are as numbered on the map, and are arranged in the order in which one comes to them on going from West to East.

It will be seen that there is no reason to believe from a consideration of the fossil evidence that the exposures are in different bands, and in this there is agreement with the field evidence, which points to the various stretches of Limestone having been originally parts of a continuous band of deposit.

Though corals do occur in the Limestone, it is impossible to regard the rock as a coral reef.

There is no abrupt line at its summit marking it off from the beds above; sandy deposits are constantly found between layers of limestone and these gradually increase in thickness, while higher up in the succession, sand predominates; and the calcareous matter is in layers of nodules in the sand. Whether these sandy beds immediately above the Limestone are to be considered as of Ludlow or Wenlock age is uncertain.

Recently the ballstone of the Wenlock Limestone of Shropshire and Herefordshire has been described,[1] and in the paper containing this description there is a reference to the Wenlock Limestone of the Usk area.[2] It is recognised that in the Usk area there is an upper division of "nodular courses with much shale, the chief fossils found being corals," and a lower "of solid, highly crystalline, stratified limestone." With most of these statements the author of this paper is in agreement, though his observations show that corals are not common in any of the Limestones and that brachiopods and trilobites are far more frequently found.

1 Proc. Geol. Assoc., vol. xxv. (1914), "Study of Ballstone and the associated beds in the Wenlock Limestone of Shropshire," by Miss Crosfield and Miss Johnston.

2 *Ibid.*, p. 212.

Murchison, in his "Silurian System," noted the occurrence of ballstones in the Limestones of Glascoed, and in the paper referred to above the occurrence of ballstones is noted in one of the Coed-y-paen quarries.

FOSSILS FROM THE WENLOCK LIMESTONE.

	68	91	22	121	35	74	51	73	32	80	110
Favosites Gothlandicus (Fougt)							x				
,, *Forbesi* (M. Edw.)			?								
,, sp.									x		
Syringopora fascicularis (Linn.)			x						x		
Heliolites sp.			x				x				
Fenestella sp.											x
Stropheodonta filosa (Sow.)					x				x	x	
,, sp.								x			
Leptæna rhomboidalis (Wilck.)			x		x				x	x	x
Strophonella funiculata (McCoy.)			x		x		x			x	
,, *euglypha* (His.)			x		x		x			x	x
Orthothetes pecten (Linn.)							x				
Chonetes ceratoides (sp. nov.)						x					
,, sp.			x		x			x			
Orthis biloba (Linn.)					x						x
,, *elegantula* (Dalm.)			?		x			x			
,, *hybrida* (Sow.)										?	
,, sp.	x								x		
Scenidium Lewisi (Dav.)								?			
Pentamerus galeatus (Dalm.)			x	x		x	x				
Camarotœchia borealis (Schloth.)					?			?		x	x
Wilsonia Davidsoni (McCoy)		x			x	x		x			
,, *Wilsoni* (Sow.)						x				x	x
,, ,, var.				x			x				
Atrypa reticularis (Linn.)	x		x	x	x	x	x			x	x
Athyris ? compressa							x				
Spirifer crispus (His.)				x					x		
,, *elevatus* (Dalm.)		x		x		x	x			x	
,, *plicatellus* (Linn.)											?
,, ,, var. *radiatus* (Sow.)					x						
Cyrtia exporrecta (Wahl.)									x		x
Rhynchospira Bouchardi (Dav.)				?							
Meristella sp.											x
Pterinea sp.								x			
Platyceras cornutum (His.)											x
Horiostoma globosum (Schloth.)										x	
,, ,, var.			x								
Phacops caudatus (Brunn)		x			x		x	x			
,, *Downingiæ* (Murch.)				x							
,, *Stokesi* (M. Edw.) var. nov. *Uskensis*		x			x			x			
Proetus Stokesi (Murch.) var. nov. *bellula*					x			x			
Leperditia sp.										x	

N.B.—All these localities are in the Coed-y-paen anticline, except 110, which is in the Llangibby anticline. At 73 the limestone was not *in situ*, but probably came from one of the numerous quarries near 51, not far away.

(*c*) THE LUDLOW BEDS.

Overlying the Wenlock Limestone all along its outcrop there are to be seen brown sandy shales with thin calcareous layers, or containing calcareous nodules, and these are covered by brown or green earthy sandstones. The topmost beds seen are brown sandstones, which immediately underlie the yellow quartzose sandstone, which, as has been mentioned above, forms the base of the Old Red Sandstone from Trostra Common to Llandegveth Church and Graigwith House.

Neither in the Coed-y-paen Anticline nor in any other part of the Usk area is there any lithological or fossil evidence of the presence of the Aymestry Limestone.

The Ludlow beds are characterised throughout by the constant presence of *Chonetes striatella* and *Orthis lunata*, while *Dayia navicula* is a common fossil from the base of the series to within 240 feet of its summit, but has not yet been found in the uppermost beds. *Holopella gregaria* and *H. obsoleta* seem to characterise the very highest strata.

The total thickness of the Ludlow beds seen seems to be about 1300 feet, but as the Old Red Sandstone is, according to the Survey, not conformable to the Ludlow beds, some of the latter may have been removed by denudation.

The beds will be described from the Wenlock Limestone upwards.

To the South of the Common Coed-y-paen mass of Wenlock Limestone occur sandy shales with calcareous nodules. They are seen at (74) in an old road which crosses the stream running down from Coed-y-paen Farm, where they dip S.S.W., and are only a few feet above the top of the Limestone, and they are also seen in an old quarry (73) just below the road, about 700 yards due South of Common Coed-y-paen, where they dip 35° W. 10° S., having been affected, no doubt, by the fault which bounds the Coed-y-paen mass of Limestone along its Western boundary.

The fossil evidence makes it doubtful whether these beds are to be considered of Wenlock or of Ludlow age, but the absence of *Chonetes striatella* and *Orthis lunata*, which are so characteristic of the Ludlow beds of the district, suggests that they might be considered to be of Wenlock age, and that,

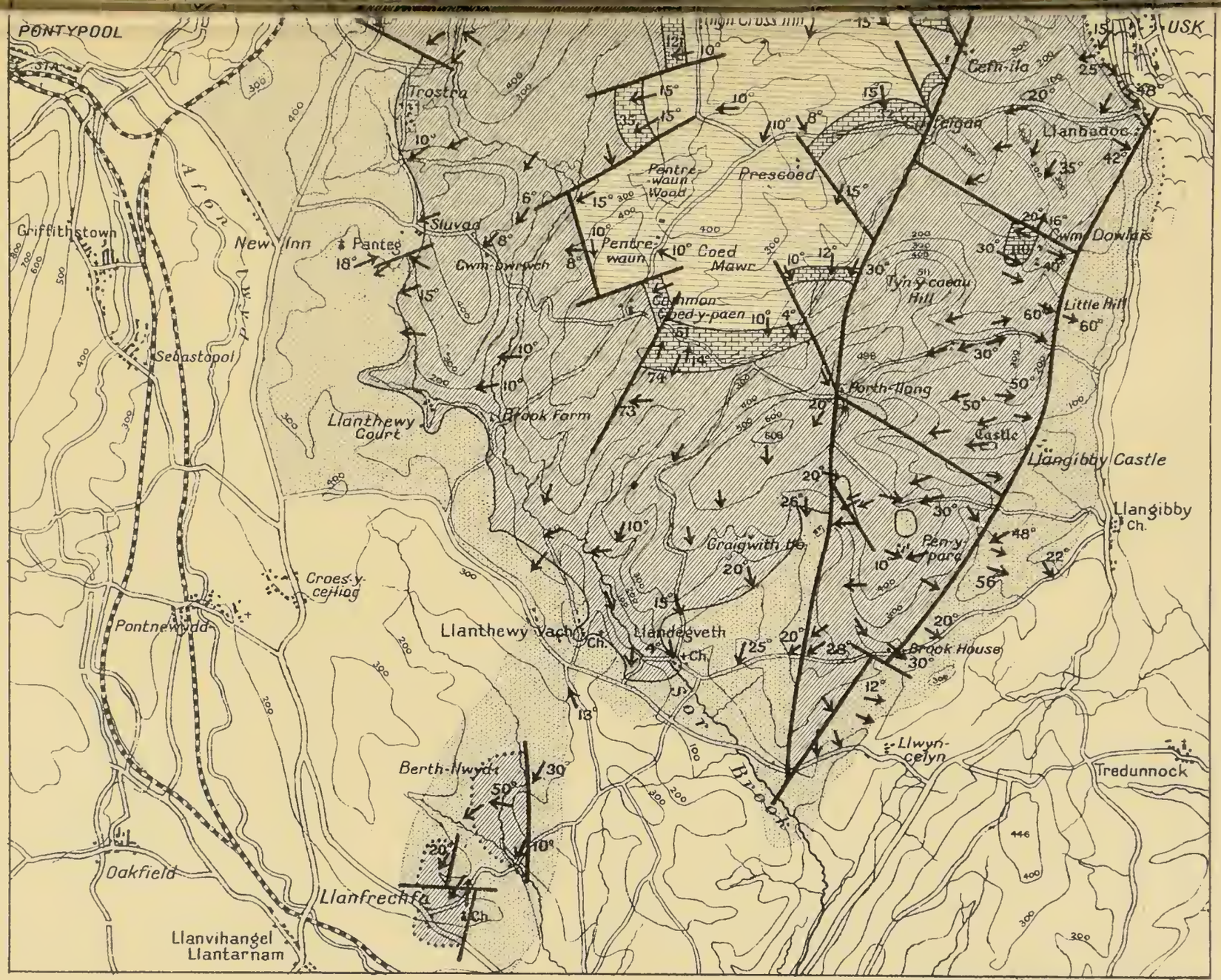
GEOLOGICAL MAP
OF THE
SILURIAN INLIER OF USK.

Scale 1 inch to a mile.

REFERENCES

- *Old Red Sandstone*
- *Ludlow Beds*
- *Wenlock Limestone*
- *Wenlock Shales*
- *Drift*
- *Alluvium*
- ..... *Hypothetical Boundaries*
- ——— *Faults*
- 30° ↘ *Dip Angles*

For other Numbers (74) See text.



Lithographed by W. & A.K. Johnston, Limited, Edinburgh.

therefore, the summit of the Limestone is not the summit of the Wenlock beds. The decision on this point must, however, be left till more exposures are made in the beds just above the limestone. In these beds were found :—

Favositella interpunctata ?
Stropheodonta filosa
Leptæna rhomboidalis
Plectambonites transversalis
Strophonella funiculata
,, *euglypha*
Orthothetes pecten
Chonetes ceratoides
Chonetes sp.
Orthis elegantula
Pentamerus (Sieberella) galeatus
Wilsonia Wilsoni
Wilsonia Davidsoni
Rhynchotreta cuneata ?
Atrypa reticularis
Spirifer crispus
,, *elevatus*
,, *plicatellus*

Above the Glascoed mass of Limestone, sandy shales, with calcareous nodules about 150 feet above the Limestone, are seen at (90), and here occurred

Crinoid remains
Leptæna rhomboidalis
Chonetes striatella
Orthis lunata
Wilsonia Davidsoni
Atrypa reticularis

In a quarry to the West of the Sôr brook, by the side of the road near Cwm Bwrwch, is seen sandstone, in which are layers of corals (*Favosites*) and similar sandy beds with coral layers occur at the same horizon, about 840 feet above the Wenlock Limestone, in Pantau Bushes close to Trostra Common.

The highest beds of Ludlow age are exposed along the Western and Southern margins of the Coed-y-paen Anticline. The Old Red Sandstone and underlying Ludlow beds along the Western margin both dip at low angles to the South-West or South-South-West. The Old Red Sandstone generally forms high-ground with a steep slope leading down to the Ludlow beds, and it is not very often that there is an exposure of either rock. The Silurian beds are to be seen in the road about 300 yards south of Trostra Farm, in a streamlet half a mile further to the south and by the roadside near Brook Farm, to the east of Llanthewy Court. The rock is a brown or green sandstone and fossiliferous. Further to the South a stream has cut back near Granary Wood into the Old Red Sandstone scarp, and, though no actual exposure of Ludlow sandstones is seen, there are plenty of fossiliferous blocks in the wood.

Continuing along the margin of the Inlier, we pass Llanthewy Vach Church, and round the nose of the Anticline up to Llandegveth Church. There is an old quarry close to the Farmers' Arms, near the latter Church, where the rock is a brown sandstone, with some sandy shales, and is very fossiliferous.

Finally, there is a quarry just below Llandegveth Church. The yellow quartzose sandstone at the base of the Old Red Sandstone is seen below the Churchyard wall, and the top-most bed in the quarry is about 6 feet below that exposure. Here is seen one foot of brown sandstone, much ironstained, and below it, 9 feet of brown earthy sandstones and sandy shales. The base of the brown sandstone is crowded with *Holopella gregaria*.

Though the Ludlow beds cannot be divided into sharply marked upper and lower divisions, one can say that the upper deposits are of the nature of sandstones and sandy shales, while the lower ones are sandstones with either thin calcareous layers or with bands of calcareous nodules. These deposits, however, are palæontologically very similar except that *Dayia navicula* does not range into the topmost beds, and *Holopella* seems to be confined to the uppermost layers.

III. (B). DETAILED ACCOUNT OF THE LLANGIBBY AREA.

The Llangibby Anticline runs from near Llwyn-Celyn for about three miles northwards to Cwm Dowlais. There it meets a cross fault, beyond which nothing but Ludlow beds are seen, in which no anticlinal arrangement is to be found.

On their Eastern side, the Silurian beds of the Llangibby Anticline dip to the South-East or South-South-East at very much the same angles as the neighbouring Old Red Sandstone beds, but that the junction between the two is a fault line is obvious from the following considerations :—

(1) The top of the Wenlock Limestone at Cwm Dowlais is only about 300 yards from the Old Red Sandstone, and as the dip of the Ludlow beds is on the average 35°, their thickness must be about 500 feet. Since, in the Coed-y-paen Anticline, there are 1300 feet of Ludlow beds, much of these must be missing near Cwm Dowlais.

(2) In a pit near the bottom of the valley, South of Llangibby Castle, Ludlow sandstones and shales very close to the Old Red Sandstone, are exposed, and are seen to be crumpled.

(3) The fossils from the Ludlow beds near the margin of the Inlier are not those which characterise the uppermost beds of the Coed-y-paen Inlier.

(4) Nowhere along this Eastern boundary has the yellow quartzose sandstone, which forms the base of the Old Red Sandstone, been observed, although in the road from Llandegveth to Llangibby and close to Little Hill Farm, Old Red Sandstone is to be seen within a very few feet of the Silurian beds.

In the region of Pen-y-parc the Anticline has a small syncline at its summit (see fig. 4), and in it a small patch of Old Red Sandstone has been preserved. There are two ponds near the house which show red soil in their deep banks, and though no actual exposure of rock is now to be seen, the Survey map is no doubt right in representing a small area of Old Red Sandstone close to the house.

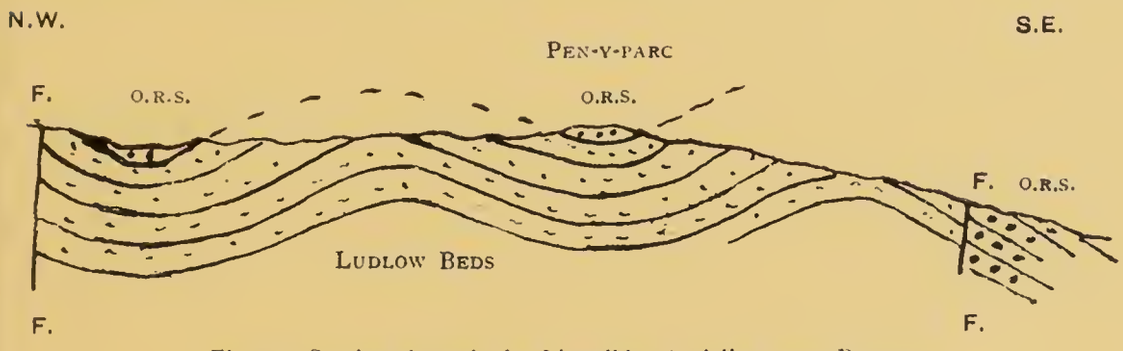


Fig. 4.—Section through the Llangibby Anticline, near Pen-y-parc. Horiz.: Scale about 4.5″ = 1 mile. Vert: Scale 1″ = 800 ft.

About half a mile to the West, Old Red Sandstone is again suggested by the colour of the soil, and is seen *in situ* in the bed of a small stream, where it dips 27° W. S. W. As five yards lower down the stream, Ludlow beds occur, dipping 10° S. W., the two sets of beds are probably separated here by a fault.

Some half a mile to the North of Pen-y-parc the Llangibby Anticline is cut across by a fault, which shifts the crest of the Anticline on its Northern side to the East, the crest running under the old Castle in a slightly sinuous line to Cwm Dowlais, where the base of the Ludlow beds is reached, and an arch of Wenlock Limestone exposed.

No Wenlock shales are to be seen in this Anticline, owing to the fault to the North of Cwm Dowlais, which has let down Ludlow beds.

(*a*) THE WENLOCK LIMESTONE.

This rock is only exposed in Cwm Dowlais, and is there well seen in several quarries. The lowest bed seen is a compact encrinital limestone, of which five feet are visible, and over this come 12 feet of irregular limestone bands with shale partings, then 10 feet of compact encrinital limestone, and then more thin irregular limestone bands with shale partings. The fossils from these quarries have already been recorded in the list on p. 141, and correspond with those found in the Wenlock limestone of the Coed-y-paen Anticline.

(*b*) THE LUDLOW BEDS.

To the East of the Cwm Dowlais Limestone, there were well seen in 1913 in a new road-cutting, dark green, earthy sandstones, which dipped 40° E. S. E., and were about 500 feet above the limestone.

Similar beds with calcareous bands are exposed in an old quarry just by Little Cwm Dowlais Farm, and at Little Hill to the South, where the Old Red Sandstone is seen, very close to them. They are constantly exposed in the road, which runs Westwards towards Porth-llong, and in the stream running down to Little Cwm Dowlais.

Further to the South Ludlow Sandstones occur in the wood to the North of Llangibby Castle, and the Castle itself is on sandstones and sandy shales. These are very fossiliferous at the extreme corner of the wood slightly to the West of the Castle.

To the South of the fault which runs through Llangibby Park, Ludlow beds are seen in a quarry to the East of the patch of Old Red Sandstone, which occurs near Graigwith House. Here they dip 36° W.S.W., and contain :—

Stropheodonta sp.
Chonetes striatella
Orthis lunata
Holopella gregaria
Holopella sp.
Phacops caudatus

The presence of *Holopella gregaria* confirming the conclusion, due to the neighbourhood of the Old Red Sandstone, that we have here the uppermost Ludlow beds.

Further to the South the road from Llandegveth, after crossing the stream near Brook House, passes through a cutting, which at one time must have clearly shown the nature of the junction between the Silurian and Old Red Sandstone beds. At present, however, one can only see red and green marls, which dip 30° S.E., and brown fossiliferous Ludlow shales, but the actual junction is overgrown.

Still further South yellow sandstones with a few calcareous layers are to be seen in a small stream which runs past Duke's Brake, and in these *Chonetes striatella*, *Spirifer crispus*, and other Ludlow fossils occur.

From the above account of the Silurian beds of the Llangibby Anticline, it is obvious that the same general succession is seen in it as is apparent in the Coed-y-paen Anticline. The Wenlock Limestone of the two areas is similar in its lithology and in its fauna, while the Ludlow beds, though perhaps they show less frequent layers of calcareous nodules in their lower parts in the Eastern Anticline than in the Western one, yet are, in the main, sandstones with calcareous layers below and sandy shales above. In both areas *Dayia navicula* is only found in the lower beds of Ludlow age, while *Holopella* characterises the upper ones.

IV. (*a*). EXPOSURES BETWEEN CWM DOWLAIS AND CWM CAYO.

These exposures are all in beds of Ludlow age. The Anticlinal arrangement so well seen to the South of Cwm Dowlais is absent in this more northerly tract, and the dips show that the beds have been much affected by pressure.

On the hillside immediately to the North of the Wenlock Limestone in Cwm Dowlais recent excavations show a hard sandstone, which dips 16° N.N.E., but the beds soon bend, and at the top of the hill are dipping 35° W.S.W. The published 1-inch map represents the Wenlock Limestone of Cwm Dowlais, as occurring in a dome with a quâquâversal dip, but this can now be proved not to be its arrangement.

The Sandstone is a Ludlow bed containing *Orthis lunata* and *Dayia navicula*. It is well seen in a road cutting close to Cefn Ila Lodge.

Near Llanbadoc there are numerous exposures in sandstones and impure calcareous beds. These have been cut back by the Usk and Alluvium laid down, which extends to an old river cliff that rises to a height of 150 feet above the river.

The face of this cliff has been quarried at its base, and its upper part is well shown in diggings near Pear Tree Cottage.

In a large quarry by the roadside to the North-East of Llanbadoc Church there are seen about 70 feet of blue-grey impure limestone covered by 30 feet of sandy beds, all dipping Eastwards. This is the only locality where any considerable thickness of calcareous beds occurs in the Ludlow deposits.

Similar beds are seen behind the Parish Room a little nearer Usk. At both places fossils are abundant. There have been obtained the following :—

Ischadites Kœnigi.
Cyathophyllum ? sp.
Stropheodonta filosa.
Leptæna rhomboidalis.
Strophonella euglypha.
,, *funiculata.*
Chonetes cf. Piperi.
Orthis aff. reversa.
Wilsonia Wilsoni.
Atrypa reticularis.
Spirifer crispus.
,, *plicatellus.*
Meristina tumida ?
Pterinea lineatula.
,, *pleuroptera.*
Pteronitella inexpectata.
Palæopecten Danbyi.
Ambonychia striata.
Gosseletia ? Tawneyi
Orthonota sp.
Pleurotomaria Lloydi
Eccyliomphalus lævus.
Craspedostoma ? sp.
Bellerophon acutus.
Orthoceras sp.
Phacops caudatus.

Proceeding Northwards, one now crosses the Usk and its alluvium, which stretches up to the foot of the ridge on which Usk Castle stands. This ridge is pierced by the railway tunnel, which opens at its Western end into a deep cutting in which the station is built. Here there is a fine exposure of hard Ludlow sandstones, which dip 20° S., are grey and light green in colour, and contain in their upper part a few calcareous nodules.

Yellow sandstones are seen dipping 20° S.E. in the lanes to the North of the Castle near the Eastern end of the tunnel, but the fault line which separates these beds from the Old Red Sandstone to the East is not seen. Red soil in the

railway-cutting, however, suggests the presence of Old Red Sandstone there. From these exposures were collected :—

Lingula sp.
Stropheodonta sp.
Leptæna rhomboidalis.
Chonetes striatella.
Orthis lunata.
,, *polygramma.*
Wilsonia Davidsoni.
Camarotœchia nucula.
Dayia navicula.
Spirifer crispus.
Whitfieldella didyma.
Pterinea naviformis.
,, cf. *subfalcata* var.
Ctenodonta sp.
Modiolopsis sp.
Palæopecten Danbyi.
Grammysia sp.
Orthonota amygdalina.
,, sp.
Bellerophon aff. *late-vittatus.*
Orthoceras sp.
Calymene intermedia.
Phacops Downingiæ.

The top of the ridge running Northwards from Usk Castle is drift-covered, and no more exposures are seen till one comes to Cwm Cayo. On the top of the ridge here hard red sandstones of the Old Red Sandstone series are seen dipping 15° S.E., while in the stream below are Ludlow sandstones dipping 20° S.S.W., and lower down at 5° W. Here, therefore, as in the Llangibby district, the Eastern margin of the Silurian Inlier is a line of fault.

In the lofty cliff by the road, just to the North of where the Cwm Cayo Brook enters the Usk, the Ludlow sandstones dip 20° N. This Northerly dip is, no doubt, due to a fault which crosses Cwm Cayo just below Baldwin's Farm, and throws back the Eastern margin of the Ludlow beds about 300 yards to the East.

From the fossil evidence and from the character of the beds in this portion of the Inlier we may class them with the lower division of the Ludlow beds of the Coed-y-paen Anticline.

IV. (*b*). THE EXPOSURES BETWEEN CWM CAYO AND LLANCAYO HILL CAMP.

On the North side of the Cwm Cayo fault Ludlow beds are seen by the Usk, and dip 20° E. They are hard greenish sandstones, with occasional calcareous bands and nodules.

Near Baldwin's Farm are two quarries, which show sandstone and impure limestone, while in the stream above the farm, dipping at first 10° E., and then, as the marginal fault is approached, 55° E., are more Ludlow sandstones, with

calcareous layers. After a short distance, Old Red Sandstone is exposed in the stream, where it dips 64° E. 10° S.

To the North of these exposures in the stream Ludlow sandstones are seen dipping 75° E., and then old Red Sandstone dipping 45° N.E., and one then reaches Llancayo Hill. As has been mentioned above, the Wenlock Shales of the Coed-y-paen anticline extend northwards along the western foot of this hill, but the hill itself is made of Ludlow sandstones, which are light green or grey in colour, and are frequently exposed.

These sandstones run on to the Northern end of the hill, where there is a fine camp, beyond which a fault displaces the Eastern margin of the Silurian beds some 300 yards to the East.

The upper beds between Cwm Cayo and Llancayo Hill Camp seem to correspond with the upper beds of the Ludlow series seen in the Coed-y-paen Anticline. They have not yielded *Dayia navicula.*

IV. (*c*) THE EXPOSURES BETWEEN LLANCAYO HILL CAMP AND HILL FARM.

To the north of the fault just mentioned, green sandy beds of Ludlow age occur close to where the road below the camp crosses the stream. They are seen in several places for a third of a mile to the North.

To the South-South-East of Hill Farm are several exposures in Ludlow sandstones, with calcareous layers and nodules, which dip to the North-East and extend in a South-Westerly direction up to the Wenlock Shales, from which they are separated by a fault.

To the North of Hill Farm the marginal fault bounding the Inlier on its Eastern side seems to be displaced by three cross faults. How far westwards any of these extend it is impossible to say. To the North-West of the farm the Bettws-Newydd drift obscures the Silurian beds, so that one is unable to say whether these Eastern Ludlow beds continue to be in contact with Wenlock Shales to the North of Bettws-Newydd, or whether any Wenlock Limestone occurs there.

IV. (*d*) EXPOSURES BETWEEN BETTWS-NEWYDD AND CLYTHA.

Very much of the country between Bettws-Newydd and Clytha is drift covered, and it is only in a few exposures to the South-East and to the North of the drift that any exposures of Silurian rocks are to be seen. To the South-East, near the margin of the Inlier, Ludlow sandstones containing *Chonetes striatella* are seen round the farm called Upper Berthlwyd.

About half-a-mile further North is the farm called Hilla, and here are sandstones dipping North-North-East, though close to the margin of the Inlier they swing round and dip South-East. They have yielded *Dayia navicula*.

On the North-Western side of the drift area Ludlow beds are exposed in the neighbourhood of Clytha Castle.

Abbout 400 yards South of the Castle is an old quarry in sandstones with calcareous nodules, which dip 10° N., and are covered by a thin capping of drift.

Clytha Castle itself is on drift, but at the farm Ffynnonau, 300 yards to the North-East, is a quarry in Ludlow sandstones, which dip 10° N., and contained :—

Stropheodonta filosa ?
Orthothetes aplanata.
Chonetes striatella.
Orthis lunata.
Dayia navicula.
Atrypa reticularis.
Spirifer crispus.
Whitfieldella didyma.
Pterinea naviformis.
,, *lineatula*.
Palæopecten Danbyi.
Cucullella ovata ?
Grammysia sp.
Modiolopsis sp.
Goniophoracymbæformis
Orthonota impressa.
Anodontopsis quadratus
Orthoceras angulatum.
Calymene sp.

Three hundred yards further North the Abergavenny road climbs up from the Usk and passes through a deep cutting. This gives a magnificent section through Ludlow beds, and shows about 12 feet of sandstones covered by 54 feet of sandy shales, calcareous sandstones, and thin calcareous layers, all dipping 12° E. They contain *Dayia navicula*.

The relation of these Silurian beds to the Old Red Sandstone to the East is quite obscured by drift.

IV. (*e*) EXPOSURES ON THE WEST SIDE OF THE INLIER TO THE NORTH OF THE USK RAILWAY.

Most of the Western side of the Inlier is obscured by Alluvium and Drift, and it is only in the bank of the Usk for 700 yards above the Chain bridge, at a spot by the road to the West of that bridge, and near the Reformatory Schools, to the North of Little Mill, that any Silurian beds are visible.

Near the Chain bridge, Ludlow beds are seen, in the left bank of the Usk, thrown into a set of gentle folds. They are sandy shales, with calcareous concretions.

There is, however, another exposure near the river some 300 yards further North, where there is an old line of workings running down the slope from Tump Farm to the river, and near the farm these show sandy shales, with calcareous nodules, but in the lowest working of all there are seen a few feet of hard encrinital Limestone. The exposure is a very bad one, and is very much covered with material which has slipped down from above. The Limestone appears to be dipping 20° S.W., and so to underlie the Ludlow beds seen lower down the river.

The fossils from these workings are very few, only an *Orthis* and *Phacops caudata* having been found, but the resemblance of the red crinoidal Limestone to the massive Wenlock Limestone of the Coed-y-paen anticline is very marked.

If this is the Wenlock Limestone it cannot be overlying the Wenlock Shales to the East, for they dip to the North-North-East, and it must be considered as underlying the Ludlow beds lower down the river and with them to be faulted off from the Wenlock Shales to the East.

It has been mentioned that the lofty hill-side above the Usk on its Western side below the Chain Bridge is made of Wenlock Shales covered by Drift. This Drift extends to the West across the road which comes up from the Chain Bridge but about half-a-mile from the bridge is a cutting by the road which shows Sandstones with calcareous layers dipping 20° N.10°W., and they contain *Chonetes striatella* and *Orthis lunata* in abundance. This, therefore, is further proof of a

strip of Ludlow beds to the West of the great central mass of Wenlock Shales.

The only other exposure of Silurian beds to the West is in the railway cutting, close to the Reformatory School, about a mile and a quarter to the South-West of the last-mentioned exposure. Here are seen sandy shales with thin calcareous partings, dipping 30° E.S.E. They contained :—

Cornulites serpularius. *Camarotœchia nucula* *Holopella ?* sp.
Chonetes striatella. *Orthonota* sp. *Orthoceras* sp.
Orthis lunata.

These beds seem to be entirely surrounded by drift, but as they lie well to the West of the boundary of the Inlier to the South of the Usk railway, where Wenlock Limestone is faulted against Old Red Sandstone, it seems probable that an East and West fault runs somewhere close to the railway and shifts the boundary of the Inlier on the North to the West.

Though these exposures along the Western side of the inlier to the North of the Usk railway are too scanty to enable one to speak with certainty about the arrangement of the beds, yet it is clear that they are of Ludlow age to as far North as Tump Farin, and it seems probable that we have here a set of Ludlow beds faulted off from Wenlock Shales to the East, and from Old Red Sandstone to the West.

Lithologically these beds correspond to the lower set of Ludlow beds seen in the Coed-y-paen anticline, and the fossil evidence tends to confirm this view.

V. THE LLANFRECHFA INLIERS.

About a mile-and-a-half to the South of Llandegveth is the village of Llanfrechfa, which is partly situated on a small inlier of Silurian rocks, while another, and slightly larger, inlier lies between this one and the Silurians of Usk. Though the exposures in these two small areas are few, yet no account of the Silurian rocks of Usk would be complete without some reference to them.

The Northern Llanfrechfa inlier is crossed from North to South by the Candwr brook, and in the bed of this stream to

the West-North-West of Berth-llwyd Farm, Old Red Sandstone beds are seen. The rock is a hard micaceous red sandstone, dipping 30° S.S.W. To the South-West of the farm, by the roadside, red marls, dipping 20° W.S.W., are exposed, and between these occur Ludlow beds. There is little doubt that the Eastern margin of the Silurian beds is a line of fault, as the Old Red Sandstone is apparently dipping below the older rocks, but there is nothing to suggest that the succession to the West is not one of apparent conformity. To the South of Berth-llwyd along the top of the valley a line of old workings shows yellow sandstone, which dips 5° W.N.W., and from which were obtained :—

Chonetes striatella, *Orthis lunata*, *Holopella gregaria*, *Orthoceras* sp.

while in the steep road leading down to the ford, about a third of a mile South of the farm, are hard sandstones, dipping 10° S.S.W., and these yielded :—

Cornulites sp.	*Orthis lunata.*	*Orthoceras filosum.*
Chonetes striatella	*Holopella gregaria*	

These are the only exposures now to be seen in this inlier, but some three hundred yards to the South, in the stream running West from Llanfrechfa House, Silurian beds are again seen with Old Red Sandstone to the North.

The latter rock is a red quartzose gritty sandstone dipping to the North-East, just below the road from the house, while a little lower down Silurian sandstones and thin calcareous beds dip 10° S.W. Some yards lower Old Red Sandstone is again seen in the North bank of the stream dipping 20° N., while Silurian beds in the stream dip 25° S.S.E. It seems plain, therefore, that the stream is running along an East and West fault line.

The Ludlow beds here contained :—

Lingula cornea.	*Orthonota.* sp	*Holopella obsoleta.*
Chonetes striatella.	*Holopella gregaria ?*	*Orthoceras* sp.

If, however, we continue Westwards along the fault line, we no longer find old Red Sandstone immediately to the North of it, but Ludlow beds. These are soft yellow sandstones, which are seen to the North of the house dipping 20° S.W.

The probable explanation of this is seen by referring to the map, where the Northern part of the Inlier is represented as being displaced Westwards along the fault line mentioned above. In the southern part of the Inlier yellow sandstones are seen by the roadside to the North-West of the Church, and an old pit to the South of the Church was, no doubt, formerly used for the extraction of Silurian sandstone, but it is now entirely covered by grass.

The colour and nature of the soil in the fields near here also point to the extension of the Silurian rocks to the South of the Church, but no exposures are to be seen.

The appearance of the Ludlow beds in these small inliers and the nature of their fossils, points to their corresponding to the topmost beds of the Ludlow series seen in the main Usk Inlier.

In the 1-inch map a third small Silurian inlier is shown near Lan-sôr, half a mile to the South-East of Llandegveth, but there is now no exposure here.

VI. THE FOLDING AND FAULTING.

It has already been pointed out that there are two sets of disturbances to be seen in the Usk area. There is one which runs nearly N.N.E.-S.S.W., which has given rise to the two anticlines in the South, to the fault line which divides them, and to the fault which bounds the Silurian beds along their Eastern margin, and there is the other which has given rise to the East and West faults which cross the latter fault.

When considering the periods at which these two sets of disturbances took place, we must bear in mind the fact that in the Tortworth area the very thin development of Ludlow beds is thought to be due to upheaval and denudation during Old Red Sandstone times, and we may well imagine that in Old Red Sandstone times a certain amount of uplift occurred in the Usk region.

There is no typical Downtonian at Usk, and there is no fossil evidence to show whether the yellow, somewhat coarse,

quartzose sandstone which comes between the Old Red Sandstone beds and Ludlow sandstones is to be considered as of Old Red Sandstone or of Downtonian age.

It may be that in early Old Red Sandstone times an uplift took place, and denudation removed Downtonian beds, and afterwards the deposition of this yellow sandstone took place. Later on, in post-Carboniferous times, two sets of earth movements are well-known. The one gave rise to the Pennine range and the Malvern fault, these running nearly North and South, the other gave rise to a series of East and West faults and folds, of which the South Wales syncline is an example, and is known as the Armorican system of folds.

No doubt, the anticlines of the Usk Silurians, though they may have been forming in Old Red Sandstone times, are due in the main to the Pennine system of earth movements. The marginal faults of the Inlier are of the same period, and it was then that the Wenlock Limestone got broken and driven in on to the softer underlying beds.

At a somewhat later date during the Armorican period of movement, came the stresses, which caused the East and West faulting and broke not only the Silurian beds but also the Old Red Sandstone above them along the Eastern margin of the Inlier.

These stresses not only shift the Silurian and Old Red Sandstone deposits, but also affect the direction of the great fault which separates the two anticlines and also the Eastern boundary fault, so that they no longer run North-North-East, but North-North-West, near Trostrey.

VII. GENERAL SUMMARY AND CONCLUSIONS.

The Usk Inlier is shown to contain Ludlow and Wenlock beds. The base of the Wenlock beds is not seen, and it seems probable that the Ludlow beds are unconformably overlain by the Old Red Sandstone.

In the Tortworth area about 625 feet of Wenlock beds occur between Llandovery rocks and a thin capping of Ludlow beds. The absence of the greater part, or even locally of the

whole, of the Ludlow beds being attributed to upheaval and erosion in late Silurian and early Devonian time.[1] In the Usk area there are about 890 feet of Wenlock beds seen, and 1,300 feet of Ludlow beds. There is no marked discordance in the dip of the strata of Old Red Sandstone and Ludlow ages.

There is no occurrence of Aymestry Limestone nor of a fauna of Aymestry Limestone characteristics. The Ludlow beds cannot be separated into an upper and a lower division, and pass down conformably into Wenlock beds. The lower portion of the Ludlow beds contains *Dayia navicula*, which is not found in the highest beds seen. The Wenlock Limestone is possibly not at the summit of the Wenlock beds, and in consequence there is a difficulty in marking on a map the exact line along which these beds begin.

The occurrence of the Wenlock Limestone in detached strips can be explained perfectly well as being due to the pressure to which the area has been subjected, this pressure having fractured the originally continuous limestone band and driven portions of it in on to the soft underlying shales to various extents. The Wenlock Shales are markedly of a sandy nature in their upper portion and more of the nature of a muddy deposit in their lower one.

Considerable differences have been found from the published 1-inch map. The Wenlock Shales have been proved by fossil evidence to cover much ground in the northern part of the area, which is represented in that map as consisting of Ludlow beds. The Wenlock Limestone shown in the map as running northwards from Trostrey is non-existent. A new outlier of Old Red Sandstone has been found to the North-West of the Pen-y-parc outlier.

The identification of the fossils from the district has been carried out by Dr F. R. Cowper Reed, to whose kindness in undertaking this task the author is very much indebted. In conclusion mention must be made of the great kindness shown to the author by Mr Albert Williams, of Pen-y-parc, who allowed him access to his property.

1 "The Fossiliferous Rocks of the Tortworth Inlier," by F. R. C. Reed and S. H. Reynolds Q.J.G.S., lxiv. (1908), p. 535. See also Summary of Progress of the Geological Survey for 1901 (1902), pp. 38-40.

VIII. LIST OF FOSSILS FROM THE LUDLOW BEDS.

Ischadites Kœnigi (Murch.)
Hallia ? sp.
Cyathophyllum ? sp.
Zaphrentoid
Favosites gothlandica ? (Fougt)
,, *Forbesi* (M. Edw.)
Favositella interpunctata ? (Nich. and Foord)
Monticuliporoid
Fistulipora sp.
Ptilodictya sp.
Trematopora ? sp.
Lichenalia sp.
Lingula cornea (Sow.)
,, *Symondsi ?* (Salt.)
,, sp.
Orbiculoidea rugata (Sow.)
Stropheodonta filosa (Sow.)
,, sp.
Leptæna rhomboidalis (Wilck.)
,, ,, var.
Plectambonites transversalis (Wahl.)
Strophonella funiculata (McCoy)
,, *euglypha* (His)
Orthothetes pecten (Linn.)
,, *applanata ?* (Salt.)
Chonetes ceratoides sp. nov.
,, cf. *piperi* (Mob. and Grönw.)
,, *striatella* (Dalm.)
Orthis elegantula (Dalm.)
,, *lunata* (Sow.)
,, *polygramma ?* (Sow.)
,, aff. *reversa* (Salt.)
Pholidops implicata (Sow.)
Pentamerus (*Sieberella*)*galeatus*(Dalm.)
,, *linguifer* (Sow.)
Rhynchotreta cuneata (Dalm.)
Camarotœchia borealis (Schloth.)
,, *nucula* (Sow.)
Wilsonia Davidsoni (McCoy.)
,, *Wilsoni* (Sow).
Dayia navicula (Sow.)
Atrypa reticularis (Linn.)
Atrypina ? sp.
Glassia obovata ? (Sow.)
Spirifer crispus (His.)
,, *elevatus* (Dalm.)
,, *plicatellus* (Linn.)
Whitfieldella didyma (Dalm.)
Meristina tumida ? (Dalm.)
Meristella sp.
Pterorhytella inexpectata sp. nov.
Palæopecten Daubyi (McCoy)
Pterinea exasperata (Reed)
,, *lineatula* (D'Orb.)
,, *naviformis* (Conrad.)
,, *pleuroptera* (Conrad.)
,, *retroflexa* (Wahl.)
,, ,, var. *demissa* (Conrad.)
,, ,, var.
,, *Sowerbyi*
,, ,, cf. *subfalcata* (Conrad.)
,, ,, var.
Ambonychia striata (Sow.)
Gosseletia ? Tawneyi sp. nov.
Ctenodonta sp.
Cucullella ovata ? (Sow.)
,, sp.
Cardiola interrupta (Brod.)
Sanguinolites aff. *anguliferus* (McCoy.)
Modiolopsis mytilimeris (Conrad.)
,, sp.
Anodontopsis bulla (McCoy.)
,, *quadratus ?* (McCoy)
,, sp.
Goniophora cymbæformis (Sow.)
,, sp.
Nuculites sp.
Pholadella McCoyi sp. nov.
Orthonota amygdalina (Sow.)
,, *impressa* (Sow.)
,, *rigida* (Sow.)
,, sp.
Pseudaxinus securiformis (McCoy).
Grammysia cingulata ? (His.)
,, *rotundata ?* (Sow.)
,, sp.
Leptodomus truncatus ? (McCoy.)
Conularia subtilis (Salt.)
Bellerophon acutus (Sow.)
,, *dilatata* (Sow.)
,, aff. *Eiseni* (Lindstr.)
,, aff. *latevittatus* (Lindstr.)
Eccyliomphalus lævis (Sow.)
Pleurotomaria Lloydi (Sow.)
,, sp.
Murchisonia sp.
Cyclonema coralli (Sow.)
,, sp.
Horiostoma globosum (Schloth.)
Trochonema ? sp.
Craspedostoma sp.
Holopea ? sp.
Holopella gregaria (Sow.)
,, *obsoleta* (Sow.)

Loxonema sinuosa (Salt.)
Tentaculites sp.
Cornulites serpularius (Schloth).
Orthoceras angulatum (Wahl.)
,, *filosum* (Sow.)
,, *Grindrodi ?* (Blake.)
,, *Ibex* (Sow.)
,, sp.
Cyrtoceras sp.
Lituites articulatus (Sow.)
Calymene Blumenbachi (Brongn.)
,, *intermedia* (Lindstr.)
Homalonotus sp.
Encrinurus punctatus (Brünn.)
Acidaspis sp.
Phacops Downingiæ (Murch.)
,, *caudatus* (Brünn.)
Proetus signatus (Lindstr.)
,, sp.
Beyrichia Kloedeni (McCoy.)
,, *mcCoyana ?* (Jones.)
,, sp.
Leperditia sp.
Pterygotus sp.

LIST OF FOSSILS FROM THE WENLOCK SHALES

Cyathophyllum sp.
Lindstræmia bina ? (Lonsd.)
,, sp.
Zaphrentis sp.
Favosites (*Pachypora*) sp.
Alveolites seriatoporoides ?
,, sp.
Cœnites sp.
Heliolites interstincta (Linn.)
Halysites catenularia (Linn.)
Monticuliporoid
Fenestella sp.
Eichwaldia capewelli ? (Dav.)
Orbiculoidea rugata (Sow.)
,, sp.
Stropheodonta filosa (Sow.)
,, *semiglobosa* (Dav.)
,, sp.
Leptæna rhomboidalis (Wilch.)
Plectambonites scissa (Salt.)
,, *transversalis* (Wahl.)
Strophonella funiculata (McCoy.)
,, *euglypha* (His.)
Orthothetes pecten (Linn.)
Chonetes ceratoides sp. nov.
,, *lævigata ?* (Sow.)
,, sp.
Orthis biloba (Linn.)
,, *elegantula* (Dalm.)
,, sp.
Anastrophia deflexa ? (Sow.)
Pentamerus (*Sieberella*) *galeatus* (Dalm.)
,, *linguifer* (Sow.)
,, sp.
Rhynchotreta borealis (Schloth.)
Wilsonia Wilsoni (Sow.)
,, ,, var.
Camarotœchia nucula (Sow.)
Rhynchonella Lewisi ? (Dav.)
Atrypa imbricata (Sow.)
,, *reticularis* (Linn.)
Athyris ? compressa (Sow.)
Spirifer crispus (His.)
,, *elevatus* (Dalm.)
,, *plicatellus* (Linn.)
,, ,, var. *radiatus* (Sow.)
Cyrtia exporrecta (Wahl.)
Rhynchospira Baylei (Dav.)
Meristina tumida (Dalm.)
Pterinea ? planulata (Conrad.)
,, *pleuroptera* (Conrad.)
,, *retroflexa* (Wahl.)
,, *subfalcata* (Conrad.)
,, ,, var.
Ctenodonta aff. *rhomboidalis* (Phil.)
,, sp.
Cucullella ovata ? (Sow.)
Cyrtodonta sp.
Megalomus ? sp.
Sanguinolites decipiens (McCoy.)
Modiolopsis complanata (Sow.)
,, *mytilimeris* (Conrad.)
Eurymyella cf. *Shaleri* (Williams.)
Goniophora cymbæformis (Sow.)
Platyceras cornutum (His.)
Orthonychia sp.
Pleurotomaria Lloydi ? (Sow.)
Cyclonema coralli ? (Sow.)
Bellerophon aff. *eiseni* (Lindst.)
Horiostoma globosum (Schloth.)
,, ,, var.
Holopella sp.
Tentaculites anglicus (Salt.)
Trochoceras striatum (Blake.)
Homalonotus johannis (Salt.)
,, sp.
Illænus barriensis ? (Murch.)
Encrinurus punctatus (Brünn.)
Lichas sp.
Phacops Downingiæ (Murch.)
,, *caudatus* (Brünn.)
Proetus Stokesi (Murch.)
Beyrichia Klædeni (McCoy.)
Leperditia sp.

PALÆONTOLOGICAL APPENDIX

BY

F. R. C. REED, M.A., D.Sc., F.G.S.

Chonetes ceratoides, sp. nov. [Pl. VIII., figs. 1, 2.]

Description.—Shell, semi-circular to semi-elliptical, widest along hinge-line; cardinal angles acute, depressed, pointed at about 60°, very rarely produced into small ears or semi-cylindrical. Pedicle-valve uniformly convex, rather strongly swollen, with small incurved, rather inconspicuous, beak, not overhanging hinge-line. Brachial valve flat to gently concave. Hinge-line furnished with three long equidistant straight spines on each side of sub-equal length, directed obliquely outwards in plane of valve, one spine arising close to the cardinal angle and the others respectively at two-thirds and one-third the distance from the beak; spines nearly as long as shell. Surface of shell covered with twenty-five to thirty-five low rounded closely-placed equal riblets, mostly primaries, nearly or quite obsolete at the cardinal angles, with very fine concentric striation over all.

Dimensions: Length (average), 4 m/m.
Width (average), 6 m/m.

Horizon and Localities.—Wenlock Shale: half a mile West of Bettws-Newydd Church and in roadside above Upper Wern-hir. Ludlow beds: (1) East bank of Usk, 300 yards above Chain Bridge; (2) by Cwm Dowlais Brook at extreme East of Inlier; (3) just above Wenlock Limestone, 600 yards South-East of Common, Coed-y-paen; (4) 600 yards South of Rhadyr Farm; (5) 600 yards West of Llangibby Castle.

Remarks.—This small and rather abundant shell is most allied to *Chonetes cornuta* Hall,[1] from the Clinton formation. It is also related to *Chonetes edmundsi* Williams,[2] from the American Silurian, but ours has fewer riblets. The Swedish species, *Chonetis Piperi* Moberg and Grönwall,[3] may also be compared. It is certainly distinct from the typical *Chonetes striatella* Dalm. as represented in Britain, though one of Davidson's[4] specimens from the Pentland Hills appears to be rather similar.

1 Hall and Clarke, Palæont. N.Y., vol. viii., Brach. I., pl. xvi., fig. 1.
2 Williams, Proc. U.S. State Mus., vol. 45, No. 1985 (1913), p. 323, pl. 29, fig. 6-9.
3 Moberg and Grönwall, Om Fyledalens gotland (Lunds Univ. Arsskr. N.F. 2, Bd. 5, No. 1 (1909), p. 34, pt. II., figs. 14-16.
4 Davidson, Mon. Brit. Foss. Brach., vol. iii., p. 331, pl. xlix., fig. 25 (non cet).

PTERONITELLA INEXPECTATA, sp. nov. [Pl. VII., fig. 1.]

Description.—Shell narrow, elongated, nearly three times as long as high, compressed, flattened, with very slightly convex undefined body, most swollen near beak; hinge-line long, straight, equal to length of shell. Anterior ear very small, flattened, not distinctly marked off from body nor projecting on margin. Posterior ear very large, long, narrow, elongated, triangular, less than one half the height of shell on posterior margin. Beak inconspicuous, obtuse, low, not rising above hinge-line, and situated close to its anterior end. Anterior end of shell blunt, steeply rounded, meeting hinge-line at right-angles, passing down into long gently arched inferior margin curving up posteriorly at about 30° towards hinge-line, but meeting it at about 45°; slightly excavated behind posterior ear, but otherwise regularly curved and not sinuated. Surface of body smooth, except for a few marginal concentric lines anteriorly; posterior ear ornamented with twenty to thirty fine straight radial ribs with four to five deeper and stronger equidistant interspaces between them, and all crossed by rather weaker transverse lines concentric with the posterior margin at somewhat irregular distances apart giving a cancellated appearance to the surface.

Dimensions:		
Length	80·0	m/m
Height (at middle)	31·0	m/m
Width of posterior ear on margin ..	13·5	m/m

Horizon and Locality.—Ludlow beds: just behind Parish Room, north of Llanbadoc Church.

Remarks.—This new species, of which only one right valve is known, must be referred to the genus *Pteronitella* Billings,[1] to which *Pt. condor* Salter[2] from the Lower Ludlow of Dudley also belongs. It somewhat resembles *Pt. oblonga* Billings,[3] from Arisaig, Nova Scotia, and especially may be compared with *Pt. passer* Clarke,[4] and *Pt. hirundo* Clarke,[5] from the Helderberg formation. In the latter species, Clarke says the radial lines on the shell are obsolete on the right valve except on the posterior wing. The same limitation of the ornament is noticeable in *Palæopinna flabellum* Hall,[6] from the Oriskany of New York and Gaspé—a shell which seems very similar except for the more terminal beak and the complete obsolescence of the anterior ear. The genus *Pteronitella* appears to be characteristic of the higher Silurian and the lower part of the Devonian. The type chosen by Billings is *Avicula retroflexa* Hisinger, but the first species described and figured is *Pteronitella venusta* Billings,[7] from the Upper Silurian of Arisaig, Nova Scotia.

1 Billings, Palæoz. Foss. Canada, vol. ii., pt. 1 (1874), p. 141.
2 Reed, Geol. Mag., Dec. IV., vol. ix. (1902), p. 147, pl. vii., figs. 6, 7.
3 Billings, *op. cit.*, p. 143, pl. 9, fig. 7.
4 Clarke, Mem. New York State Mus. No. 9, pt. 2 (1908), p. 30, pl. 4, figs. 12-14.
5 *Ibid.*, p. 29, pl. 4, figs. 8-11.
6 Hall, Palæont. N.Y., vol. 5, pt. 1 (1884), p. 240, pl. 87, fig. 4; Clarke, *op. cit.*, pt. 1., pp. 159, 233, pl. 21, figs. 1-5.
7 Billings, *op. cit.*, p. 142, pl. 9, figs. 5, 5a.

Palæopecten Danbyi McCoy.

Remarks.—As Williams[1] has recently pointed out, it is probable that more than one species has been included by McCoy amongst the shells from Westmoreland, which were named by him *Avicula Danbyi*. In the Usk district also the species may likewise be composite. The genus *Palæopecten* has been established by Williams (*op. cit*) for this type of shell, and the British representatives must be revised in the light of his conclusions.

Horizon and Localities.—Ludlow beds : (1) in Usk Station Cutting ; (2) behind Parish Room, close to Llanbadoc Church ; (3) in the quarry close to Ffynnonau, near Clytha Castle ; (4) in the quarry 500 yards South of Clytha Castle ; (5) in the quarry by the side of the road leading East from Sluvad, about half a mile from the farm of that name ; (6) in Sôrbrook, half a mile North-East of Llanthewy Court ; and (7) in the quarry to South-West of the Farmers' Arms, Llandegveth.

Eurymyella cf. Shaleri Williams [Pl. VIII., fig. 3.]

Remarks.—The reasons for the separation of the genus *Eurymyella* from *Modiolopsis Eurymya, Anodontopsis* and *Whiteavesia* have been carefully explained by the author of the genus, H. S. Williams,[2] and following his definition, there is a shell from Usk, which must be referred to it, and it agrees closely with one of his species, *E. Shaleri* Williams,[3] occurring in the Cobscook Bay Series (Silurian) of Moose Island, Maine. Williams remarks on the resemblance of this species to the British *Anodontopsis angustifrons* McCoy[4], from the Upper Ludlow of Kendal ; but our Usk right valve cannot be referred to *A. angustifrons*, as it has no posterior lateral teeth.

Dimensions.—Length, 11.5 m/m.

Horizon and Locality.—Near the top of Wenlock Shales by the road-side above Upper Wern-hir.

1 Williams, Proc. U.S. Nat. Mus., vol. xlv. (1913) No. 1985, pp. 330-333, pl. 29, figs. 13, 17, 18.
2 Williams, Proc. U.S. Nat. Mus., vol. xlii., (1912), No. 1908, p. 382
3 *Ibid.*, p. 385, pl. 49, figs. 1-4.
4 McCoy, Syn. Brit. Pal. Foss. Woodw. Mus. (1855), p. 271, pl. 1 K, figs. 14, 15.

GOSSELETIA (?) TAWNEYI, sp. nov. [Pl. VII., figs. 2, 2a.]

Description.—Shell large, sub-triangular, inequilateral, about one and a half times as long, as high, gently convex, most so near anterior end, somewhat compressed and flattened posteriorly. Beak elevated, pointed, incurved, directed forwards, rising high above hinge-line, situated at about one fourth the length of shell from front end; pre-umbonal and post-umbonal slopes meeting at beak nearly at right-angles. Anterior end of shell short, steep, straight, inclined to inferior margin at about 75°; anterior inferior angle blunt, abruptly rounded area beneath and in front of beak concave, not sharply limited. Inferior margin very slightly arched; long. Posterior end of shell somewhat produced, bluntly pointed, the inferior and post-umbonal margins meeting at about 45°. Post-umbonal margin straight, oblique, about one and a half times as long as anterior end of shell. Surface of shell marked with fifty to sixty regular, equidistant, strong, straight, flattened, radiating ribs parallel to anterior and post-umbonal margins of shell; ribs separated by shallow, rounded, regular, equal interspaces one and a half times to twice as wide as ribs, crossed by regular equidistant strong transverse concentric lines, not passing over ribs. Towards inferior margin the ribs become narrower and sharper, the interspaces wider, and the transverse lines closer and more numerous.

Dimensions : Length, 50 m/m.
Height, 35 m/m.

Horizon and Locality.—Ludlow beds behind Parish Room, near Llanbadoc Church.

Remarks.—There are three specimens of this species from Usk, all of which are right valves. It cannot be considered identical with the typical *Cardium striatum* Sow.[1] of the Aymestry Limestone and Lower Ludlow, which has usually been referred to the genus *Ambonychia,*[2] but if congeneric with *Ambonychia radiata* Hall, of the Ordovician of North America, it should be put in the genus *Byssonychia* Ulrich. I am more inclined to refer our shell to the genus *Gosseletia* Barrois, which belongs to the same family or sub-family,[3] but is not supposed to appear till Devonian times. Unfortunately, the internal characters of our shell are unknown; so its generic place must remain uncertain. *Gosseletia* is a somewhat protean genus, but Frech divides it into several groups. Our species seems to belong to the group of *G. truncata* (Roemer) (Frech, *op. cit.*, p. 119), and especially resembles *G. trigona* (Goldf.)[4] and *G. carinata* (Follmann)[5] which occur in the Coblenzian beds of the Lower Devonian.

1 Murchison, Silurian System, p. 614, pl. 6, fig. 2.
2 McCoy, Syn. Palæoz. Foss. Woodw. Mus., p. 264.
3 Frech, Devon. Aviculiden, Abhandl. kön. preuss. geol. Landesanst., Bd. ix., Heft 3, 1891, p. 109.
4 Frech, *op. cit.*, p. 120, t. xii., figs. 5-7a, text figure 10.
5 Frech, *op. cit.*, p. 122, t. xii., figs. 8-11; t. xiv., fig. 3.

Pholadella McCoyi, sp. nov. [Pl. VII., fig. 3; Pl. VIII., fig. 4.]

Description.—Shell oblong, inequilateral, subventricose anteriorly highest at beak; anterior end rounded; posterior end obliquely truncated above, subacute below; inferior margin nearly straight, very slightly convex, parallel to hinge-line, meeting posterior margin at 60° or rather less; hinge-line straight, about three-fourths the length of shell, meeting posterior margin at an obtuse angle. Beak prominent, high, swollen, obtuse, rounded, somewhat incurved, rising well above hinge-line, situated at about one-fourth the length of shell from front end. Umbonal ridge well marked, sub-angular, oblique, running diagonally to posterior-inferior angle; area between it and hinge-line narrow, small, somewhat flattened or depressed. Surface of shell with anterior two-thirds marked by regular fine equidistant thread-like concentric lines; posterior third and umbonal ridge ornamented with fifteen to twenty fine straight radial lines, to which the concentric lines are inclined at 75°-90°.

Dimensions: Length, 15 m/m.
Height, 10 m/m.

Horizon and Locality.—From near the top of the Ludlow beds in the Quarry 150 yards South-East of Pen-y-parc.

Remarks.—This species is well characterised, though none of the Usk specimens are quite perfect. It seems to resemble the American *Pholadella radiata*, Hall,[1] of the Hamilton and Chemung formations, rather than any Silurian species from England, except perhaps the shell referred by McCoy[2] to *Nuculites post-striatus* Emmons.[3]

Orthonota rigida Sowerby.

Remarks.—In spite of a large number of British species of Ordovician and Silurian lamellibranchs being referred to the genus *Orthonota*, American geologists appear to regard it as limited to the Devonian. The type of the genus is *O. undulata* Conrad, and the strict definition of the genus given by Hall[4] would exclude many, if not all, of the forms which commonly are ascribed to it in this country. Further work is required before a conclusion can be reached in this matter. Only one example of *Orthonota rigida* Sow. occurs in Mr Gardiner's collection from the Usk district.

Horizon and Locality.—Ludlow beds seen in the quarry by the side of the road leading East from Sluvad, about half a mile from the farm of that name.

1 Hall, Palæont. N.Y., vol. v., Lamellib. ii., p. 469, pl. lxxviii., figs. 15-21.
2 McCoy, Syn. Pal. Foss. Woodw. Mus., p. 286, pl. 1 K, fig. 6.
3 Emmons, Geol. Report, 1842, p. 399, fig. 4.
4 Hall, Palæont. N. York, vol. v., pt. 1, Lamellibr., ii. (1885), p. xlv.; Eastman-Zittel, Textbook of Palæontology, 2nd edit., vol. 1, 1913, p. 462.

Orthonychia, sp. [Pl. VIII., figs. 17, 17a.]

Remarks.—The genus *Orthonychia*[1] does not appear to have been recorded from the British Silurian rocks, but there is one internal cast of a shell from the Usk district in Mr Gardiner's collection which must be referred to it rather than to *Platyceras* or any other genus.

The shell forms a tall, acutely-pointed conical cap, slightly unsymmetrical, with the apex bent backwards so as to overhang the base. The lateral portions are not ridged except for a weak angular keel on each side, which starts from the apex and dies out towards the base; the back is well rounded; there is a slight median angulation of the posterior concave side, and between this keel and the lateral keels the surface is somewhat flattened or excavated, especially near the apex. The apertural basal margin is gently sinuated, having a broad shallow rounded anterior and posterior emargination and a broad slightly dependent rounded lateral lobe on each side. The back or convex arched portion of the shell is marked by gently curved lines concentric to the anterior marginal sinus. The apical angle is rather less than 30°.

Height of apex from base	.. ..	about 25 m/m
Transverse diameter at base	.. ..	,, 28 ,,
Antero-posterior diameter at base	.. ..	,, 32 ,,

Horizon and Locality.—Near the top of Wenlock Shales in the track leading West from the Usk railway, 300 yards North of Tynewydd.

Proetus Stokesi Murchison, var. nov., *bellula*. [Pl. VIII., figs. 5-11.]

Description.—Head-shield semi-oval, with its genal angles produced into stout spines having about three-fourths the length of the head-shield. Glabella short, convex, sub-oval, widest near base, narrowing anteriorly to blunt sub-truncate end, not reaching marginal furrow; marked with three pairs of lateral furrows; first pair of furrows faint, short, horizontal, situated at about one-fourth the length of the glabella from the front-end; second pair stronger, deeper, rather obliquely inclined backwards and extending inwards about one-fourth the width of the glabella; third pair not connected with the axial furrows, arising a short distance within them as deep depressions at about two-thirds the length of glabella from its front end, continued very obliquely backwards as deep curved furrows weakening posteriorly to meet

1 Perner, Syst. Silur. Bohême, vol. iv., Tome iii. (1911), pp. 2, 92.

the meso-occipital furrow nearly at right angles and bounding the large basal lobes internally. Frontal lobe about one-fourth the length of the glabella; first lateral lobes very small; second lateral lobes about twice as large; basal lobes large, slightly projecting laterally, oblique to axial line, about one-third the length of glabella, and fully one-fourth its width at this level, swollen, with slight independent convexity. Axial furrows well marked, diverging slightly from front end of glabella to basal lobes, then curving out gently round them and bending in behind them to base of glabella, which is therefore somewhat contracted. Meso-occipital ring rather flattened, with median tubercle; meso-occipital furrow strong, horizontal; occipital nodules low, faint, large, as wide as base of basal lobes. The facial sutures cut the posterior border at acute angles, bending out sharply behind the eyes; the anterior branches curve out gently to cut the anterior border at about twice the anterior width of the glabella.

Fixed cheeks narrow, with large semi-circular eye-lobe bent up, elevated and extending from second lateral furrows nearly to base of glabella; pre-glabellar area forming narrow band; anterior wing of fixed cheeks small, triangular, flattened.

Border of head-shield flattened, widening in middle in front of glabella to more than twice the width of pre-glabellar band, marked off by very broad shallow marginal furrow holding in it a short narrow raised ridge concentric to the margin and median in position in front of the glabella; outer half of border marked with a few strong raised concentric thread-like lines.

Free-cheeks large, very slightly convex, with a fine ridge concentric to lateral margin dividing each into two parts and ending at genal angle. Eye large, rounded, prominent, semi-circular, nearly touching sides of glabella. Genal angle furnished with stout spine, marked down centre with continuation of marginal furrow of cheek. Border of cheek flattened and concentrically striated. Pleuro-occipital segment wide, marked off by slightly sigmoidal furrow, meeting marginal furrow at genal angle at about 60°. Surface of glabella and of meso-occipital ring covered with very fine closely-placed broken sinuous lines arched forwards; anterior wings of fixed cheeks and eye lobes ornamented with similar lines directed nearly at right-angles to the facial sutures; ornamentation of free-cheeks not preserved, but probably similar.

Hypostome sub-oblong in shape, having the body strongly convex, oval, and highest at about one fourth its length, with its apex sub-conical and the anterior face somewhat flattened and triangular. Lateral furrows short, oblique, situated at about three-fourths the length of the body at a slight transverse constriction, having large oblique transversely oval maculæ behind them; posterior transverse lobe of body somewhat depressed. Border rounded, clearly marked off by deep furrows at sides and behind, and bearing three strong raised concentric thread-like lines on its surface.

Pygidium broadly semi-circular, gently convex, with prominent sub-cylindrical axis less than one-fourth its width and extending about three-fourths its length, annulated nearly to blunt tip by 9-10 complete rings Lateral lobes composed of 5-6 pleuræ, separated by fine interpleural furrows; pleural furrows very fine, diagonal, chiefly developed at outer ends of pluuræ. all ending at weak concentric marginal furrow, which is most marked posteriorly.

Dimensions :	Length of head-shield	.. ..	5·0 m/m
	,, glabella	.. ..	3·3 ,,
	Width of ditto at base	.. ..	3·0 ,,
	Length of hypostome	.. ..	4·4 ,,
	,, pygidium	..	about 7·5
	Width of ditto ..	..	,, 4·6 ,,

Horizon and Locality.—Wenlock Limestone in stream by quarry, 300 yards North-East of Greenpool Farm.

Remarks.—The head-shield closely resembles that of specimens usually referred to *Proetus Stokesi* (Murchison),[1] but the original description is scanty and the figure of this species is poor, and the type-specimen is not known. McCoy's[2] description was unsatisfactory, and Lovén[3] was the first to give a full diagnosis of the specific characters with good figures. Our Usk head-shields differ from the Wenlock examples labelled *Pr. Stokesi* by McCoy and Salter by the relatively shorter and blunter glabella, the stronger development of the first and second glabellar furrows and the larger eyes. The median ridge in the marginal furrow in front of the glabella which is present in our form and in some specimens from the Wenlock Limestone of Dudley is not mentioned by McCoy or Lovén, nor is it shown in any of the figures of *Pr. Stokesi*, and the species is stated by Lovén to have a double elevated line on the cheek, whereas in our specimens the line is single. A similar ridge is present on the cheek in *Pr. astyanax* Corda, as figured by Barrande and Oehlert.[4] The segmentation of the glabella and the ornamentation of the surface closely resemble *Proetus* (*Phaetonides*) *rugulosus*, Lindström[5], from the Silurian of Gotland, but no median ridge in the marginal furrow appears to be present, and the eye is smaller. *Pr. astyanax*, Corda, has a head-shield, glabella, and ornamentation much like those in the Usk species, as well as the concentric ridge on the cheek.

If the hypostome and pygidium found associated with the head-shields in the Limestone in the Usk district are all referable to one species, we may remark that the former resembles that of *Pr. concinnus* Lindstr.,[6] and *Pr. signatus* Lindstr.,[7] and that the latter has the usual characters of *Proetus* and not of *Phaetonides*, which Oehlert (*op. cit.* p. 5) put as a sub-genus of

1 Murchison, Silur. Syst., p. 656, t. 14, fig. 6; Reed, Mon. Girvan Trilob. (Palæont. Soc.), pt. 2, p. 79, pl. xi., figs. 10, 11.
2 McCoy, Syn. Brit. Palæoz. Foss. Woodw. Mus., p. 174 (*Forbesia Stokesi*).
3 Lovén, Ofv. K. vet. Akad. Forhändl. (1845), p. 50, t. i., figs. 3a—d.
4 Oehlert, Bull. Soc. Et. Scient. Angers (1885), pl. 1, fig. 8; Barrande, Syst. Silur. Bohême, i., p. 470, pl. xvii., fig. 22.
5 Lindström, Ofv. K. Vet. Akad. Forhändl. (1885), No. 6, p. 75, t. xvi., fig. 13.
6 Lindström, "Researches in the Visual Organs of Trilobites" (Kongl. Svensk. Vet. Akad. Händl., Bd. 34, No. 8, 1901), p. 67, pl. vi., figs. 21-23.
7 Lindström, Ofv. K.Vet. Akad. Forhändl. (1885), No. 6, p. 80, t. xv., fig. 17.

Proetus. From the above considerations we may regard this Usk form as at any rate a distinct variety of *Pr. Stokesi*. if not a distinct species. Hall's[1] *Proetus* (?) *Stokesi* (Murch.), from the Niagara group of New York, is certainly not identical with Murchison's species, so far as we can judge from the description and figures.

Proetus signatus Lindström. [Pl. VIII., fig. 12].

Remarks.—One cast of a complete head-shield of a species of *Proetus*, with the genal angles somewhat imperfect, occurs in Mr Gardiner's Usk collection, and it appears to be indistinguishable from *Pr. signatus* Lindström,[2] from Gotland, of which the free cheeks were not figured. The shape and length of the glabella, the character of the lateral glabellar furrows, the size and position of the eyes, the course of the facial sutures, the size of the occipital lobes, and the nature of the border and marginal furrow agree precisely with the figure and description. The free cheeks are seen to have been slightly produced backward at the genal angles, ending in short stout spines.

Dimensions: Length of head shield 8·0 m/m
Width of ditto .. 17·0 ,,
Length of glabella .. 6·1 ,,
Width of ditto .. 5·5 ,,

Horizon and Locality.—Ludlow beds near Hilla Farm, one mile North-East of Bettws-Newydd.

Calymene intermedia, Lindström.

Remarks.—It does not seem to be the case that *Cal. intermedia* has been previously recorded from the British Isles, but this fact may be due to the loose way in which the name *C. Blumenbachi* has been used to cover more than one species. The Usk specimens which seem to agree with Lindström's species *C. intermedia*,[3] are of small size, none of the head-shields measuring more than 7 m/m in length. In the Russian Baltic provinces this species occurs in Stage K (Upper Oesel Stage).

1 Hall, Palæont. N. York, vol. ii. (1852), p. 316, pl. 67, figs. 13, 14.
2 Lindström, Ofv. K. Vet. Akad. Forhändl. (1885), No. 6, p. 80, t. xv., fig. 16.
3 Lindström, Ofv. K. Vet. Akad. Forhändl. (1885), No. 6, p. 71, t. xv., figs. 5-12 ; Schmidt, Rev. Ostbalt. Silur. Trilob. Abth. iv. (1894), p. 16, t. ii., figs. 1-3 ; Moberg and Grönwall, Om Fyledalens gothlandium, Kungl. Fysiogr. Sällsk. Händl. (1909), Bd. 20, No. 1, p. 71, t. iii., figs. 15, 16.

Horizon and Localities.—Ludlow beds (1) by roadside East of Usk Castle; (2) at Trostra Common; and (3) in old road leading North from Llandegveth and one mile from the Church.

Phacops (Phacopsidelia) Stokesi, Milne Edwards, var. nov. *uskensis* [Pl. VIII., figs. 13-16.]

Description.—Head-shield semi-circular; genal angles blunt, but not rounded, the lateral and posterior margins meeting at about 75°.

Glabella trapezoidal, increasing considerably in width anteriorly, obtusely angulated in front. Frontal lobe large, transverse, fully half the length of glabella; anterior lateral angles slightly overhanging. First lateral furrows situated at nearly half the length of glabella, composed of two portions meeting at about 120°, the outer part being short, straight, or slightly sinuous, directed back at about 20° to axial furrow, the inner portion being transverse, arched, extending about one-third across the glabella on each side and curving back so as nearly to meet the third lateral furrow and to define a sub-circular lateral lobe. Second lateral furrows weak, short, isolated, nearly obsolete, only the inner portion being developed and not reaching axial furrow. Third lateral furrows situated far back, close to base of glabella, deeply impressed at sides, concave forward and bounding posteriorly the sub-circular lateral lobes, on which the second lateral furrows are impressed; the third furrows are connected across the base of glabella by a broad shallow depression arched forward, and marking off a narrow but distinct basal ring swollen into a weak median tubercle. Behind the deep lateral portions of the third furrows this basal ring is depressed and constricted, forming small subnodular transverse third lateral lobes. Median basal portion of glabella somewhat swollen. Meso-occipital ring rounded, wider and higher than basal ring, and marked off by strong meso-occipital furrow deepening into conspicuous pits at the sides similar to the third lateral furrows.

Axial furrows strong, curving slightly inwards immediately behind the anterior lateral angles of the frontal lobe, then running back subparallel and nearly straight to the base of head-shield.

Surface of glabella smooth, except for 2-4 sub-parallel rows, of 5-6 tubercles running back from the front margin of glabella to form an acute V-shaped ornament on the frontal lobe, with its apex level with its first lateral furrows.

Cheeks incompletely known; eyes rather large, raised on swollen base, reaching from about first to third lateral furrow. Marginal furrow broad, shallow; border rounded. Pleuro-occipital furrow slightly concave forwards. Facial suture cuts lateral margin rather behind level of inner portion of first lateral furrow.

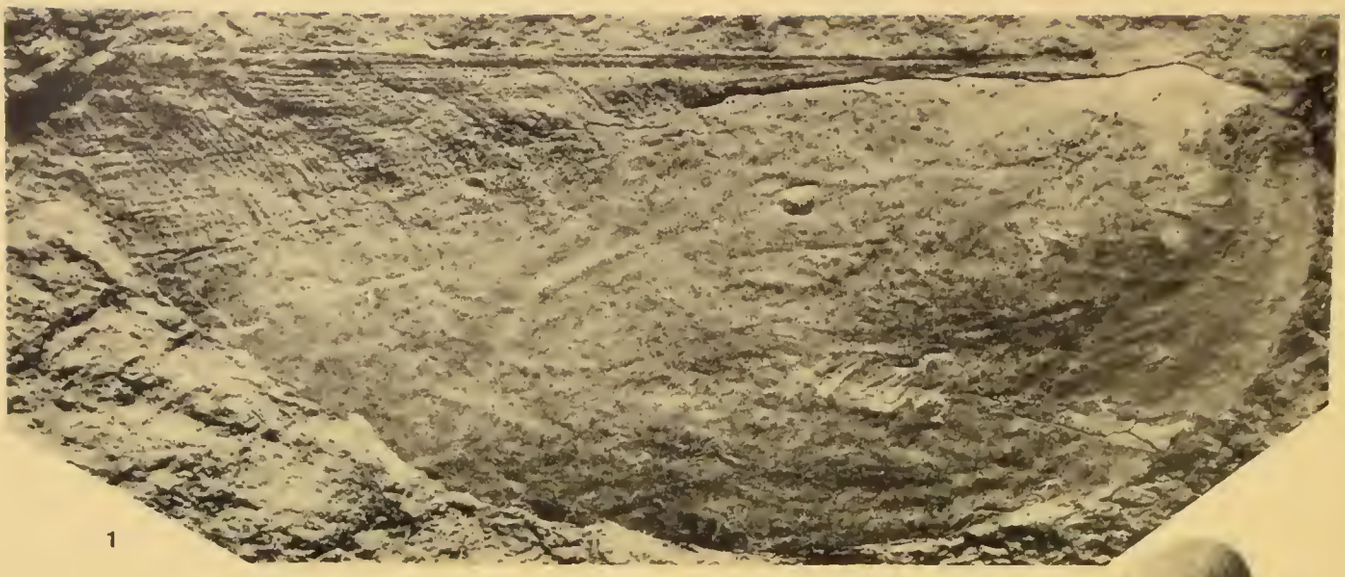
Pygidium somewhat subquadrate-rounded. Axis large, convex, prominent, slightly tapering to blunt extremity, extending about four-fifths the length of pygidium, and nearly one-third its width, composed of 5-6 complete distinct rings followed by 2-3 fainter, narrower ones. Pleural lobes gently arched down, convex, composed of 4-5 pleuræ, of which only the first three are usually distinct; pleural furrows strong, deep, dying out at about three-fourths the length of the pleuræ.

Horizon and Localities.—In Wenlock Limestone in (1) Stream below quarry, 300 yards North-East of Greenpool

Farm ; (2) quarry just to North of Tynewydd Farm ; and (3) shallow digging two-thirds of a mile North-East of Greenpool Farm.

Remarks.—This small form may be regarded as more allied to *Ph. Stokesi* Milne Edwards[1] than to *Ph. elegans,* Sars and Boeck.[2] The much reduced and isolated second lateral furrows on the glabella, the long frontal lobe and strong third lateral furrows recall also *Ph. Musheni* Salter.[3] The division of the first lateral furrow into two parts is always a marked feature in the two first-named species, but the greater distinctness of the sub-circular composite lateral lobe in our form seems to mark it off from the typical *Ph. Stokesi,* and to warrant its separation as a definite variety.

1 Salter, Mon. Brit. Trilob., p. 21, pl. ii., figs. 1-5 (non 6).
2 Schmidt, Rev. Ostbalt. Silur. Trilob., Abth. i., p. 72, t. 1, fig. 1 ; t. x., figs. 10-12 ; t. xi. fig. 17 ; Wigand, Zeitschr. Deut. Geol. Gesell., xl., 1888, p. 42.
3 Salter, *op. cit.*, p. 23, pl. ii., figs. 7-10 (?11, 12).



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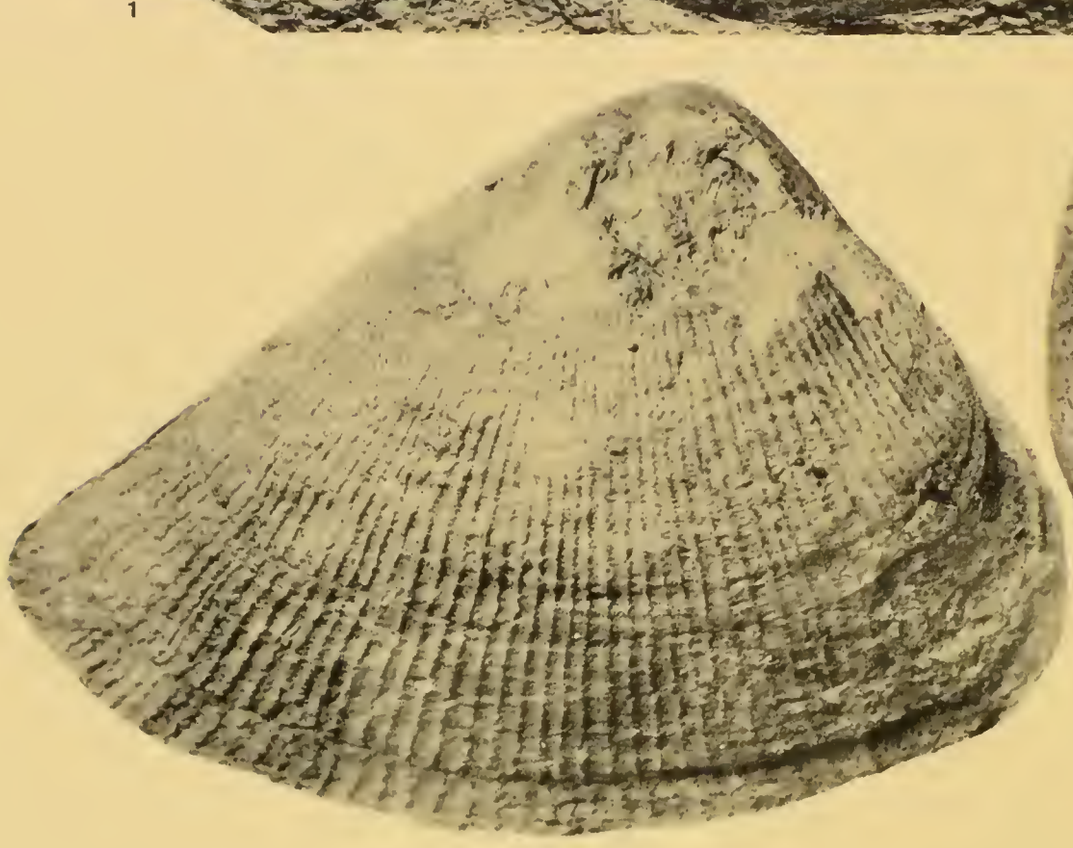

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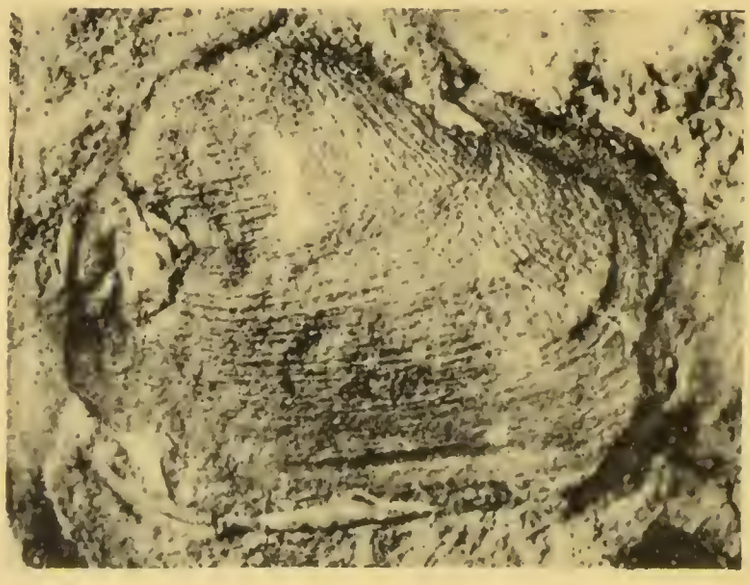


3

EXPLANATION OF PLATE VII.

FIG. 1.—PTERONITELLA INEXPECTATA, sp. n. × 1.5.

Quarry near Llanbadoc Church, in Ludlow Beds. Sedgwick Museum, Cambridge.

FIGS. 2 and 2*a*.—GOSSELETIA ? TAWNEYI, sp. n. × 2.

Quarry near Llanbadoc Church, in Ludlow Beds. Sedgwick Museum, Cambridge,

FIG. 3.—PHOLADELLA MCCOYI, sp. n. × 5.

Quarry close to Pen-y-parc, in Ludlow Beds. Sedgwick Museum, Cambridge.

EXPLANATION OF PLATE VIII.

FIGS. 1, 2.—CHONETES CERATOIDES, sp. n.

1.—Road cutting near Cwm Dowlais, in Ludlow Beds, × 4. Sedgwick Museum, Cambridge.

2.—Quarry by road, half-a-mile west of Bettws-Newydd Church. in Ludlow Beds, × 3. Sedgwick Museum, Cambridge.

FIG. 3.—EURYMYELLA cf. SHALERI Williams × 2.

Wenlock Shales, near High Cross Inn. Sedgwick Museum, Cambridge.

FIG. 4.—PHOLADELLA McCOYI, sp. n. × 2.

Quarry close to Pen-y-parc, in Ludlow Beds. Sedgwick Museum, Cambridge.

FIGS. 5, 6, 7, 8, 9, 10, 11 ?.—PROETUS STOKESI. (Murchison) var. nov. bellula, × 3.5.

Wenlock Limestone. Sedgwick Museum, Cambridge.

FIG. 12.—PROETUS SIGNATUS. Lindström × 2.

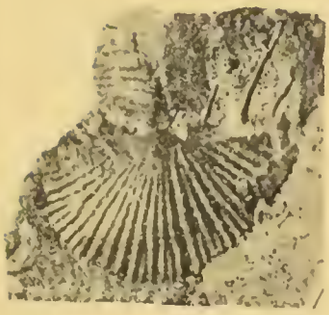
Quarry near Hilla, in Ludlow Beds. Sedgwick Museum, Cambridge.

FIGS. 13, 14, 15, 16 ?.—PHACOPS (PHACOPIDELLA) STOKESI. Milne Edwards. var. nov. uskensis × 3.

Wenlock Limestone. Sedgwick Museum, Cambridge. (Fig. 14 is the counterpart of Fig. 13).

FIGS. 17, 17*a*.—ORTHONYCHIA sp. × 1.

Road north of Tynewydd, in Wenlock Shales. Sedgwick Museum, Cambridge.



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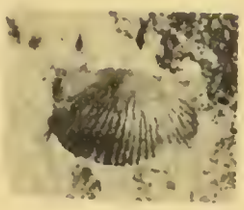

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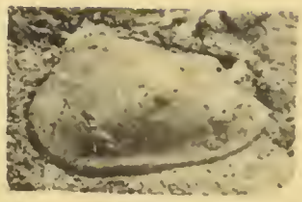

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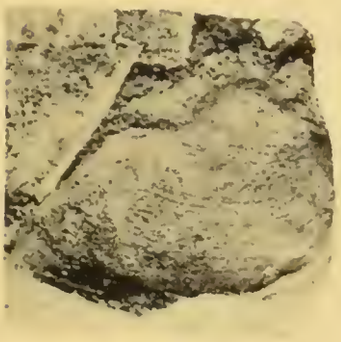

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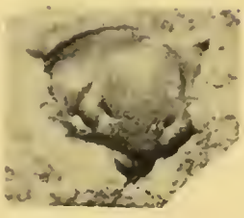

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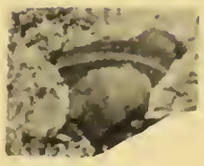

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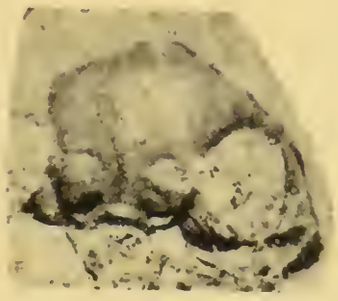

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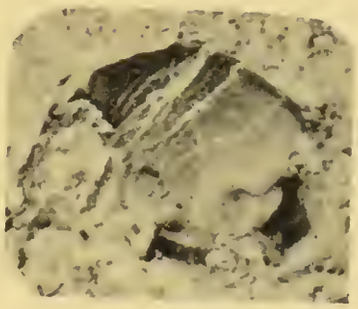

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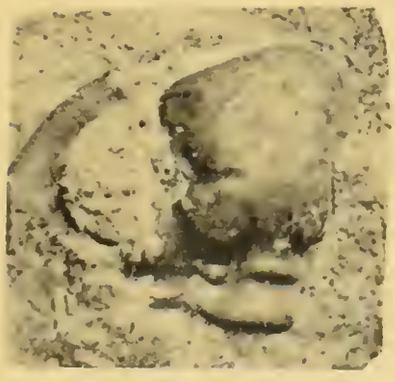
12



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*** The Publication Committee's decision as to the publication of any paper is final, and the Committee will not be able to consider any paper unless it is placed in the Secretary's hands within a month of its being read.

[*The Editor of the Proceedings of the Cotteswold Naturalists' Field Club is directed to make it known to the Public that the Authors alone are responsible for the facts and opinions contained in their respective Papers.*]

S-ES-G
[Gloucester]

VOL. XIX. PART III.

PROCEEDINGS

OF THE

Cotteswold Naturalists'

FIELD CLUB

FOR

1917

Museum of Comparative Zoology
17 APR 50
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JOHN BELLOWS, GLOUCESTER 12173

MEMBERSHIP

The objects of the Club are to promote the systematic investigation of the Natural History and Antiquities of the County; to make excursions in the County and to other parts; to facilitate intercourse on scientific matters, and to aid in obtaining more general attention for the objects of Science.

Members are elected on a Certificate of Recommendation, signed by two Members, one of whom must have personal knowledge of the Candidate. The Admission Fee is £1; and the Annual Subscription is 15s.

Winter Meetings are held at Gloucester, and there are frequent Field Meetings. "Proceedings" are published annually.

Forms of proposal for Membership and any further information may be obtained on application to the Acting Honorary Secretary.

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The lists of Societies exchanging Publications and of Transactions of other Societies, etc., in the Club's Library, and the Rules of the Club, will be found printed on pp. viii.–xii. of Part I., Vol. XIX. of the "Proceedings."

PROCEEDINGS

OF THE

COTTESWOLD NATURALISTS'

FIELD CLUB

1917

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VOL. XIX. PART III.

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1908—1910	*Rev. Walter Butt, M.A.*
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1912—1914	*Rev. Walter Butt, M.A.*
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1916—	W. St. Clair Baddeley

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1887—1894	E. B. Wethered, J.P., F.G.S., F.C.S., F.R.M.S.
1894 [died 19th Dec.]	*Prof. A. Harker, F.L.S.*
1895—1897	*The Rev. Canon E. Cornford, M.A.*
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1898—1904	S. S. Buckman, F.G.S.
1904—1917	L. Richardson, F.R.S.E., F.G.S.
1916—	Roland Austin (*Acting Hon. Secretary*)

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(*Corrected to 31st December*, 1917)

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✠1913	Rev. H. J. Riddelsdell, M.A., The Rectory, Wigginton, Banbury

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✠1913	Austin, Roland	.. 38 Brunswick Road, Gloucester
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1912	Brown, O. A.	Shiel, Sandy Lane Road, nr. Cheltenham
1910	Bruton, Henry Tew	Quinsan, Horton Road, Gloucester
1896	Bruton, H. W.	Bewick House, Gloucester
1893	Bubb, Henry	Ullen Wood, near Cheltenham
1913	Butt, Walter	The Hyde, Newnham-on-Severn,
✠1904	Carles, W. R., C.M.G., F.L.S. ..	Silwood, The Park, Cheltenham
✠1888	Chance, H. G., M.A.	Barnwood Court, Gloucester
✠1912	Clutterbuck, C. G., F.E.S.	16 Clarence Street, Gloucester
✠1893	Colchester-Wemyss, M.W., C.B.E.	The Bell House, nr. Newnham
1906	Cole, R. M., M.R.C.S.	Northgate House, Gloucester
1904	Collett, J. M., F.C.S.	Wynstone Place, Brookthorpe
1915	Cooke, The Rev. J. J. D.	The Vicarage, Churchdown, near Gloucester
1917	Crane, C. A.	The Reddings, Cheltenham
1913	Crewdson, J. D.	Syde House, Syde, near Cheltenham
✠1909	Cullis, A. J.	21 Park Road, Gloucester
✠1903	Cullis, F. J.	23 Brunswick Road, Gloucester
1893	Currie, G. M.	26 Lansdown Place, Cheltenham
1909	Daniels, J. S.	Lightpill, Stroud
1915	Darwin, Sir Francis, M.A., M.B., F.R.S.	Brookthorpe, near Gloucester
1906	Dixon, J. M., B.A., LL.B.	Mickleton, Campden
1914	Duart-Smith, F. W., F.G.S. ..	Duart, Cheltenham Road, Gloucester
1876	Ducie, The Earl of, F.R.S., F.G.S. .	Tortworth Court, Falfield, R.S.O.
✠1899	Duke, Lieut.-Col. J. C.	Gwynfa, Cheltenham
✠1883	Ellis, T. S., M.R.C.S.	10 Alexandra Road, Gloucester
1906	Finlay, D. E. C., M.B., B.S., F.Z.S.	Wells Dene, Park Road, Gloucester
1914	Frith, John C.	Sunnyside, Painswick, Glos.
1914	Fyffe, E. W.	Trullwell, Box, Minchinhampton
1912	Gardiner, C.I., M.A., F.G.S. ..	5 Grafton Terrace, Cheltenham
✠1891	Garrett, J. H., M.D., F.L.S., D.P.H.	Municipal Offices, Cheltenham
✠1903	Gray, J. W., F.G.S.	Glevum Lodge, Battledown, Cheltenham
1895	Grosvenor, W. W., B.A., M.D. ..	Granville House, The Spa, Gloucester
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1910	Haigh, Herbert	Coed Ithel, Llandogo, Mon.
✠1914	Haines, J. W.	St Helier, Hucclecote, Gloucester
1894	Hannam-Clark, F.	12 Queen Street, Gloucester

✠1913	Hanson, C. O., M.B.E. ..	.. 3 Malvern Place, Cheltenham
1878	Hartland, Ernest, M.A., F.S.A.	.. Hardwick Court, Chepstow
1903	Hedley, G. W., M.A., F.C.S.	.. 1 East Lawn, Old Bath Road, Cheltenham
1905	Hobbs, J. N.	.. Concord, Moorend Grove, Cheltenham
1917	Homer, G. W.	.. Rowcroft, Stroud
1913	Hurry, A. E.	.. Hempsted Court, Gloucester
1917	Jenkins, Canon W. O., D.D.	.. Bagendon Rectory, Cirencester
1917	Jeune, Colonel E. B. ..	.. Whaddon Manor, Gloucester
1915	Johnstone, The Rev. P. M. C., M.A.	All Saints' Vicarage, Cheltenham
1877	Jones, John H.	.. Barrow Hill, Churchdown
✠1909	Knight, H. H., M.A. ..	.. The Lodge, All Saints' Villas, Cheltenham
1896	Knowles, H.	.. Egerton House, Spa Road, Gloucester
1912	Lawrence, E.	.. Southlands, Queen's Road, Chelten-
1913	Leach, R. E., M.A.	.. Fairview, Painswick [ham
1909	Little, E. P.	.. Amberley Court, near Stroud
1917	Lucy, Walter	.. Leasgill Cottage, Amberley
1891	Margetson, W.	.. Bright Side, Stroud
1913	Martin, J. Middleton, B.A., M.D., B.C., D.P.H.	The Chestnuts, Stroud
1867	Marling, Sir William H., Bart., D.L.	Stanley Park, Stroud
1888	Marling, W. J. Paley ..	.. Stanley Park, Stroud
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1878	Moreton, Lord	.. Sarsden, Chipping Norton, Oxon.
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✠1905	Prevost, E. W., M.A., Ph.D., F.R.S.E.	.. Weston, Ross
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1909	Price, W. R., B.A., F.L.S.	.. Pen Moel, Chepstow
✠1900	Richardson, L., F.R.S.E., F.G.S.	10 Oxford Parade, Cheltenham
1908	Rixon, W. A.	.. Turkdean Manor, Northleach, Glos.
1915	Rogers, E.	.. Glendronach, Christ Church Road, Cheltenham
1878	Sewell, E. C.	.. The Beeches, Cirencester
1910	Sinclair, The Ven. Archdeacon	.. The Greenway, near Cheltenham

1882	Smith, A. E.	.. The Hollies, Nailsworth
1913	Smith, G. H. Pavey.. ..	.. High Beeches, Nailsworth
1909	Smithin, James A.	.. Lloyds Bank, Gloucester
1908	Stanton, A. W.	.. Field Place, Stroud
1906	Stephens, A. J.	.. Clovelly, Denmark Road, Gloucester
1887	Taynton, H. J.	.. 8 Clarence Street, Gloucester
1914	Thomas, J. H.	.. 2 Wedderburn House, Wedderburn Road, Hampstead, London, N.W.
✠1889	Upton, Charles	.. Rooksmoor, Tuffley Avenue, Glouces-
1916	Wait, Major H. W. K. ..	.. 2 Worcester Road, Clifton [ter
1889	Waller, F. W.	.. Horton Road, Gloucester
1894	Washbourn, William ..	.. Blackfriars, Gloucester
✠1880	Wethered, E. B., F.G.S. ...	... The Uplands, Cheltenham
1914	Wilkin, L., M.A., B.C. ..	.. 46 London Road, Gloucester
✠1884	Winnington-Ingram, Rev. A. R.	.. Lassington Rectory, Gloucester
✠1896	Witchell, E. Northam ..	.. Lansdown, Stroud
1885	Wood, Walter B.	.. Barnwood, Gloucester

A cross signifies those who have contributed papers printed in the "Proceedings" of the Club.

(*Any corrections in this List should be notified to the Acting Hon. Secretary*)

INCOME AND EXPENDITURE FOR THE YEAR ENDING 31st DECEMBER, 1916

INCOME

		£	s	d	£	s	d
To	1 Subscription for 1914	0	15	0			
,,	5 ,, ,, 1915	3	15	0			
,,	100 ,, ,, 1916	75	0	0			
,,	1 ,, ,, 1916	1	0	0			
					80	10	0
,,	Sale of Proceedings				2	2	5
,,	Surplus from Flaxley Abbey Meeting ..				0	10	3
					£83	2	8

ASSETS—

Subscriptions in arrear	3	0	0

J. H. JONES, *Hon. Treasurer.*
January 15th, 1917.

EXPENDITURE

		£	s	d	£	s	d
By	Balance due to Treasurer, 1915				11	15	0
,,	RENTS—						
	Bristol and Gloucestershire Archæological Society 1915	4	0	0			
	,, ,, ,, 1916	4	0	0			
	Winter Meetings—Technical Schools ..	1	5	6			
	,, Northgate Mansions ..	0	12	6			
	Gloucester Public Library	1	3	6			
					11	1	6
,,	"PROCEEDINGS"—						
	Bellows, Vol, xix., part 1				43	2	11
,,	GENERAL PRINTING AND STATIONERY—						
	Bellows	1	8	4			
	Thompson—Programmes, &c.	5	18	5			
	Norman Sawyer	0	18	6			
	Osborne	0	7	0			
					8	12	3
,,	POSTAGES—						
	Hon. Treasurer	0	15	0			
	Hon. Secretary	1	10	5			
	Rev. H. J. Riddelsdell (County Flora) ..	1	9	0			
					3	14	5
,,	Lantern—A. H. Pitcher				1	12	6
,,	Custodian, Technical Schools				0	9	0
,,	Expenses of Field Meetings				2	10	3
,,	Library ("Proceedings" of Woolhope Club)				0	4	5
					83	2	3
	Balance, 31st December, 1916				0	0	5
					£83	2	8

Audited and found correct, F. HANNAM-CLARK.
January 15th, 1917.

INCOME AND EXPENDITURE FOR THE YEAR ENDING 31st DECEMBER, 1917

INCOME

		£ s d	£ s d
	Balance 1st January, 1917		0 0 5
To	2 Subscriptions for 1915	1 10 0	
,,	4 ,, 1916	3 0 0	
,,	106 ,, 1917	79 10 0	
,,	1 ,, 1917	1 0 0	
			85 0 0
,,	8 Entrance Fees	... ...	8 0 0
,,	Sales of "Proceedings"	... ...	6 18 5
			£99 18 10

J. H. JONES, *Treasurer.*

January 19th, 1918.

EXPENDITURE

		£ s d	£ s d
By	Rents—		
	Bristol and Gloucestershire Archæological Society, 1917	4 0 0	
	Winter Meetings—Northgate Mansions ...	1 5 0	
	,, ,, Technical Schools ...	0 15 0	
	Gloucester Public Library	1 3 6	
			7 3 6
,,	"Proceedings"—		
	Bellows, Vol. xix., part 2	61 0 11	
	Tutcher ,, ,, (Photographs) ...	2 5 5	
	Bellows, Paper for Vol. xix., part 3, and future use	5 6 6	
			68 12 10
,,	General Printing and Stationery—		
	Osborne, Programmes, &c.	3 18 6	
	Bellows	0 15 0	
	Norman Sawyer	0 9 0	
	Thompson, Programmes	2 5 3	
			7 7 9
,,	Postages—		
	Treasurer	0 15 0	
	Hon. Secretary	4 12 7	
			5 7 7
,,	Expenses of Meetings		2 5 9
;,	Cheque Book		0 5 0
,,	Library ("Proceedings" Dorset N. H. Club) ...		0 3 4
,,	Clerical assistance		0 12 3
,,	Removal of Property from Eastgate House ...		2 19 6
			94 17 6
	Balance, 31st December, 1917 ...		5 1 4
			£99 18 10

Audited and found correct, C. GRANVILLE CLUTTERBUCK.

January 23rd, 1918.

PROCEEDINGS

OF THE

COTTESWOLD NATURALISTS' FIELD CLUB

AT THE

SIXTY-NINTH ANNUAL GENERAL MEETING

JANUARY 16TH, 1917

W. ST. CLAIR BADDELEY, PRESIDENT,

IN THE CHAIR

The Minutes of the Sixty-eighth Annual Meeting, held on Tuesday, January 18th, 1916, were read and confirmed.

The Acting Hon. Secretary (Roland Austin) reported that the number of members was 113—there being four honorary and 109 subscribing members. Four members resigned during the year, and one, Richard Gibbs Foster, had died. Two new Members had been elected.

The Hon. Treasurer presented the Financial Statement for 1916, which showed a balance in hand of five pence.

Mr W. R. Carles, Vice-President, temporarily occupied the chair in order to propose the re-election of Mr St. Clair Baddeley as President for the year 1917. In doing so he expressed their thanks to Mr Baddeley for the very active interest he had taken in the proceedings of the Club, and said that its position had been strengthened by his acceptance of office. The proposition was carried by acclamation. Mr Baddeley resumed the chair and returned thanks for his re-election.

The election of Vice-Presidents, elected Members of Council, and Officers, was then proceeded with. Sir Francis Darwin was elected a Vice-President in place of Rev. Walter Butt, and Mr E. C. Sewell a Member of Council in place of Mr J. M. Dixon, both of whom had resigned their respective offices.

It was resolved that the charge for back parts of the "Proceedings" should be reduced to 1s. each part.

The Field Meetings for 1917 were arranged as follows:—May 15th, Cirencester; June 5th, Deerhurst and Tewkesbury; July 10th, Cleeve Hill; July 31st, Moreton Valence; September 12th, Gloucester.

The President then delivered his presidential address, the subject being "Salt: Its Origin, Uses, and Folk-lore"[1]

1 Printed p. 205 *et seqq*

ORDINARY WINTER MEETINGS, 1917

TUESDAY, FEBRUARY 20th, 1917.

W. ST. CLAIR BADDELEY, President, in the Chair.

The President referred to the deaths of three Members since the previous meeting. By the death of Archdeacon Scobell they would miss one who possessed in marked degree the characteristic of helping in a practical and sympathetic way every movement with which he was connected, and who took enormous pains in his administrative work. His membership of the Club dated from 1883, since when he had shown continuous interest in its objects and pursuits, being himself a great lover of Nature and a keen observer of country customs and folk-lore, to which he had made printed contributions. In Mr J. W. Skinner they had lost a safe authority and enthusiastic student of botany. Major Wenden took considerable interest in county matters, especially in the local literature of Gloucestershire.

Mr G. W. Homer, of Rowcroft, Stroud, proposed by William Thompson, seconded by John C. Frith, was elected a Member.

The Secretary submitted a list of *Rubus* for Gloucestershire, drawn up by the Rev. H. J. Riddelsdell, editor of the County Flora, in which there are some 118 named forms for the whole County, of which 110 occur in the western, and 52 in the eastern division. The Rev. Walter Butt, who had examined the list, had written the Secretary a letter, in the course of which he said :—

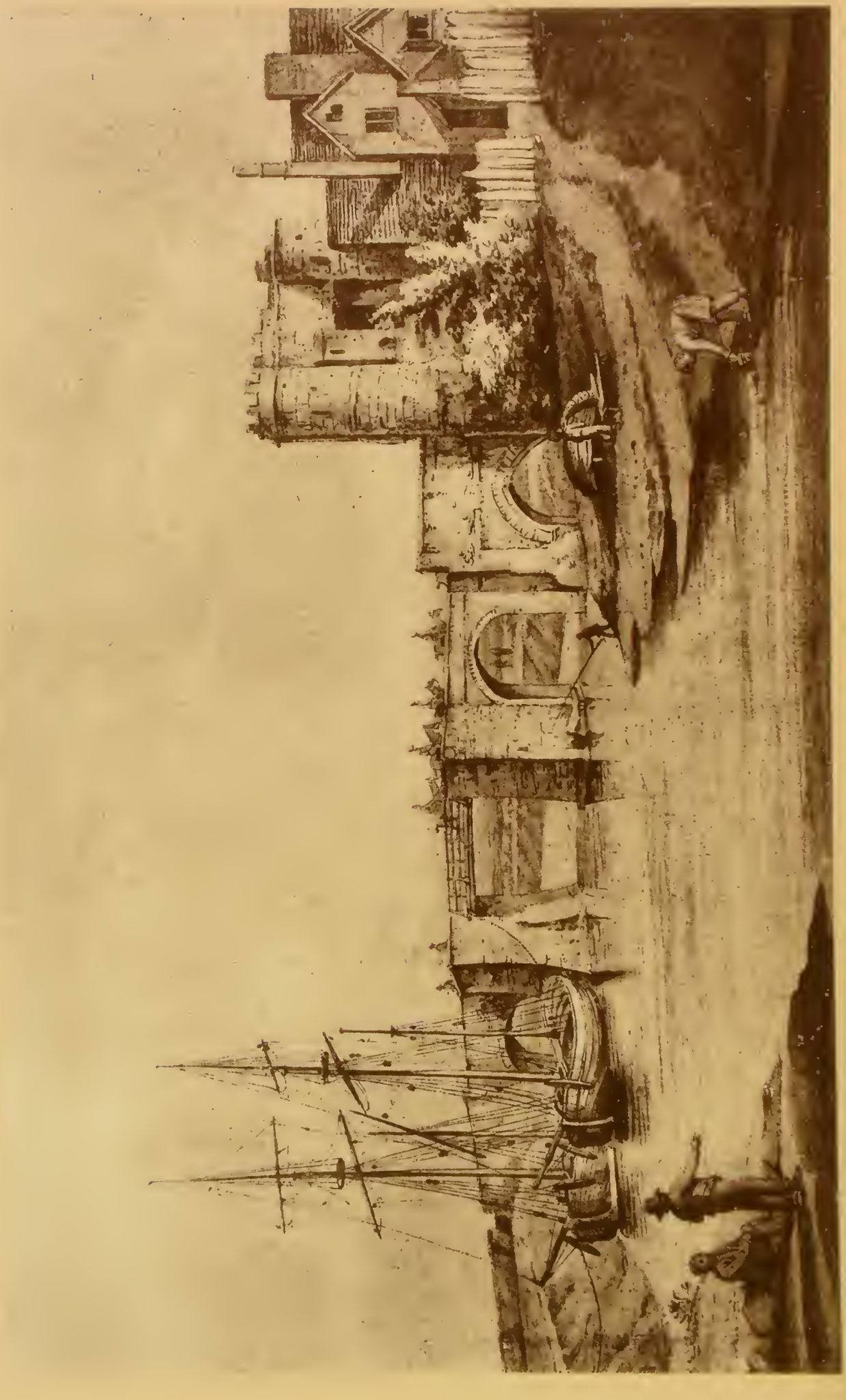
> "The List is a perfectly wonderful production. No County Flora —so far as I am aware—has anything like so full a list of *Rubi*, not even Ley's list in the Herefordshire Flora. . . . The *Rubi* are among the most critical of plants. All our sheets about which there was the slightest doubt have been through Mr Moyle Rogers's hands, and he is the greatest British authority. But as a matter of fact, Riddelsdell has himself become an acknowledged expert of the *Rubi*. So this list is of great value, as being accurate so far as our knowledge of to-day goes. Specimens of all are here in my Herbarium."

Thanks were expressed to Mr Riddelsdell for his excellent list, and a suggestion that it should be printed in the "Proceedings" was approved.

Mr J. W. Gray exhibited a fine specimen of Keuper Marl, in which were embedded matrices of rock crystal.

Mr F. J. Cullis communicated notes on "Gloucester as a Fortress."

In the course of his paper, Mr Cullis (without, however, pressing the points suggested) dwelt on the fact that from early days Gloucester was a



WESTGATE BRIDGE (c. 1780-5).

well-protected City, the walls in 1643 proving a firm defence against the Royalist forces. The growth of the City had necessarily caused extension of the area occupied by the Romano-British settlement, and he discussed the probability of supplementary defences having been raised at a later period, suggesting that these were built along the natural lines of the water-courses in and around the City.

In the discussion which followed, a question was asked as to the meaning of 'Foreign Bridge'—formerly applied to the bridge in Westgate Street, near the present Priory Road, over an arm of the Severn—and the President explained that the term occurs in the history of many places, not in reference to the stranger, but representing the boundary between the burgesses of the two portions of the City: those within the ancient bounds and those without. (L. *Forinsecus*: foreign; outside). Proceeding with the subject of Mr Cullis's paper, the President spoke first of evidence collected which determined the precise date of the destroyed Gate-house to the old Westgate Bridge, at any rate, within a space of two years. It was constructed in the very last years of Norman architecture, just before the transition into pointed style, namely 1175-7, or late Henry II.[1] An example of similar (if later) gate-construction may be seen in the plan of the château of Pierrefonds[2] though this has been restored in after years, and was a work on a larger scale.

Mr Baddeley then exhibited a fine water-colour drawing of the Westgate Bridge, by Joseph Farington, which he had compared with five prints, of varying dates, in the Gloucester Public Library. The series, taken together, present trustworthy evidence as to the 18th cent. conditions of the Bridge, and the necessity of the frequent repairs which were then required. He also exhibited a Crown Derby cider-cup, bearing a coloured representation of the Bridge, now identified as a copy of Catton's drawing, of 1793.

This drawing (Pl. IX.) illustrates the known fact that the Bridge-House was in part rebuilt *temp.* Henry VIII., the hood-moulding of the windows, and the mouldings above the gate on the western face, being distinctly of Tudor date. From Farington's drawing it is plain that the main body of the structure was Norman. This quadrilateral Bridge-House had four little tourelles, one at each angle. Examples of these are well shown by Viollet-le-Duc.[3]

The series of views of the Bridge mentioned above comprised:—

(1) Farington's water-colour drawing, c. 1780-85.
(2) Bonnor's drawing, c. 1790.
(3) Ravenhill's drawing, c. 1790-95.
(4) Catton's drawing, dated 1793.
(5) Carter's drawing, dated 1796.
(6) Lysons's drawing, dated 1802.

1 In consequence of that King's Council at Gloucester regarding Wales: June 30, 1175. St. C.B.
2 Mr T. S. Ellis has kindly brought to my notice illustrations of the château of Pierrefonds before and after restoration, given in Reclus' *La France et ses Colonies* (1887), vol. i., pp. 564, 565. R.A.
3 *Dictionnaire de l'Architecture Française*, iii., 157, ix., 189-195.

No. 5 is a singularly useful representation; and though taken from the north side, and slightly on north-east, it is the only one showing the nearly perfect Norman arch of the east front of the Gatehouse; *i.e.*, towards Gloucester town. It also shows some Norman crenellated details untouched. The picturesqueness of the Bridge thus seems to have attracted the attention of several artists within quite a short period, and the various changes shown in these drawings indicate constant repairs. It is not surprising that the patience of the busier citizens became at length exhausted, and that application was made to Parliament for authority to remove the Gatehouse and rebuild the Bridge. An Act was granted in 1806, and the Gatehouse was removed in 1808.

In Speed's plan (1610) of Gloucester, the walls on the northern side of the City are shown in very clear detail. These Norman fortifications we know were frequently repaired. Sir Thomas Bradeston, long Constable of the Castle, *temp.* Edward III. (as the Close Rolls shew), was responsible for drastic restoration of the walls. Thus portions of the walls were of long-post-Norman date, and it is clear from examination of the length still *in situ* under the Technical Schools in Brunswick Road that no wall-work of Roman times remains visible. What there is belongs to the mediæval period; the particular characteristics of the prevailing style—jointing and size of stones—are conclusive. Norman workmen limited the size of their stones to the carrying capacity of three men, and the familiar tile-bonded (8-13 ft. thick) courses raised by the Romans had little in common with the practice of Norman masons. The Romans extended to Britain a regular little-varied style of building town-walls, which may be recognized at Porchester, in London-wall, and at Caerwent.

Domesday Survey informs us that Gloucester Castle was built by Fitz Osbern for the Conqueror, and it is later described as "Turris cum Castello:" *i.e.*, keep and fortified enclosure. It had a square keep (built 1108—13: and finished, or enlarged, (*c.*) 1132), like Rochester, not built on a mound. The right to have a keep-tower, or *turris*, belonged only to the Crown. The presence of Gloucester Castle obviated the need for continuing the defensive wall on the western side of the City, and the Westgate Bridge Gatehouse was built by Henry II. as a riverine additional defence from the incursions of the Welsh. The triangular form of the mound that formerly rose hard-by the Castle, and called the Barbican, as shown in Hall and Pinnell's map (1780), which was identified with the term *old-castle*, may well have been the then surviving S.W. angle (*Vallum*) of the Romano-British fortification. In it were found many late Roman coins when removed in 1818. The site fits perfectly with such a supposition. It is quite possible that Glevum may have remained without actual Roman walls. If this was the case there is the more reason for the building of the Abbey of S. Peter's without trouble across an angle of the earthworks. No trace of a west wall occurred in the deep excavation along Berkeley Street for the extension of the Shire Hall buildings; but rather distinct remains of a staked rampart: the carbonized stumps remaining in their holes.

TUESDAY, NOVEMBER 20th, 1917

The President in the Chair.

The President exhibited a small metal lamp said to have been found in Gloucester, and described as of Roman workmanship, but this was pronounced as of modern manufacture. Other articles found in the Sandhurst-Kingsholm district included a Romano-British culinder, and a jug of apparently foreign manufacture and mediæval in date. These had been presented to the Gloucester Museum.

Mr Upton exhibited three small utensils, somewhat similar to honey jars, of late 17th c. or early 18th c. date, found at Clapton (N. London).

Mr C. G. Clutterbuck exhibited specimens of the Gooseberry Saw-fly (*Nematus Ribesii*) found by him in May, and also a hornet found in Gloucester in October.

The President exhibited a drawing of an extremely rare tile from Ewenny Priory: a representation of a very early shield bearing the trade-mark probably of a wool-merchant buried at Ewenny, it being the custom to use such marks by those not entitled to bear arms.

Mr Hurry exhibited a slate tablet from the hill-district of Chamba,[1] Northern India, where it is the custom to place such memorials by the water supply of the villages in honour of deceased members of the community. Some of the tablets are six and seven feet high. On the one shown are carvings (measuring 8½ inches by 7 inches) of three figures, partly surrounded by a roughly-cut zig-zag border.

The Rev. A. R. Winnington-Ingram exhibited a specimen of the Little, or Danish, Owl, found on the railway near Barber's Bridge.

Colonel E. B. Jeune communicated some notes on "Extinct Animals of Queensland" and exhibited bones of animals found by him some thirty years ago in the banks of King's Creek, on the Darling Downs, Queensland, among them those of *Diprotodon megalanea* (land-lizard), *Macropus gigas* (giant kangaroo), Wallaby (ancient), and the Wombat.

"The Darling Downs to-day consist of rolling downs extending for a couple of hundred miles at an elevation of about 1000 feet above sea-level, commencing about 100 miles from the coast. The soil is black volcanic, 20 feet or so in depth, with hardly a stone, and in places there is a layer of pipe-clay just below it. In some places a layer of gravel gives a grand supply of water. There can be little doubt that in ages past there were vast swamps and lagoons here, and in droughts the various animals came to drink at the

1 A photograph of the tablet has been submitted to Mr W. Crooke, who is of opinion that it is a Sati (or Suttee) stone, and in this view Colonel Rose, a well-known authority on such matters, concurs.—R.A.

boggy waterholes, and, being weak, sank in the mud, which closed over them and preserved their bones for us to find now. Many of the skulls I found could not be removed, as they came to pieces as soon as they dried in the sun. The great point of interest to my mind is that all the fossil animals which we have found are represented at this day by animals of a precisely similar type only on a much smaller scale."

Colonel Jeune intimated that he would present the bones to the Gloucester Museum. He also read some notes on the Ants of Queensland, extracted from a paper by Henry Tryon, read before the Royal Society of Queensland. [1]

Mr Upton produced a small collection of pebbles, flints, and fragments of chalk taken from two beds of drift material on the banks of the Gloucester and Berkeley Canal. He drew attention to the fact that in the two cuttings through which the Canal runs—i.e., between Sims' Bridge and Rea Bridge and near the Pilot Bridge—the elevated patches of Lower Lias Clays and Limestones are overlaid by banks of reddish clayey sand, in which are found a number of pebbles of quartz, quartzite and other material such as are usually found in "Northern Drift," together with a considerable number of angular fragments of flint and a few pieces of chalk. The sand of which the Drift-banks are composed consists almost wholly of well-rounded quartz grains with a small admixture of fragments of darker coloured rocks. The "Northern Drift" was usually assumed to have been transported from the North and North-west down what is now the main Severn Valley, whilst the flints came, in all probability, down the Avon Valley from a North-easterly direction, possibly from the cretaceous districts of Yorkshire and Lincolnshire. The chalk is very hard and quite unlike that which occurs in the South of England. One point in connection with the flint fragments is that they are not in the slightest degree waterworn and are just such as may be seen on the surface of ploughed fields in chalk country. Their fragmentary character is probably due to alternations of temperature. Among the quartz pebbles were three which bore obvious evidence of ice polishing. The speaker thought that the evidence pointed to a time when what is now the lower Severn Valley was occupied by a Lagoon, which, though extending over a considerable area, was comparatively shallow and suggested that a continuation of the range of Rhætic Rocks, which the river cuts through near Sharpness, would have been sufficient to hold up the water until such time as the channel was deepened sufficiently to drain it off. Both the Northern Drift pebbles and the flints were probably brought from their respective places of origin by comparatively small fragments of ice towards the close of the glacial period. He did not claim to be an authority on the superficial deposits, and invited Mr Gray to give his views on the matter.

1 *Notes on Queensland Ants*, by Henry Tryon. Brisbane, 1886. (From *Proc. Roy. Soc., Queensland*, vol. ii., pt. 2, 1885).

TUESDAY, DECEMBER 18th, 1917

In the unavoidable absence of the President, the chair was taken by Mr F. H. Bretherton.

The Acting Hon. Secretary read a letter from Mr Richardson, in which the Club was asked to accept his resignation, it being understood that for the duration of the War it was impossible for him to attend meetings or to conduct the affairs of the Club. The resignation was received with very great regret, and the hope expressed that at some later date it would be possible for Mr Richardson once more to give assistance to the Club in a similar manner to that which he had rendered so successfully and acceptably for the many years he had carried out the duties of Secretary.

The result of the inquiry made as to the wish of Members to make any alteration in the hour of meeting during winter months was announced, it being found there was a considerable majority in favour of retaining the usual time of 3 p.m.

The Acting Hon. Secretary reported that, in accordance with the direction of the Council, he had communicated with various National and Public Libraries and Museums and offered copies of surplus volumes of the Club's *Proceedings* for their use, and that over twenty of these Institutions had gladly accepted the offer.

Mr Charles Upton communicated a paper on "Brachiopoda of the Cotteswold Area," in which he drew attention to certain apparent irregularities in the succession of forms and in the distribution of genera and species, and in the genetic connections of some of the Brachiopoda of the area. He also gave an interesting outline of the distribution, reproduction, and growth of living forms, and the conditions under which they exist, mentioning that there was little doubt the fossil forms to which the paper more particularly applied lived under conditions not essentially different from those now existing. The difficulties of working out what may be termed the pedigrees of any special group of Brachiopods were pointed out, Mr Upton stating that he had frequently found it easier to start with a later form and work backwards, rather than commence with an early form and work onwards.

The occurrence of Brachiopoda found in the strata deposited during the several hemeræ of Lias and Inferior Oolite in the Cotteswold Area was discussed, and forms which appear to spring up without any apparent antecedents, and others which disappear suddenly, were referred to.

Mr Bretherton thanked Mr Upton for the very interesting and clear way in which he had submitted his paper, and Mr Gray congratulated the Club on having a member so well qualified to deal with the subject. The hope was expressed that the paper would be printed in full in the *Proceedings*.

EXCURSIONS—1917

(Reports by The President and Roland Austin.)

The Excursions of the year had perforce to be planned with due regard to facilities for travel, and though the programme included places more or less familiar, the meetings, judging from the attendances, proved attractive, and gave opportunities for Members to gather together, which might not otherwise have occurred.

CIRENCESTER MEETING.

May 15th, 1917.

The first of the excursions was attended by a large company, there being present:—The President, Earl Bathurst, C. Bowly, E. C. Sewell, Roland Austin, C. Bailey, F. H. Bretherton, O. A. Brown, H. T. Bruton, H. W. Bruton, Rev. J. J. D. Cooke, Colonel Duke, G. Embrey, J. C. Frith, E. W. Fyffe, Ernest Hartland, A. E. Hurry, J. W. Gray, H. H. Knight, J. H. Jones, W. C. Lucy, E. Lawrence, Dr. Middleton Martin, A. S. Montgomrey, J. F. Muir, Surgeon-Major Newton, H. E. Norris, L. Richardson, E. N. Witchell. The Hon. E. H. Pierrepont, Dr. Beeby, and other visitors were also present.

Members travelling from Gloucester arrived somewhat earlier than those from Cheltenham, and on the invitation of Earl Bathurst took the opportunity of visiting the Roman pavement at the Barton,[1] discovered in 1825, and from there walked to the Roman "Bull Ring," situated on the property of the Hon. E. H. Pierrepont, who had given permission for the visit. Here the Cheltenham party was met and a position was taken up on the raised bank overlooking the "Ring" on the one side and the town on the other.

Mr E. C. Sewell made the following observations:—

"When the Members of the British Archæological Association visited Cirencester in 1868, one of the subjects that evoked much discussion was whether this so-called Amphitheatre was of Roman origin or of later date. Mr J. Bravender, a surveyor at that time in Cirencester, had prepared a plan[2] with the following dimensions of the arena. This, including the two open ends or entrances, measured 328 feet in length, and 129 feet in breadth, while the level of the arena was about 24 feet below the summit of the surrounding mounds. The question whether these mounds are artificial, wholly or in part, may be answered by saying that the greater part of them on the

1 Described by E. C. Sewell and Alfred H. Powell, and illustrated, *Trans. B. G. A. S.*, xxxiii., 67-77.

2 *Jour. Brit. Arch. Assoc.* (1868), xxv.

eastern side are in the natural oolite formation, and have been quarried out on the town side so that the steep slope dips down for nearly 40 feet. Parts of the remaining mounds around the arena are undoubtedly artificial. Locally, it is always called the Bull Ring. In 1860 Mr T. C. Brown, an eminent local antiquary, described the amphitheatre, and said he had made a section of one of the banks, but found no stones or steps, such as had been found in similar amphitheatres in foreign countries. This, however, did not alter his opinion as to its being an amphitheatre, as he considered that in this cold climate it would not be comfortable to be sitting on stone seats. He thought, therefore, the seating must have been of wood, which in the course of centuries had perished. A curious feature of the position of this amphitheatre is that while it is just outside the town wall, it is in a direct line with the ancient Roman road : the Foss Way.

" Standing on the mound on the East side one gets the best view of the site of the Roman city of Corinium, probably for many years ranking third in importance in Britain. The city walls were in the form of a parallelogram, rounded at the angles and enclosed about 240 acres of ground. The circumference was more than two miles, according to Dr. Stukeley, who traced their whole course about the year 1723. They were probably about 15 feet high and 6 to 8 feet thick. Within these walls must have been many magnificent buildings, judging from the beautiful pavements discovered and preserved, and the massive worked stones of temples and other buildings brought to light from time to time."

The President then spoke of the Roman occupation of the town, and, in the course of his remarks, said :—

Corinium having been hitherto the tribal, or Cantonal, centre of the Dobuni (just as Silchester (Calleva) was of the Atrebati), it is probable that the Roman General captured and established a permanent camp near its South side before sweeping down to the lower Severn Vale and the river. Two facts point to its Romano-British occupation from the topographical point of view : (1) the survival of the local name *Chesterton*, or *camp-enclosure*; and (2) the roads. If the map be consulted as well as the surviving bull-ring, it will become apparent that the Foss-way took its actual start Northwestward from the Roman Camp (destroyed by mediæval quarries), independently of the Acman Street or Road to Aquæ Sulis (or Bath), South-westward, which must be of later date. Similarly, the Irmin Street, or road to Glevum, was made from Corinium, *not* from Glevum, and, like the Acman Street, it started not from Chesterton, but from the north-western end of the town proper ; these latter (and later) two roads actually starting at right-angles, at the (now) west end of the Parish Church. Priority, in any case, belongs to the great strategic Foss-road to and from Lincoln across the Midlands ; and that probably dates from the first century or before, 98 A.D., when Glevum became constituted a small earth-fortified settlement of time-expired veterans (a *Colonia*), beside the Severn ; otherwise, a weapon of offence as well as of culture (civil and religious), and probably the third in order of date of the four *Coloniæ* in Britain.

The President remarked, further, that, standing above the Bull Ring a person in Henry the First's time—say 1130—would have seen below him the surviving long barrow of the Stone Age; and just beyond the present railway station the Norman Royal *Castle* (which became burnt in Stephen's civil war. *c.* 1142); also much of the solid walls with their mediæval gates, and the Abbey buildings and enclosures beyond that.

The grounds of "The Querns," the residence of the Hon. E. Pierrepont, were then entered in order to view the long barrow. This was partially opened before 1850 by Professor Buckman and Mr C. H. Newmarch, when a certain amount of débris of skeletons was found. On December 17th, 1913,[1] a Romano-British (uninscribed) stone coffin was found in the garden, these interments of different ages indicating that the site was a favourite burial ground in ancient days. From the gardens the party walked through the Park to the Corinium Museum, where the President thanked Earl Bathurst for his friendly courtesy in permitting the use of his private walks. Outside the Museum, Mr Sewell had most kindly provided refreshments for Members, which were much appreciated, and then, in his capacity as Curator, he took his guests into the Museum, where he made the following remarks:—

The Corinium Museum was erected by Henry George, fourth Earl Bathurst, for the reception of the two magnificent pavements that had been discovered in Dyer Street. These were most carefully traced on paper and coloured before removal, and then were moved by the firm of Minton. The result is that the pavements are very much as they were *in situ*. The cases around the building contain a fine collection of articles in iron and bronze and pottery. Among the most noticeable are the examples of inscribed Sepulchral Stones and Altars, and particularly a stone 17 inches square discovered in 1892, having inscriptions on three sides. On one face of the pedestal is a dedication to L. Septimius, and on the other two inscribed sides are rough hexameters, in which Septimius is also recorded as having restored the statue of Jupiter and the column which bore it, in honour of the old religion.

Attention was also directed to the fragment of painted wall-plaster, on which the following squared words are scratched upon five lines through the surface colour:—

ROTAS
OPERA
TENET
AREPO
SATOR

interpreted as meaning "Arepo, the sower, guides the wheels at work." There is a very fine example of a Roman Cinerary Urn of glass that was wrapped in lead and enclosed in a hollow stone found in King's Mead, Cirencester, about the year 1765. This passed into the Bateman Collection, and on its dispersion in 1893 was secured by Sir A. H. Church, at one time a Curator of this Museum, who generously presented it.

1 See *Trans. Brist. and Glouces. Arch. Soc.*, xxxviii., 219-20.

Mr Sewell then called the attention of the party to five gold Roman coins, in mint condition, the munificent gift of Lady Church to the Museum in memory of her husband, Sir A. H. Church. The coins are of the Emperors Valentinianus A.D. 364 (2), Gratianus A.D. 375, and Honorius A.D. 395 (2), and a very interesting contemporary forgery of Valentinianus found in the Market Place, Cirencester.

These coins were secured by Sir A. H. Church while residing at Cirencester, and formed a valued part of his collection. On his death, they were found by Lady Church, who felt that their proper place was in the Corinium Museum, and accordingly offered them to Mr Sewell, as Curator, who accepted them with gratitude.

Mr Sewell added that it was fitting that the first announcement of Lady Church's valuable gift should have been made known to the public at a meeting of the Club, of which Sir Arthur Church was for many years a very distinguished member.

The President drew attention to the fine example of a Saxon warrior's skeleton, with remains of his shield ; *i.e.*, its boss and studs, found eight years back beneath the Barton Villa pavement, and to a stone (uninscribed) Romano-British coffin from the "Querns." He also referred to the importance of the local place-names. Cecily Street occupies the site of a district which formerly bore the interesting name *Inchstrop—i.e., incg :* streamlet ; *thorp :* vill—which lay beyond the actual walls of the town, and may well have commemorated the temporary and peaceful settlement of the beaten Danes who remained here throughout an entire year (having come up from Chippenham), after their defeat, under Gothrum at Ethandune (c. 879). A *Salt-wick* is mentioned in 1522 as existing beside the Bothehall, (*i.e.*, near the modern Corn Hall buildings). The common term *Wick*—in the above *Salt-wick*—signified a store or a dairy, as well as (earlier) a village (L. *vicus*). As at Gloucester, there was a Goose-ditch, and a Goose-acre, in St. Lawrence's Ward, and a *Gildene-bridge* (1317) in the custody of the town Confraternities, or Guilds (M. E. Güldena). *Sperring-gate* was a gate closed with a bar : M.E. *sparren*, hence the term in shipping : "*a spar.*"

Proceeding to the Church, the Anne Bullen Cup given by Queen Elizabeth to Dr. Master, her physician, and the other Elizabethan Plate, was, by the courtesy of the Churchwardens and the authorities of the Bank, displayed to the Members of the Club. After the main features of the Church, and its various periodic additions and rebuildings, had been noticed, the Members were admitted, by the kindness of Mrs Dugdale, to the neighbouring grounds (or precinct) of the vanished ancient Abbey of S. Mary (*Augustinian*). The history was related of the transition from a Saxon College of Prebends under its once famous Dean, Reinbald de Cirencestre, the first Chancellor of England (and a mighty landowner in Dorset, Hereford, and Berkshire), to a rich Abbey of Canons Regular under its warm patron Henry I., and onwards to its acquiring practically life and death powers (by purchase from the impecunious King Richard I.) over the entire population of the town. The Abbots thus became Rectors of the Parish, and Lords of one local Manor that

had been Fitz Osbern's, and of the Seven Hundreds. Until the Reformation and Dissolution there consequently occurred perpetual and very bitter quarrels, resulting often in bloodshed and fierce litigations between the Abbey and the Town, the Abbey invariably winning the day with its Royal Charters and Confirmations, which re-established its questioned autocracy. To mention a single fact, the entire taxation became placed in the Abbot's hands. Moreover, the Abbots enclosed 62 acres of the common pasture of the town in 1292 at the Crundles (*i.e.*, Querns), and appropriated to their own uses both the local hospitals, turning out the Guild-masters, and taking their tithes. It was this evil and victimizing monopoly that prevented Cirencester from ever rising to independence and importance, and probably the inhabitants were not loath to leave no single stone of the Abbey *in situ*, when at last the grim day of reckoning arrived in 1539.

The President brought his remarks to a close with mention of Leland's visit in Henry VIII.'s reign to the Abbey Church, and his leaving record that there were conspicuous marble tombs in it to its founder, Reinbald, Dean of the Church, and to Thomas Ruthall, Bishop of Durham, whose body lies in the North choir-aisle of Westminster. The latter was not only a great benefactor of both the churches at Cirencester, but was a native of the town. His arms occur in the Parish Church, and his surviving sister, Mistress Alice Avening, shared his benefactions to it. He died (1523) of grief, it is believed, at Durham House, in the Strand, at having discovered that, by error, when asked by King Henry to draw up a Brief of the lands of his Diocese, he had sent the inventory of his own great possessions. He is known to have borne one-third of the expense of the great (then) new bridge at Newcastle-upon-Tyne. Truly such a citizen deserved commemoration, and it is remarkable that there is no tablet to his memory. Of the Library of the Abbey there are thirty-four volumes surviving, of which sixteen are at Hereford, four in the British Museum, ten at Jesus College, Oxford, and four are in the Bodleian.

The MS. Register [Phillipps, 6692. XIII. c. fol. (vellum)] is in Thirlestaine House, Cheltenham.

Before dispersing, the President thanked Mr Sewell heartily for the excellent arrangements he had made for the meeting, and for the information on many local matters imparted by him during the day. A few Members visited Cripps Mead, where Mrs Cripps received them in her Museum of Roman antiquities, for the most part, found in and around Cirencester.

Mr W. J. Greenwood had kindly arranged at the Bingham Library sheets of plants native to the district, which he had selected from his herbarium, and these were examined by Members interested in botanical work, who appreciated the trouble taken.

Walter Lucy, Leasgill Cottage, Amberley, proposed by E. W. Fyffe, seconded by A. E. Smith ;

Colonel E. B. Jeune, Whaddon Manor, proposed by A. E. Hurry, seconded by Roland Austin,

were duly elected Members of the Club.

DEERHURST AND TEWKESBURY MEETING

JUNE 5TH, 1917.

The second meeting included visits to two of the most notable buildings in the Severn Vale—Deerhurst Church and Tewkesbury Abbey—and the journey thence on the river added to the pleasure of the day. The Members travelling from Gloucester were The President, F. H Bretherton, O. A. Brown, J. M. Collett, F. J. Cullis, F. W. Duart-Smith, E. W. Fyffe, J. N. Hobbs, W. C. Lucy, A. S. Montgomrey, Rev. H. Moxon, J. F. Muir, Surgeon-Major Newton, C. Upton, J. A. Smithin, and Roland Austin (Secretary), who were joined later by Colonel Duke, F. J. Mylius, A. J. Stephens, G. Embrey and J. W. Gray.

At Deerhurst, the Vicar (Rev. J. Griffin) welcomed his visitors, who assembled in the churchyard, where the President outlined the early history of the village, the antiquity of which is assured, a monastery (traditionally) having been founded there some time in the 7th century. Bede knew of it, and the Danes destroyed it. The present church may be dated for the main part as of the reign of Edgar (959-975). The so-called stone *dragon* above the west door was explained to have been a Saxon *ante-fixa*, or decorative *finial* to the ridge-roof, as is to be noticed in the Bayeux tapestry of Westminster Church. St. Alphege (Archbishop of Canterbury, d. 1011) took the monastic habit at Deerhurst. There is also the historic incident of Cnut's pledge with Edmund Ironside, the Alney of the A. S. Chronicle being therein stated to be at Deerhurst. The early connection of Deerhurst with the Abbey of S. Denis, near Paris, was also referred to. Edward the Confessor had deprived it of its possessions in order to endow S. Denis, reserving some of them, however, for Westminster. Hence, he was no benefactor to Deerhurst. In the time of Edward IV. (1469) there remained but two monks in this sadly-impoverished cell.

In late-Saxon times the church consisted of N. and S. aisles, with a double western porch under the remaining tower; but the idea of a former central tower (suggested by some archæologists) is not favoured by Mr Baddeley, though there was most probably another storey to the present elevation. In many of the very early churches the Baptistery was situated at the west end, and passages—called respectively the Narthex and Æsonarthex—crossed the west front, this being the locality where penitents were alone permitted to hear certain parts of the services. There was such a double porch at Deerhurst, though the character of the inner chamber (as such) has long been destroyed. Passing to the north side (external) the President drew attention to the interesting features of the three decorated windows, each distinct in design, which he dated as the work of the early 14th century, there being a few years between the building of each of the three.

Entering the garden on the south side, it was observed that the very centre of the monastic life of the community was there in view. The cloister (mere fragments only remain) was on the usual south side of the Church, and the positions of the Cellarer's door, or lay-brother's entrance, and the processional-door, were clearly recognized. From this point the "herring-bone" work, a feature usually, but not always, of Saxon date, and derived from the previous Roman *Opus spicatum* (*spica* : a spike, point, or a wheat-ear), is well seen. On the eastern side of the house, adjoining the Church, remains a fine example of an oblong curvilinear window of the time of Edward II. Near this site, we learn from Matthew Paris, was intended to be built, when the Priory was sold to him by the Abbey of S. Denis, Richard Earl of Cornwall's Castle. Paris (*sub anno* 1250) mentions the intention to build. The immense quantity of stone brought down for the intended castle is referred to in a contemporary document.

A careful examination of the burned Apside, or eastern end, of the Saxon Church was then made. There is reason to attribute the early 15th century as the date of the fire. Members then entered the Church, where the several problems—in the President's opinion, never likely to be settled—of its architecture were touched upon, and the Early hood-mould, the font, the Cassey brasses, the pre-Reformation chancel-rails, and the beautiful glass,were viewed with much interest. When returning to the boat the Saxon (Odda's) Chapel (1058) was visited, and its masonry (in both cutting and jointing), contrasted with that of the Church ; and here the Vicar was warmly thanked for his kindness in receiving the Club, and for giving them the facilities which they had enjoyed.

Tewkesbury was reached in time for Members to walk from Lower Lode ferry to the great and well cared-for Abbey, where the President again took much pains to present the main incidents in its history, and to point out a few of the most noteworthy monuments in the choir chapels.

Canon W. Owen Jenkins, Bagendon Rectory, near Cirencester, proposed by W. R. Carles, seconded by Roland Austin ;

Rev. H. Moxon, The Vicarage, Somerford Keynes, proposed by the President, seconded by Roland Austin ;

Charles Arnold Crane, The Reddings, Cheltenham, proposed by Rev. J. J. D. Cooke, seconded by J. H. Jones,

were elected to membership of the Club.

CHELTENHAM AND CLEEVE HILL.

July 10th, 1917.

For this meeting, Mr J. W. Gray had been at much pains to prepare an attractive programme, and he was rewarded with complete success and an excellent attendance, those present being :—

The President, C. Bailey, F. H. Bretherton, O. A. Brown, Rev. J. J. D. Cooke, C. A. Crane, F. J. Cullis, Colonel Duke, F. W. Duart-Smith, T. S. Ellis, J. C. Frith, E. W. Fyffe, J. H. Garrett, J. W. Gray, Ernest Hartland, J. N. Hobbs, A. E. Hurry, Colonel Jeune, Rev. P. M. C. Johnstone, J. H. Jones, H. H. Knight, E. Lawrence, A. S. Montgomrey, Rev. H. Moxon, J. F. Muir, F. J. Mylius, Surgeon-Major Newton, A. J. Stephens, C. Upton, J. A. Smithin, and Roland Austin, the visitors including Dr. Lloyd, A. J. de Havilland Bushnell, Dr. Davies, etc.

By permission of the Chairman and Committee of the Cheltenham Museum, the Members assembled in one of the rooms in the Museum, where A. J. de Havilland Bushnell, M.A. gave a lecture on "Man before Metals," which was illustrated by flints collected on the Cotteswolds.

Mr Bushnell observed that the subject of Early Man was of special interest to such a Society for two reasons. In the first place it was a new science, being not yet sixty years old ; therefore an enormous amount remained to be done for it, and why not a portion of this by some of those present, particularly as one division of the science could be better studied in Gloucestershire than elsewhere ? The second reason was that the science of Early Man owed its inception entirely to amateurs. The first of these amateurs, Boucher de Perthes, director of the Custom House at Abbeville, found flint hatchets among the mammoth bones there, and hence concluded that man was co-æval with these animals. Hugh Falconer, a retired Indian doctor, was, however, the real founder of the science ; it was he who began in 1858 to stir up the hidebound geologists. He urged Joseph Prestwich, a wine merchant, to visit Abbeville and see for himself, and, together with John Evans, a paper maker, Prestwich went. Going as sceptics, they were at once convinced, and the commanding genius of these two men satisfied the savants not only of England but of France also ; and in 1860 the learned world admitted that man had existed for over 100,000 years. Lartet, a lawyer of Toulouse, visited Abbeville, and afterwards began hunting in the cave of Aurignac, between Toulouse and the Pyrenees. His friend, Henry Christy, joined him in the work, and, with princely liberality, paid all expenses. Following these, a young banker, John Lubbock, who afterwards became Lord Avebury, made the subject popular by his work on prehistoric man and animals, and by drawing the distinction betwen palæolithic and neolithic time. The French Government gave the Château of St. Germain, where James II. died, as a museum for buried "finds," and

appointed a newspaper proprietor, Gabriel de Mortillet, as curator, who, having all these objects before him, was able to divide the palæolithic age into four great periods.

Mr Bushnell went on to describe the discoveries in those periods. In the first, the Chellean—named from Chelles on the Marne—which was a tropical period, when the straight-tusked elephant and the great hippopotamus lived in England, Man, he said, was of a higher type than some of his successors. The most famous of the Chellean human remains was the Piltdown skull, two casts of which (one by Smith-Woodward and the other by Professor Keith) he exhibited and described in detail. The second period, called the Mousterian—named from Le Moustier on the Vézère—was arctic in climate, when man was obliged to live in caves and when animals possessed extraordinarily thick coats, these animals being the woolly rhinoceros, the mammoth and the reindeer. In the Chellean period the flint implements were made of whole nodules, from which he deduced that they were not intended for hafts ; in the Mousterian period they were thinner, being split and flat on one side, and were undoubtedly hafted. The Mousterian man had been found in twenty places ; he had been named the Neanderthal man, and was a being of very short stature with tremendous jaw and enormous teeth. From the thickness of the skull and supra-orbital ridge and the enormous size of his teeth, Mr Bushnell believed he was a butting as well as a biting animal. The next period, the Aurignacian, was much the same as regards climate, and the mammoth and woolly rhinoceros still persisted, but the culture of this period was marked by the beginning of art. There was not only painting in black and white, but carving, sculpture, and beautiful necklaces, bracelets, and other ornaments worn by women. The flints had now become smaller in size, but the Cro-Magnon man was taller, averaging 5ft. 11 in. in height, and very much like the Sikhs of the Punjaub in build—a great improvement on the brutal Neanderthal man. The last of the palæolithic periods, the Magdalenian—named from La Madeleine on the Vézère—was that in which art had considerably developed, pictures of mammoths being engraved on their tusks, and reindeer on their horns, and pins and needles being made of ivory and of horn, and polychrome paintings were numerous. A great change in climate now took place, and, with the melting of the ice, England became too swampy for the palæolithic fauna, which all crossed over to the Continent (by way of the forests, which have now become submerged by the sea), followed by man, who needed them for food, with the result that for thousands of years there was no animal life in these islands.

Neolithic time began with the return of animals of modern species, followed by man over the chalk bridge, to this country—the time of the sheep, the ox, and the dog as we know them. The Neolithic period was easily divisible into two : that of the long barrow men and that of the round barrow men. The long barrows could be studied better in Gloucestershire and Wiltshire than anywhere else, for they contain three-quarters of the long barrows in England. Neolithic man apparently brought no ornaments

with him ; there were no paintings, no sculpture, and no carvings traceable to him, but his stage of civilisation had advanced ; he had got beyond the hunting stage, and cultivated the domestic animals, living in a pastoral community and in settlements. For the first time a very rough pottery was used, and the men had a high respect for their women. The West Tump, in Buckholt Wood, for example, was built entirely as a burial place for a girl and her baby. Another peculiarity of the long barrow was that in it pet dogs were sometimes buried with their owners. The men of this period were short and dark. Their modern name was " the Mediterranean race," because they could be traced from Algeria through Sicily, Italy, Sardinia, Spain, and France, to England. They followed the chalk line, where they found flint for implements in plenty, and of all the long barrows in this country, about 170 in number, more than half were to be found in the chalk county of Wiltshire. From Wiltshire the long-headed men overflowed into Dorsetshire, and a few also into Somersetshire, but the main overflow was on to the Cotteswold plateau, and it was this fact which made Gloucestershire the first non-chalk county in England for the number of its long barrows, at least forty.

Another peculiarity about the long barrow was that it was almost invariably solitary, and placed on lofty eminences, visible from great distances; and points about the Gloucestershire long barrows were that they had containing walls with horned ends, that no round skulls or cremated bodies were found in them, and that they were almost entirely free from ornaments. In fact, the only ornament found in a long barrow was an amulet of Kimmeridge shale, one specimen of which was found by Mr Witts at Notgrove, and was now in the Cheltenham Museum, while the only other two known were found, one at Eyford, near Bourton-on-the-Water, and the other at West Kennet. Mr Bushnell exhibited the local specimen and also the single leaf-shaped flint found by the late Mr G. B. Witts in the long barrow at Notgrove, but said that, from its size, he was doubtful if it were an arrow-head : he thought it was more probably the head of a dart. A few bone scoops and bone pins had also been found. The long barrow flints were never ground or polished, were small and hafted, and were found on the surface. The round barrow men came after the long barrow men : they were a tall race, real Celts, and mostly Gauls. The round barrow men had skulls the width of which was more than 80 per cent. of the length, whereas the average skull of the present day inhabitants of these islands was not more than 76 per cent. of the length. The round barrow men were in a higher stage of civilisation as compared with the long barrow men : they knew how to plant cereals, to spin and weave, to use ornaments, and they had also discovered how to trepan. A skull had been discovered in which trepanning had been done in three places, and the patient had lived afterwards. There was an enormous difference in the weapons these men used, for they invented a barbed arrow and a ground and polished celt, which was generally made of tougher stone than flint, such as diorite. The extraordinary thing, however, was that celts were seldom found in Gloucestershire. Mr Witts

found seven only, not one of which is made of flint, and these were in the Cheltenham Museum. In Gloucester Museum there were some flint celts which were found at Nailsworth.

At the close of Mr Bushnell's extremely interesting address, the President, in proposing a very warm vote of thanks, congratulated him on his grasp of the subject, and the clearness with which he had presented the history of the various periods of Ancient Man.

Proceeding by tram to the " Rising Sun," on Cleeve Hill, the Members walked to the summit of the hill, and, while partaking of lunch, listened to an address from Dr Garrett on the topography of the District. The atmosphere was rather against any good view of distant country, but Dr Garrett endeavoured to overcome this by a very clear description of the positions of the various points which should have been seen.

He also described the common, its boundaries, and its ancient roads, the useful purpose served by its pasturage and its quarries, not omitting its value to Cheltenham for recreative uses. It was observed that portions of the camp are being let down by quarrying, and the suggestion was thrown out that the Club should make some attempt to prevent further destruction. The Club recognised with gratitude the efforts made by the Conservators in the preservation of this magnificent open space, and the care bestowed upon its ancient monuments. Dr. Garrett mentioned that a gallop or walk could be taken in one direction for two and a half miles, although at the extreme westerly end the ground narrowed to a breadth of a few yards.

The President gave a description of the camp on the western promontory, expressing the view that it was not originally a Roman camp, but that both this and the camp on Nottingham Hill are Neolithic in origin. Compared with Nottingham Hill camp, Cleeve camp is small, that on Nottingham Hill being one of the largest enclosures on the Cotteswolds. Mr Baddeley went on to state that there was every indication that the builders of these camps and the makers of the long barrows were the same people. He also called attention to the fact that the Britons, as in the case of many other ancient and partly civilised peoples, were great adepts at basket-making, mention having been made by Martialis of the arrival at Rome of a consignment of *bascaudæ* (Welsh : *basgawd*) from Britain, and Juvenal also having a reference to the sale of British baskets in Rome.

The Members next proceeded, under the direction of Mr Charles Upton, to inspect a section (near the 11th hole) in the Lower *Trigonia*-Grit, Snowshill Clay, and Harford Sands. The Sands are of considerable interest, and have been examined, with other Inferior Oolite and Upper-Lias Sands, by Prof. Boswell, who has very kindly placed the information given in the table at the disposal of the Club.

At the section Mr Upton gave an outline of the ancient geography of this district, in the course of which he pointed out that at the commencement

of the Liassic period an arm of the Liassic Sea, which then covered the greater part of Central Europe, extended in a northerly direction through a strait, of which the western shore was formed by the Welsh Mountains, and in that locality had a width of approximately 100 miles. Towards the north this arm had a north-westerly extension which covered a portion of the North of Ireland, the North-West of England, and embraced, practically speaking, the whole of the Hebridean Islands and a considerable portion of the mainland of Scotland. Towards the North-East another expansion covered a large portion of the central and eastern Midlands, including Lincolnshire and the whole of Yorkshire to the east of the Pennine Range, and extended far out into the North Sea. The fauna of the western extension is entirely marine, while that of the eastern arm is more of an estuarine character, and it is considered probable that a river of some magnitude came in from the North-East. Towards the close of the Liassic period, barriers appear to have arisen towards the South, somewhere in the neighbourhood of the Mendips, and also towards the North, so that the Cotteswold area became to a considerable extent isolated, and this condition persisted during practically the whole time that the Lower Oolitic Rocks were being deposited, with the result that the fauna of the area became differentiated from that of the larger or European area to the South. Eventually, owing probably to a general depression, the whole of the Cotteswold area was again united with the southern waters, and the fauna became to a large extent general, as is shown in the Upper *Trigonia*-grit and later rocks. During the isolation period, the Cotteswold area was subjected to various oscillatory movements, resulting in local deposits of a limited area, and of a more or less lenticular character and of varying composition, such as were displayed in the section there present, which showed the "Harford Sands," consisting of almost pure silex resting on Upper Freestone, and overlaid by a stiff blue clay known as the Snowshill Clay, upon which again rested the Lower *Trigonia*-grit, here for the most part consisting of a siliceous grit with beds of limestone and replete with fossils. This again is succeeded by a somewhat sandy Limestone known as *Buckmani*-grit. A short distance away is a section showing the junction of the *Buckmani*-grit, with the overlying Gryphite-grit, with Notgrove Freestone succeeding the latter bed.

Mr Upton also called attention to some remarkable concretions in the "Harford Sands" formed by the consolidation of the siliceous sand through infiltration. After an examination of the fossils and other details of the pit, the Rolling-Bank Quarry was visited, and a series of Sandy Limestones known as the *Phillipsiana Bourgnetia* Beds, a series of singular interest, and, so far as known, confined to the Cleeve Hill plateau. These contain a Brachiopod fauna peculiar to the Beds, a complete series of which was produced for inspection. This particular series of Beds was for a long time a puzzle to geologists, and it is due to Mr S. S. Buckman's researches that their correct relationship to the other Inferior Oolite Rocks has been ascertained.

ELUTRIATION OF CERTAIN INFERIOR OOLITE AND UPPER LIAS SANDS

By Prof. P. G. H. Boswell, D.Sc., A.R.C.S., D.I.C., F.G.S.

Percentage Weights. No sample contained grains > 1 m/m diameter.

Sample and Locality	Date (approx.)	Coarse sand > ½ m/m & < 1 m/m	Medium sand > ¼ m/m & < ½ m/m	Fine sand > 1/16 m/m & < ¼ m/m	Total sand grade > 1/16 m/m & < 1 m/m	Silt grade > 1/160 m/m & < 1/16 m/m	Clay or mud grade < 1/160 m/m diameter	Notes
Bridport Sands .. .. .. Foot of the western end of East Cliff, West Bay, nr. Bridport, Dorset.	*moorei*	–	0·1	16·5	16·6	68·1	15·3	
Bridport Sands .. .. .. Chideock Quarry Hill, Chideock, nr. Bridport.	*aalensis*	–	0·9	22·05	22·95	67·55	9·5	
Yeovil Sands .. .. .. Babylon Hill, nr. Yeovil	*moorei*	–	0·1	38·05	38·15	49·4	14·25	Anomalous, but not calcareous
Yeovil Sands, Stoford	*moorei*	–	0·1	26·75	26·85	68·95	4·2	
Midford Sands .. .. .. Station, Midford, nr. Bath, Somerset.	*dispansi* or later	–	0·3	36·9	37·2	50·95	11·85	Calcareous on treatment with acid 50·95 per cent. raised at expense of 36·9
Midford Sands .. .. .. nr. William Smith's house, Midford	? *dispansi*	–	0·1	21·05	21·15	65·95	12·9	Slightly calcareous
Cotteswold Sands.. .. .. Wotton-under-Edge, Glos.	*variabilis*	–	0·1	26·5	26·6	65·55	7·85	
Harford Sands .. .. .. Cleeve Hill, nr. Cheltenham.	*concavi*	0·15	7·25	37·35	44·75	25·85*	29·4	Very calcareous

* During the elutriation it was clear that this grade consisted of very fine sand, mostly of diameter > 1/200 m/m. These analyses conform to a type which is very different from that of any other British deposits I know.—P.G.H.B.

Under the direction of Mr J. W. Gray, the Ring and other prehistoric remains on the western face of the hill were inspected, and eventually the site of the ancient British Village was reached. This is a little to the south of the Golf Club House, and was originally a flat platform apparently originally made to the south of the hill. The many prehistoric traces left, point, Mr Gray considers, to a considerable population having dwelt in the Village. The Pre-Roman interments were so numerous in the ground between Ben's Tump and the Racing Stables that the spot became known to the quarrymen as "the graveyard." One of the interments was that of a woman who had been buried in a crouching position, the bones of a child being found in close, contact. As the excavation proceeded several other bodies were exposed indicating, as did the black earth markings of the old surface of the Village, as well as other objects found, that the platform was part of the site of an ancient British settlement. The pits were of various shapes and sizes, the smallest about one foot in diameter and about 18 inches in depth, others being two or three feet in diameter. One, probably a pit dwelling, was 9 ft. long and 3 ft. wide, with a stone bench at the bottom. These pits contained burnt clay and basket work, suggesting a wattle and daub covering. Among other things found in them were the antler of a red deer, bearing marks of a saw. There are various opinions as to the uses to which the pits were applied. The smaller ones may have been used for cooking purposes, or as pottery kilns, and one of the reasons why this site was chosen for the village was probably the fact that a bed of clay is close by, and also a spring that has never been known to run dry. It may fairly be inferred from the information obtained that this was the settlement of a Celtic tribe, which possessed the domestic animals, such as ox, sheep, horse and pig. Roman coins have been found in some quarry rubble about two feet above the old floor of the village.

The detailed evidences of this ancient occupation have been recorded in the *Proceedings* (xv., 49-67) by Messrs. Gray, Brewer, and others.

Mr and Mrs Charles Bailey had kindly extended an invitation to tea at "Haymesgarth," and after the long day on the Common their hospitality proved welcome. On a former occasion Mr Bailey was able to exhibit his Herbarium, but shortly before the present visit the entire collection had been removed to its permanent home in Manchester University, to which it has been presented. By this gift, Mr Bailey completes the work of a lifetime, and Manchester is enriched by the finest private herbarium in Great Britain. The following announcement appeared in the *Manchester Guardian* of 30th March, 1917:—

"It was reported on Wednesday to the Manchester University Council that Mr Charles Bailey, formerly connected with the firm of Messrs. Ralli Brothers in Manchester, had offered to present his magnificent herbarium of British and foreign plants to the University.

"The acquisition of this superb collection, added to the existing herbarium of the Manchester Museum, and more particularly to the large and

valuable collection of non-European plants presented to the University in 1904 by Mr Cosmo Melvill when he retired from business, places Manchester University among the foremost of British institutions in respect of this necessary instrument of botanical study and research.

"In a communication which Mr Charles Bailey made last Tuesday to the Manchester Literary and Philosophical Society, he mentions that the foundations of his herbarium were 'laid more than sixty years ago, in the dingy lecture-room of the late Professor W. C. Williamson, in the old Owen's College in Quay Street, and it is fitting that it should revert to the University of which Owen's College was the forerunner.' It is equally appropriate that the vast collection which has been brought together by the enterprise and assiduity of a Manchester business man should permanently enrich the city of which he was a prominent and active citizen. His long and intimate connection with the scientific interests of Manchester, both as treasurer of the Literary and Philosophical Society and as president of the Manchester Field Club, and the charm of his personality have endeared him to a long line of botanical students, and this last generous gift to the University of Manchester is a fitting climax to a lifetime in which he devoted so much thought and all his wonderful methodical energy to the building up of what is at present undoubtedly the finest private herbarium in Britain.

"The comprehensiveness of his collection may be gathered from the fact that the British portion contains no less than 87,000 separate sheets of mounted plants, while the European portion amounts to 295,000 sheets. Mr Bailey has made generous provision for the cost of transference of his herbarium to Manchester, and also towards the expenses of completing the mounting of the specimens, so that it may be available for study and reference.

"The Committee of the Manchester Museum and the Council of the University have expressed their thanks to Mr Bailey for his most generous gift, and their appreciation of the great value which the herbarium will be to all students of botany. Some of those charged with teaching such students feel themselves unable adequately to express their thanks for the great services which Mr Bailey is rendering to botanical science in Manchester by his munificent gift."

Mr Bailey's communication to the Manchester Literary and Philosophical Society has been published in its *Memoirs and Proceedings* (Vol. 61, part II.), where the formation, methods adopted, and extent of the collection, are given in detail, and present some idea of the enormous labour which has been bestowed upon it. Mr Bailey is also presenting his library of printed books, of which the botanical section forms a valuable part.

Before leaving Haymesgarth, Mr J. H. Jones thanked Mr and Mrs Bailey for their hospitality, and referred to the magnificent gift made to Manchester. He also thanked Mr Gray and Dr Garrett for the trouble they had taken to make the day's proceedings so thoroughly interesting.

The following note is contributed by Mr L. Richardson :—Near the tram terminus on Cleeve Hill is Stockwell Green. In 1910 a well was sunk here in an endeavour to obtain an additional supply of water for Cleeve Hill. From Upper-Lias clay dug out, Mr Richardson obtained a piece of the ammonite *Peronoceras bollense* (Zieten). This ammonite indicates *Fibulatum*-Zone—one of the smaller divisions made in recent years in the *Bifrons*- or *Communis*-Beds of Northamptonshire. Its position will be seen from the following :—[1]

Oyster Bed.

The *Bifrons*- or *Communis*-Beds	*Braunianum*-Zone	Middle *Leda-ovum*-Beds.
		Lower *Leda-ovum*-Beds.
		Unfossiliferous or *Fibulatum*-Zone.
	Upper Cephalopod Bed	*Communis*-Bed or *Subcarinatum*-Zone.

A sharp look out should be kept in Gloucestershire for specimens of *Leda ovum*.

The yield of the Stockwell Green spring gauged by continuous pumping for fourteen days and nights in May, 1910, was 5,712 gallons a day.

Owing to the prevalent dip of the beds being *away* from the western side of Cleeve Hill, the springs on the western side are small. Thus :—

	Gallons per day
The spring on the cart-road to the south-east of the "Rising Sun," about 100 yards or so from the hotel, gauged in February, 1909	1728
The Emblem Cottage pipe, from the same spring as that tapped in the Stockwell Green well, gauged in February, 1909 ..	2448
Deck's Spring, Post Office Lane, gauged on November 6th, 1911	1728

On the opposite or eastern side of the hill mass, however, water breaks out copiously. Thus :—

	Gallons per day
Rushey Cockbury springs yielded, in September, 1910, and in September, 1911	17,280 10,800
Water from spring conveyed by pipe into the trough at Postlip Hall	18,000 to 19,000
Spring from Dry Bottom	9,000 to 13,5000

1 *Vide* S. S. Buckman, *Q. J. G. S.*, vol. lxvi., (1910), p. 86.

MORETON VALENCE MEETING.

JULY 31ST, 1917.

The fourth meeting was arranged at a seldom-visited village situated but a short distance from the Gloucester and Berkeley Canal, and, with the sanction of the Directors of the Dock Company, those who attended were able to have the use of the launch *Sabrina*, which conveyed them to Parkend Bridge, from whence they walked across the fields to Moreton Valence Church.

Those present were :—The President, F. H. Bretherton, O. A. Brown, W. R. Carles, J. M. Collett, C. A. Crane, F. J. Cullis, Colonel Duke, T. S. Ellis, G. Embrey, Ernest Hartland, Rev. P. M. C. Johnstone, J. H. Jones, A. S. Montgomrey, J. F. Muir, Surgeon-Major Newton, A. E. Smith, C. Upton, E. N. Witchell, and Roland Austin.

Before entering the Church the President referred regretfully to the very sudden death of the Rev. Walter Butt, and spoke of the great loss which the Club had thus suffered. He mentioned that though neither he, nor the Secretary, were able to attend the obsequies, Mr Ernest Hartland, Mr Haigh, and Mr Thompson represented the Club, and that he had written to Mr. Butt's family, conveying the sense of the loss which all felt.

In the Church, Mr Baddeley stated that the population of Moreton Valence could never have been large, and in the Middle Ages possibly amounted only to some 80 or 90 people. Records show there were 64 gallows in Gloucestershire in the year 1290, and one of them was erected at Moreton, probably just outside the church-yard. The place-name (to which De Valence was added in 14th c.) was derived from the character of bare, or marshy, land, the suffix *ton* indicating the usual enclosure, or farm. The road from Bristol to Gloucester was an ancient one developed from a track of Romano-British times, and near this Moreton Valence became established. The moated mound (as at Haresfield) gave rise to the questions : Why adopt the, in this county, not frequent method of strengthening the position of a mansion house by a moat ? Was this moat a necessary increase of protection, perhaps, owing to the propinquity of the Severn-raiding Danes ? The Church from the 12th century onward formed the endowment of a prebend in Hereford Cathedral, showing clearly that Milo, Earl of Hereford, and his De Bohun descendants—who also held extensive other lands near by—were the part-owners in descent from Durandus the Sheriff. On the mound before them they had owned a castellated mansion, the foundations of which are doubtless there still. In the *Inquisitiones ad quod damnum* the owners of Moreton Valence were asked by what right they used a gallows and whipping-post ? They answered by the right granted to their predecessors. In 1246 the manor descended (by marriage) to William de Pont-l'arche, who became suddenly outlawed for either felony or treason. His forfeited lands fell to the Crown, which in turn bestowed them upon William de Valence, half-brother to Henry III. His widow, Joan (De Monchensi) resided here on her journeys from Goodrich to London. She was here in June, 1297, with a suite of 16 people, and went on to Painswick and Cirencester. Pont-l'arche

had married a daughter of De Bohun. The Church (of Norman middle period) was no doubt built in the reign of Stephen or Henry I.

The Norman method of dressing the stones diagonally is here well in evidence. The Church originally comprised a Norman nave of two bays, a north door, and probably a south Norman door. The two members and abacus of the main chancel-arch had been cut into in order to receive a wooden screen in pre-Reformation days. There are traces of colour on the stone work, which point to vanished mural drawings. Numerous interesting masons' marks can be seen on the east wall: the stones bearing them were probably originally used inside the Church. An important feature of the Church is the Norman inscription (as at Clapton) on the Abacus (south) of the chancel-arch, which proves to be the re-dedication of the Church to St. Stephen. With much pains Mr Baddeley has succeeded in reading most of the inscription, which, through his kindness, is here for the first time printed so fully.

(1) (Ista. Basi) Lica. Fuit. Dedicata.
(2) (Nomine. Domini. n (ost)ri. Iesu. Christi. et. in. Honorem.
(3) (Beatæ. Mariæ. Vir)ginis. et. Ssancti. Stephani. Proto (Martyris).
(4) ? (et) ? Dedicare.
(5) ? Diepa . . ys.

The Tympanum in the north porch is described by Mr C. E. Keyser[1] as follows :—

"St. Michael has the nimbus and outspread wings, flowing robe carried down to his feet, long spear in his right hand, pressed into the open jaws of the dragon, and a large circular shield in his left hand. The dragon seems to be endeavouring to escape to a wood, represented by foliage on the right, but has its head turned back towards the archangel, behind whom are several figures, probably intended for rescued souls."

The porch shows evidence of having been used as a fortified chamber at some time in its history. On the south side of the Church are three examples of 'scratch' or 'mass-marking' dials, so frequently met with on Churches in this and other counties.[2] Such dials (usually made by the Priest) were set for nine o'clock.

While in the churchyard the President took occasion to exhibit (for the Ethnologists) a fine specimen of a Chellean paleolith[3] found in the gravel-pit in Upton Lane, near Barnwood, which is of especial interest as being possibly the first found in the county. He also read notes[4] of other finds at Barnwood. After walking over the moated-mound, and discussing the probability of discovering the ground-plan of the castellated mansion of the De Valences and their Talbot successors mentioned by the President, Members returned to the launch and journeyed back to Gloucester.

1 *Memorials of Old Gloucestershire* (1911). Also illustrated in the same writer's *Norman Tympana* (1904).

2 Dom Ethelbert Horne has published (Taunton, Barnicott and Pearce. 1917) an interesting work on *Primitive Sun Dials or Scratch Dials*, which contains illustrations of Dials at Daglingworth and Saintbury, Glos.

3 See illustrations, pp. 234, 235.

4 Printed pp. 233-235.

GLOUCESTER MEETING.

SEPTEMBER 11TH, 1917.

The last meeting of the summer took place at Gloucester, and the programme was arranged to give an opportunity of studying the Monastic life of the community in the Middle Ages. Numerous visitors pass in and out of the Cathedral Church of St. Peter's, but probably not many are able to trace the precincts of the great Abbey which was once here, and therefore the guidance of Mr F. W. Waller, Architect to the Dean and Chapter, for this purpose, was much appreciated. The Members who assembled in College Green or who joined the party later were :—

The President, H. W. Bruton, C. A. Crane, Dr. R. M. Cole, F. J. Cullis, J. M. Collett, A. E. Hurry, T. S. Ellis, G. Embrey, J. W. Gray, J. N. Hobbs, J. H. Jones, J. M. Dixon, E. Lawrence, Rev. H. Moxon, J. F. Muir, F. J. Mylius, Dr. Prevost, F. W. Duart-Smith, A. E. Smith, C. Upton, F. W. Waller, W. Washbourne, Roland Austin, Colonel Duke, Ernest Hartland, F. H. Bretherton, Rev. J. J. D. Cooke, and they were accompanied by several visitors.

Before commencing their perambulation, Mr Waller invited Members into his office, where he had arranged a series of drawings and photographs, by means of which he explained the position of the original walls which bounded and enclosed the precincts of St. Peter's Abbey. Of the four gateways that formerly gave access to the grounds only two remained : King Edward's gateway at the entrance to College Court, and St. Mary's Gateway leading to St. Mary's-square. The latter was a 13th century structure, and possessed great interest, and was one which they were now endeavouring to preserve. Mr Waller emphasised the importance of a good water supply to such an institution, and how the site of an Abbey was determined by the proximity of such water. In the case of St. Peter's the stream coming by Northgate westward was diverted into four ducts. In College-street, the course of King Edward's Lane was still marked by the entrance to the back of the Palladium on one side of the street to Messrs. Healey's Garage on the other. Proceeding to the Cathedral Gardens, Mr Waller said that just inside the gates was the division between the two cemeteries, that of the monks and that of the citizens. The Cathedral Green was full of graves, one being found only three feet beneath the surface, and in another place bodies were found three deep, buried in woollen, there being no trace of decayed woodwork, iron, or brass. Remains had also been found under many of the houses surrounding the Green. The passage under the Lady Chapel was made to connect the two sides of the building, as the boundary wall stood at the end of the Chapel before the ground further east was acquired.

By the Infirmary arches, the President, (who attributed the Gateway and its adjoining line of houses now under repair, to the Guest-accommodation of the Abbey), gave a detailed account of this set of buildings, as they once stood, saying they were built in Henry III.'s reign, and accommodated the old and invalid monks of the convent. Outside patients

were sometimes admitted here. They had their own dining-hall and chaplain. It was here that the monks were removed to recover from their bleedings, which took place twice a year, it being sometimes three or four days before they were fit to take up their ordinary duties again. The Little Cloisters were really the former Infirmary garden. The small house adjoining was once used, among other purposes, for preparing "simples" and the mixing of potions. A few minutes spent in Pitt-street gave Mr Baddeley an opportunity of showing what was left of the Abbot's Palace, which had been replaced by the present Bishop's Palace some 50 or 60 years ago. In the Palace Yard, which Mr Waller said used to be called Miller's Green, were formerly the mill and workshops of the Monastery, and the water there used had been turned to good purpose long before by the neighbouring monks of St. Oswald's Priory. Passing into the Green again, Mr Waller said there was a time when he thought all monastic masonry was good, but since he had been excavating the foundations of St. Mary's Gateway, or the Broad Gate, as it was once called, he had altered his opinion. He had had prepared a specimen of the foundation re-formed in order to show its faulty construction.

The room over the Gateway, once the living chamber of the Constable of the Green, was visited, and Mr Waller's graphic description of the ruinous condition in which he found the structure was certainly not exaggerated. This is now in course of very careful restoration by Mr Waller, who has, incidentally, been able to reveal some most interesting features of the building—one, a fine Tudor fire-place.

In the Cloisters, Mr Baddeley said in most monasteries the cloisters were situated on the south, but at Gloucester, Cirencester, and Tintern, they were found on the north side, a site determined by the local water supply. The monks' lavatory and the connecting drains, remains of which still exist in the Garth, were described, and also the characteristics of the three other cloister-alleys, and the former Refectory.

GREY FRIARS (A.D. 1230).

After lunch the members assembled at Grey Friars, where Mr Baddeley discoursed on the various later monastic houses of Gloucester, which were founded within a comparatively few years of each other, and may have given rise to the saying "As sure as God's in Gloucester." Besides the Franciscans (Grey Friars) there were the Dominicans (Black or Preaching Friars) within a few hundred yards of where they were standing; in the north, where the Cattle Market now stands, were the Carmelites (White Friars), and, at Llanthony, the Augustinians. All these distinct Houses (excepting the last) were founded in the reign of that sincerely pious but weak monarch Henry III. Monastic influence was shown by the number of abbots and priors who sat as barons in Parliament. With the Franciscans a revolutionary reaction set in. They professed humility, and were mendicants under the vow of poverty, going about barefooted, and possessing at first no painted churches or property at all, yet claiming the right to preach from any priest's pulpit. Within 45 years of its foundation, the order of St. Francis, so popular had it grown, became the richest in Europe, and a

great change came over the original idea of owning no property. The grounds of the monastery at one time extended to the present Crypt School buildings, and occupied some 1¼ acres. One reason of St. Francis' popularity was that it was believed he had the power to release a soul in purgatory once a year, and each person was under the fond delusion his might be that one. Another reason was that it was believed St. Francis was marked with the "stigmata" (the five wounds of Christ). The rival Dominicans later on (1380) made a similar useful claim in behalf of their patron, St. Catherine of Siena; and other orders followed suit. Referring once again to the water supply, Mr Baddeley said the Grey Friars at Gloucester laid a leaden pipe from a field abounding in springs at Matson so that they might be independent of the authorities at St. Peter's for their supplies.

Such remains of the original buildings as are to be seen from the outside were then inspected.

BLACK FRIARS (A.D. 1239).

Mr Baddeley said the college of Black Friars was established by Henry III. in 1239, and was one of 50 such Houses which existed in England in the 16th century. Henry III. was the proto-patron of this as of the other orders, and large gifts of oak timber were made by him to the monastery from the Forest of Dean. In the 16th century the buildings passed into the hands of Sir Thomas Bell (son of a former benefactor), and it was from the name of his wife that the adjoining Ladybellegate-street derived its name. In examining the interior of the monks' dormitory, Mr Baddeley remarked that the Dominicans in their architectural ground-plans were not so bound by tradition as were the other orders, and peculiarities in these were found, as at Gloucester, which existed in no other monastic buildings. Gloucestershire was once famous for its architectural artists, amongst the best known being John of Gloucester, who built a chief part of Westminster Abbey.

Upon inspecting the long-time so-called 'Dormitory,' Members for the first time became aware that this is a misnomer. Along each of the long-sides (N. and S.) of the room remain, in good preservation, a line of stone *scriptoria*, revealing that here must have been the work-room of the Preaching Order at Gloucester. It is consequently to be hoped that in addition to accurate measurements of the same a good photograph may be possible to obtain.[1] The interior of the house, and the undercroft, or cellars, perhaps used for the storage of provisions, were also visited.

During the meeting the President thanked Mr Waller for the trouble he had taken in making plans and the help he had rendered in other ways; and also Dr. Washbourn, Mr J. W. Bayley, Mr R. Talbot, and Mr Fred Clark for allowing them to visit their premises.

After leaving Blackfrairs, Members proceeded to Bewick House, where Mr H. W. Bruton kindly entertained them to tea, and also took a few who wished to see the little Norman chapel of St. Mary Magdalene at Wotton, which has been described by him in the *Proceedings*, vol. xvi., 221-2.

1 A plan of the remains of the Monastery, and reproductions of sketches of the exterior of the "Dormitory," and details of its windows, are given with the interesting paper on "The Friar-preachers, or Black Friars, of Gloucester," by Rev. C. F. R. Palmer, printed in *Archæological Journal* (1882), xxxix., 296-306.

Notes on the Dormitory or Scriptorium are also given in J. H. Parker's "Mediæval Houses of Gloucestershire," *Gentleman's Magazine* (1860), N.S., ix., 335-54.

SALT: ITS ORIGIN, USES AND FOLK-LORE

By W. ST. CLAIR BADDELEY

PRESIDENT

Although we have Salt-ways running through Gloucestershire, they derive their name from Anglo-Saxon workings in an adjacent county. The beds are not here. The occurrence of Salt-beds is not confined to any one geological horizon. They have, for the most part, been formed in a very simple manner: namely, by the gradual evaporation of sea-water that has become cut-off from sea-communication at various periods. Consequently, their age varies with their depth. The Spanish beds, near Montserrat, belong to the Cretaceous age; those at Salzburg to the Triassic; while those in Galicia, which have been worked continuously since A.D. 250, belong to the Tertiary. The deposits in Britain occur in the basin of the river Weaver (Co. Chester), and are there as thick as 240 feet; at Droitwich and Stoke Prior (Co. Worcester), at Fleetwood (Co. Lancs.), and at Middlesbrough and Hartlepool (Co. York). The lake of Utah and the Dead Sea are examples of inland bodies of salt-water so highly saline as to support no fish-life. Like the Aral Sea, these derive from underlying rocks and subsoils of salt, probably of immense thickness. There is a Permian bed of Salt near Berlin that is 4,200 feet in thickness. As these beds are seldom pure, but are intermingled with marls and other soils, marketable salt is largely obtained (at any rate by us), from heating brine in great pans. At a temperature of 165° common salt is formed at the surface in crystals, which there collect and sink down, leaving room for fresh formations of crystals. Presently the irregular lumps thus formed are raked out, put into moulds, then left out to drain. Later, these, in turn, are dried in gentle stoves, and

placed in store. Much, however, of the Spanish and Italian Salt, is really only what is called ' bay-salt,' or common sea-water evaporated. Salt is a State-monopoly in both countries.

Among the various minerals in use, possibly there is none more really useful to mankind, in a good sense, than Salt. Its relationship to us would indeed seem to make it deserve a place with the more commonly-called precious metals. Perhaps it is even more precious than those, for many of them are not, as salt is considered, at all indispensable to man. Homer even calls salt ' Divine.' It has almost universal properties. It flavours ; it purifies ; it also preserves. Hence, Herrick, the Devon Poet, in his *Hesperides*, paying it great praise, in a comparison with the soul, says :—

> " The body's salt the soul is, which when gone
> The poor flesh sucks in putrefaction." (I, 394)

It was of old looked upon as a steriliser : almost an embalmer. With the ancient Jews, as with the Vestals in Rome, it was commanded to be used in all sacrifices. Elisha with it purified the Fountain at Jericho. The Bedâwî Job opens his mouth in its praise. The Greek word Ἅλς, signified the sea or ocean, which indicates to us pretty clearly the chiefest provenance of ancient salt, although our forefathers certainly utilised the brine-springs, as well as rock-salt (or saltpetre) ; but they also took advantage of the isolated inland deposits ; the result (as aforesaid) of pre-historic lakes and inland seas. Ammianus Marcellinus tells us (Lib : 28.5) that the Alamanni and Burgundii fought fiercely for the possession of salt-springs. The fact makes evident the high value those particular warrior-tribes set upon salt. But there was another source whence salt might be obtained in areas where such convenient mineral deposits were not to hand. Tacitus in his Annals, mentions that, among the Teuton tribes, water thrown on to burning timber (Pliny names *quercus optima*) produced (potash) salt. The same underlying fact is witnessed to-day ; and among certain of the Indian tribes of Brazil, Spruce (ii. 447) tells us that the ashes of the drum-tree (*Cecropia peltata*) are saline and antiseptic. Wallace, likewise, says that from the fruit of the *Inaja* palm and the *jara*

palm a saline flour is extracted. He further suggests that the excessive use of peppers by certain Amazonian Indians may be due to lack of salt. This lack is in some lands the known cause of migrations. The salt in human blood (it has been suggested) may be one cause of the attraction of anthropophagy. According to Pliny, the uses of salt were, in his day, already exceedingly various; in both medicine and in food. He alludes to bricks made of it which were imported from Cappadocia. This reminds us that in the early eighteenth century tablets of salt still passed round as currency in certain of the Southern States of India. Herodotus knew of the Saharan rock-salt and its employment for building purposes. At Gerra, in Arabia, Pliny relates that both houses and towers were built of squared blocks of salt. The story of Lot's wife and her cruel supposed doom for mere curiosity seems to hand on a geological story. We have a similar one at Hammam-Meskoutin, in Algeria.

Salt, nevertheless, is not considered absolutely essential to daily life by a good many primitive tribes. The North American Indian eats meat rarely, and but little salt. Certain of the South African Namaqua-land (Herrero) tribes are altogether non-salt-eaters. Its needfulness may quite possibly be over-rated. We are reminded that one, Michel Tourant, died September 6th, 1734, aged 98, suffering from no infirmities of old age, of whom it was especially averred that he had never taken salt. The Egyptians (it is well-known), hated salt and the sea also. The priests of Isis were forbidden to place salt upon the Table (Plut: De Iside 32). The mediæval Devil is said to have loved no salt with his meat (Bodin).

These, however, are marked, but few, exceptions. To them is opposed the universally high estimation of salt as a source or sustainer of health. Lycophron calls salt "ἅγνιτης" —the cleanser. The Vestal priestesses of the Forum covered their sacrificial cakes with it; and these were, therefore, called '*mola salsa*,' or salted meal-cakes. The Vestals guarded the central Hearth of the Roman Goddess of Light, to whom all

Note.—On the Orinoco at Javita, the Indians incinerate the spadix and fruit of the Chimu palm-tree. In Madagascar the natives extract it from the sap of another palm.

the domestic hearths of the State were affiliated. Hence, a grain of salt flung over the shoulder into the fire propitiated the Penates or Divinities, who guarded the household store-cupboards. A grain of it was also sprinkled on every animal that was to be sacrificed to the Gods ; and the ' granum salis ' was also placed in a new-born infant's mouth. Consequently, it became, later, by borrowing, a special element in Christian baptisms (Cf. *Rituale Romanum*), and even in *"Ordeals"* (Lea 280 *supra*), and, again, in late mediæval days, witches were often accused of the deliberate misuse of salt in baptizing beasts.[1] It is obvious that the spilling of so sacred an element and a human necessity, became a prognostic of ill-fortune. Even to upset it was to offend the Divinity. Hence, Leonardo's fine use of it in his fresco of the Last Supper ; although all trace of that sellar has long vanished from that long-suffering master-piece, and only appears in the engravings. Good luck to the Tsar, as father of the Russian people, was signalised on all his arrivals at Moscow or Kieff, by offering him in the name of Holy Moscow bread and salt. Salt is here the symbol of Hospitality, therefore, as well as of Friendship. Salt (it was, and is, held) should not get into the hands of any doubtful well-wishers to a house from thence, for it is thought by certain people that this salt will at once place the household in the power of its enemies. In Ireland, before sowing a field, some propitiatory salt is put by the Kerry farmer in the ground. On the other hand, as a token of destructive and sterilizing conquest the Ancients (and also that autocratic Mediæval Pope, Boniface VIII., in imitation of his classical predecessors, in his war with the House of Colonna), sowed a furrow with salt on the ruined site of the town of Palestrina. King Philip of Spain ordered the self-made tyrant, Lope de Aguirre, in 1561, in Trinidad, to be put to death by his Viceroy in Peru : and he commanded that his houses be destroyed and their sites sown with salt, which was done. In Scotland, salt is still put into the mouth of a cow after calving, to prevent ' skaith' or ' evil.' In the Isle of Man no man will accept your proffered food unless salt is added ; nor will a woman marry, or change her

1 For baptizing a bell, oil, holy water, cream and salt are offered in naming it. In the Russian dedications of churches it is mixed with ashes and holy water. Here it represented Divine Truth. The Bishop sprinkles the various parts of the building.
It was even given to catechumens instead of the Sacrament, A.D. 307 Carthage).

house without it. In Pembrokeshire, you may supply your needing neighbour with salt, but on no account must he return it; so, you must always tell him to keep it. The supposed ill-luck of being helped to salt is averted by receiving a second help. This reverses things.

Salt is, of course, also used as a charm by disappointed Christian lovers, by throwing it into the fire on three successive Fridays.

> It is not this salt I wish to burn;
> It is my lover's heart to turn,
> That he may not rest nor happy be
> Until he comes and speaks to me!

Here, it may be propitiatory of the Symbolic, or sacred, flame of Love.

In the earliest stories of Rome we hear of great gifts of salt being made to the Roman people by King Ancus Martius. 'The sun and the salt' was a Roman proverbial saying. Hence, the origin of the Via Salaria, or Salt-way, and the city gate called Porta Salaria even till to-day. There was in early days a certain allowance of salt given all officers and soldiers in Rome. This became in time converted into a money allowance. From this, we obtained the term 'salary.' The Roman trade in salt became a State-monoply, even as early as the Decemvirate; and it is a monopoly (together with tobacco) there in Italy, to-day: 'Sale e tabacchi.' *Salerno*, near by, took its name from the river, *Sàle*, meaning salt. I have seen a boatman arrested by the police, at Amalfi, near by, and another, in Sicily, for soaking his clothes in sea-water and drying them in the sun so as to get the salt crust from them, and thus evade '*custom*.' In the Middle Ages, Venice was a great provider of salt. We read of caravans numbering annually 40,000 horse, employed between Austria, Hungary, and Germany for fetching away her salt.

It is thus easy to understand how it came to pass that the Roman family salt-cellar,[1] like our own, was usually of silver,

1 The word 'salt-cellar' is an anomaly. '*Cellar*' is merely a corruption of Fr. *Salieri*, a 'salt-seller,' Italian *Saliera*. It is equivalent to salt—salt-holder!! The spelling with *c* is quite modern. (*cf.* Skeat. Etym. Dict.)

Most of the 'salts' were ornamental only. A smaller salt, called a 'Trencher,' was actually used. Sometimes the cellar was made like a chariot on wheels, and some cellars were fashioned like silver dogs.

and it descended religiously from father to son. The poorer folk used only a shell. This cellar was sometimes of terra-cotta. It was placed in the middle of the table, to which, if itself, it gave a sacred character. 'Splendet in mensa' says Horace, 'paternum salinum.' Od. 2. 16. 13. In mediæval times it remained a well-known mark of caste. Edward III. once lost a fine silver one engraved with apes and birds. Pennant relates of Wales that a certain tune called Gosteg-yr-Halen, or the Salt-prelude,' was always played when, in the story of King Arthur, the salt-cellar was placed before the Knights of the Round Table. As containing salt it was regarded as the sacred symbol of sworn friendship.

The Saxon 'Salt-ways' of England lasted as such from the eighth down to the eighteenth century: at least one ran through Gloucestershire[1] from Droitwich as far as the Thames at Lechlade. The salt could not be produced in most inland villages, and therefore its supply became a very profitable industry; so that the salter ranked high among traders, the numerous monasteries becoming his chief customers. There were few root crops in those Middle Ages, consequently towards winter the herds had to be turned into stored meat, and the value of salt was paramount.[2] The Salt-hill of Eton gave rise to the now abolished festival of 'Montem.' (*Gent. Magazine*, 1799, pt. 2, p. 1026). Many streams and towns all over the world (as might be surmised) are named from the presence of salt, In the Argentine, one of the loveliest provinces in all South America is called Salta; and the Rio Salado flows beneficently through it. Salzburg in Austria is on the Salzach river, and is famous for its salt-mines. Halle in Saxony is on another river Saale: and the name Halle is here probably of the same root as the Welsh Halen, or Helli, and Greek Ἅλς. In Painswick manor the Saltbox stood near Shepscombe and Ebworth, on the salt-ridge, where once was kept, no doubt, the supply of salt for distribution in that great manor with its deer-park and farms; and to provide for the November-saltings of meat.

The fondness of deer for Salt is illustrated by an incident within my own experience. At Wissen Park (John

1 Salperton is on it.
2 After the Black Death, salt doubled and trebled its price.

Goring, Esq.), Sussex (near Steyning), after violent gales, brine is sometimes deposited quite thickly upon the old windows. In the early eighties (April, 1882), after a famous south-western storm, the deer got at the lower window-panes of the house, and while licking them, smashed many of them in with their horns. In consequence of this, a preventive wall had to be built. A curious story was told to my brother, Mr John Baddeley, by a game-keeper in Russia of the Lynx, which is not a rare animal there, even near the great cities. The wild deer are so irresistibly attracted by salt that they sometimes discover in the snow the spot where the lynx has discharged water. No sooner are they engaged with this, to them, satisfactory find, than the wily and fierce animal drops from an over-hanging tree upon his victim and finishes him off. A mixture of salt, mortar, and carraway-seed is found to be very attractive to most wild birds. This fact was known in former days, for there is an Act forbidding the putting down of rock-salt in order to attract a neighbour's birds, particularly his pigeons.

A curious use of salt comes from Borneo, namely, as a judgment. Each Dyak litigant is given a lump of salt, and at a given signal both drop their lumps into water. He whose lump dissolves quickest is adjudged the loser.

Livy and the Kaiser call the Greeks '*Sal Gentium:*' or 'Salt of the Earth.' Mr Lloyd George formerly called the South-Wales miners by the same flattering phrase. Christ, of course, used the same term: '*Vos estis sal terræ.*' St. Jerome, four centuries later, flatteringly applied this phrase to the Bishops of the Church.

This makes one consider how it is that a grain of salt should be used proverbially as applied to a somewhat exaggerated, though not necessarily witty, story. In this case, I think, the grain of salt may have reference to the ritual use of salt as a propitiation to the Gods, for having stretched the Truth. The phrase 'Attic salt' referred merely to flavour, or wittiness. The Attic variety was held to be less bitter than other salt. In Latin, I remind myself, 'dicere aliquid salse' is to speak shrewdly, or wittily, and not too long! And, with your leave, I will close here this mere sketch of a rather too-much-neglected subject.

RUBUS IN GLOUCESTERSHIRE

BY

REV. H. J. RIDDELSDELL

This list is printed for a particular purpose. It looks not so much to the past, as to the future. It does, indeed, embody certain results of long, strenuous, critical work already done : but its chief purpose is to ask for more, and to ask for it in the most useful way. In other words, it forms a first and typical instalment of the Preliminary List of Gloucestershire Flowering Plants. For the Preliminary List is to do for the whole of the flowering plants of the county what this present list does for one genus only. Judge the whole from the part ! The purpose of the P.L. is to serve as an encouragement and help to those who have leisure and ability to procure further information about the County Flora. It should encourage, for it will indicate how much has already been done. And it should help, and that in the best possible way, by showing exactly in *what parts of the County* further work is needed. And this not only with regard to *general* botanical research, for it indicates the gaps that exist in the records of each individual species and variety. Let us take the very first instance in the list now printed, *viz.*, the common Raspberry, *Rubus idæus* L. It is difficult to believe that it does not grow elsewhere in district 3, where much ground favourable to brambles exists ; or in the south part of district 6 ; or more frequently in 7b. In such places it should be looked for, and the records put down, and sent to the Editor.

This *Rubus* list is only a sample, indeed ; other genera are equally ready—*e.g.*, all up to *Violaceæ*—but it will be well to keep them back until the *whole* Preliminary List is ready. The latter, when printed, will have a blank page opposite each

page of print, for convenience of record, correction, and comment, and in the case of genera less critical than *Rubus*, questions will be suggested, in order to aid research.

This special class of plants—the Blackberries, etc.—was chosen for first publication, on several grounds. It has been worked at steadily and perseveringly by several first-class specialists, especially the Rev. A. Ley, the Rev. W. Moyle Rogers (who is the one safe English referee on the subject), Mr Shoolbred, and Mr J. W. White (the author of the "Flora of the Bristol Coalfield") as well as by other botanists less expert in the genus : and the results, though far from complete (and how can botanical records over such a large area ever be complete ?) are tolerably certain and undisputed, chiefly owing to the enormous advantage of Mr Rogers's great knowledge being at our disposal. Thus, though to any but a keen worker, the list looks terribly dry—for it is a mere statement of localities—yet even to the uninitiated it bears with it much hope and encouragement. It will also be plainly indicated by the list now published which are the most hopeful kinds of ground, and the most encouraging localities, to examine for further records of *Rubus*. The Forest of Dean is second to none ; the high ground of Tidenham Chase, the flat tops and the slopes of wooded Cotteswold Hills, such as Cooper's Hill and Haresfield Hill, must have further treasures to yield to a determined search.

But, of course, when all is said and done, *Rubus* remains a very special study ; specimens need careful collection and drying and annotating ; and it is unlikely that many general botanists will attempt to go far in it themselves. But, if a beginner may speak, it is by no means difficult to get a good initiation into it, provided one goes armed with a good pair of scissors, a fair pocket-lens, Mr Rogers's Handbook, and a zeal which scorns scratches.

Two things remain to be said. The first is that the numbers, 33 and 34, which (one or both) appear here after the Latin name of a plant, refer respectively to the (conventional) East and West divisions of the County. The divisions are separated by the Stroudwater Canal as far as Framilode, and

then by the Severn to Tewkesbury. The *districts*, however, into which the county is divided for the purposes of the Flora, are indicated by the numbers 1, 2a, 2b, 3 to 6, 7a, 7b. These numbers appear among the actual localities, e.g., *R. idæus* occurs in district 1, on Westington Hill, &c.: in 2a at Knoll Hill, &c.

The other is this. The P.L., of which the following is only a first instalment, is *not* the ideal on which the completed County Flora will be framed. Its true purpose has already been set forth. If an ideal for the County Flora is to be looked for among actualities, the uninitiated should consult Mr White's "Bristol Flora," a book which combines scientific knowledge, literary taste, and human interest in a degree which excites at once admiration and envy.

THE LIST

436.[1] **R. idæus,** L. 33, 34.
1. Westington Hill; Racecourse, Northwick. 2a. Knoll Hill, etc., Cheltenham. 3. Dymock, Flaxley Abbey. 4. Woodland, generally. 5. Rather common and well-distributed. 6. Well-distributed and fairly frequent N. of the Canal. Little known S. of it. 7a. Many records from N. and E. of the district: few elsewhere. 7b. Six scattered localities.

437. **R. fissus,** Lindl. 34.
4. F. of Dean, seven spots in woods on coal measures. Also Tidenham and the Chase; Hewelsfield: Lydney.

438. **R. suberectus,** Anderss. 34.
[1. ? Campden.] 4. St. Briavels; Lindors; Tidenham.

441. **R. plicatus,** Wh. and N. 34.
4. Scattered: Mitcheldean Meend, Foxes Bridge; Bigsweir, two spots on Tidenham Chase. 5. Wyck Valley, two bushes.

b. var: **Bertramii,** G. Braun, 34.
4. Foxes Bridge.

c. var: **hemistemon** (Genev. ?). 34.
4. Weak *f.*, Blackpool Bridge, Staple Edge Wood.

1 These Nos., which precede the specific names, are those of the London Catalogue, Ed: X.

442. **R. nitidus,** Wh. and N. 34.
4. Mitcheldean Meend, *f.*
b. var : **opacus** (Focke). 34. ?
3. Apparently this in woods near Shaw Common.

443. **R. affinis,** Wh. and N. 34.
4. Tutshill ; much in Tidenham Chase Woods.
5. Two or three spots close to Bristol.

448. **R. imbricatus,** Hort. 34.
4. Mitcheldean. Mostly by R. Wye ; Coldwell, English Bicknor, Symond's Yat, Redbrook. 5. Frequent in one narrowish strip of country (on the pennant sand-stone) running N.E. of Bristol from Stapleton to Wickwar : about = Valley of the Frome. Also Clifton Down, *f.*

450. **R. carpinifolius,** Wh. and N. 34.
4. Mitcheldean Meend ; Whitecroft and Sudeley uncertain : Cinderford, Blackpool, Ruspidge. Hudnalls ; Tidenham Chase.
? × **Marshalli.** 4. Stempis.

451. **R. incurvatus,** Bab. 33, 34 ?
7a. Heath near Four Shire Stone : with var : **subcarpinifolius,** *Rogers MS.* 6 or 7b. Cherrington, possibly.

452. **R. Lindleianus,** Lees. 33, 34.
3. May Hill, Newent. 4. F. Dean, common on the coal measures. Also Lydney ; Tidenham Chase and Wye Cliffs, Tutshill. 5. Frequent, but unevenly distributed. 7a. Nottingham Hill : Todenham. 7b. Near Charlton Kings.
× **rhamnifolius.** Clifton Down.

453. **R. argenteus,** Wh. and N. 34.
3. Newent Wood. 4. Woods, etc., near the Wye. Coleford, Redbrook, Hudnalls, Tidenham Chase. Also Lydney to Blakeney. 5. Abundant in the S. part of the district.

455. **R. rhamnifolius,** Wh. and N. 33, 34.
1. Campden, probably. 2a. Oxenton Hill and Wormington ' Scrubs ' ; Churchdown. 2b. Arlingham. 3. Clifford's Mesne, May Hill, Newent to Dymock.

4. Common on Coal measures of F. Dean. Lancaut, Tidenham Chase, Hudnalls, Symond's Yat. Lydney. 5. Frequent and well-distributed: up to Wotton-under-Edge. Shepherdine and Hill. 6. Woodchester, Cam Peak. 7a. Not uncommon on Cotteswolds. Several places in the West. Guiting Power: Bourton to Moreton, several spots: Todenham. 7b. Lineover Wood; Cirencester Road, Cheltenham.

b. var: **Bakeri** (F. A. Lees). 33, 34.
4. Speech House. 7a. Todenham.

456. **R. nemoralis,** P. J. Muell. 33, 34.
4. Mitcheldean Meend. ? Ruspidge. ? Tidenham. 7a. Four Shire Stone and Todenham, much.

b. var: **glabratus,** Bab. 33, 34.
4. Tidenham. 7b. Lineover Wood, not quite typical.

c. var: **Silurum,** Ley. 34.
4. Mitcheldean Meend. Drybrook to Mitcheldean.

457. **R. Scheutzii,** Lindeb. 34 ?
4. Apparently this, Ruspidge.

458. **R. dumnoniensis,** Bab. 33 ?, 34.
5. Yate Common, plenty; and near. 7a. ? this at Four Shire Stone, going off to **rhamnifolius.**

459. **R. pulcherrimus,** Neum. 33, 34.
4. Fairly common in F. Dean: also Hudnalls, Tidenham Chase. 5. Clifton Down: many places in Frome Valley: Sodbury Common: Milbury Heath. 7a. Plenty, Four Shire Stone and Todenham.

460. **R. Lindebergii,** P. J. Muell. 34.
4. Mitcheldean Meend.

462b. **R. mercicus,** Bagn., var: **bracteatus,** Bagn. 34.
5. Mangotsfield.

463. **R. villicaulis,** Koehl. 33, ? 34.
5. Stapleton and Bury Hill (not quite certain.
7b. Pegglesworth Hill.

464. **R. Selmeri,** Lindeb. 34 ?
4. Whitecroft, doubtful.

465. **R. rhombifolius,** Weihe. 34.
4. Mitcheldean Meend, at 1000 ft.

466. **R. gratus,** Focke. 34.
4. Plenty about Mitcheldean Meend.

b. var : **sciaphilus,** Lange ? 34.
5. Kingsweston.

467. **R. leucandrus,** Focke. 34.
3. Plenty on May Hill : Newent Wd. : Flaxley Abbey.
4. Five places on the coal measures of F. Dean. Tidenham Chase. St. Briavels.

468. **R. ramosus,** Briggs. 34 ?
4. Lancaut, apparently.

469. **R. thyrsoideus** Wimm. 33, 34. Characteristic of the oolite.
1. Welford Hill, plenty. 6. Woodchester Park. 7a. Seven Springs, Windrush, Ford, Stow to Moreton, Farmcote to Northleach, Guiting Grange.
7b. Eastleach : near Birdlip.

470. **R. Godroni,** Lecoq. and Lam. 33, 34.
3. Clifford's Mesne and May Hill, plenty, *f.* 4. About Ruardean, near Ruspidge, Mitcheldean Meend. Tidenham and the Chase. 6. Wood near Selsley Hill, Stroud. 7a. Bourton Downs, *f.* Guiting Wd. ; thence to Farmcote : thence to Hailes.

? × **angustifolius**. 34.
4. Hewelsfield.

c. var : **robustus** (P. J. Muell). 33, 34.
3. May Hill. 4. St. Briavels. 5. Winterbourne Down : Damery Bridge and thence to Charfield. 7a. Near Guiting Wood ; Hailes to Farmcote.

d. var : **clivicola,** Ley. 33, 34.
3. Clifford's Mesne and May Hill, scarce. Longhope : Flaxley Valley. 7b. Birdlip : Withington to Colesborne.

471. **R. rusticanus** Merc. 33, 34.
No doubt common over all the county : but records wanted from district 1, S. half of 2a, all 2b, all except N. and W. borders of 3. Many hybrids occur. The following may be named here :—

× **corylifolius.** 33, 34.
5. Near Wyck Rocks. 7a. Bourton-on-Water to Westcote.

× **hirtifolius** ? 34.
4. St. Anthony's Well, Cinderford.

× **pyramidalis ?** 34.
5. Ivory Hill, abundant.

f. **leucocarpus.** 34.
5. Downend.

472. **R. pubescens,** Weihe. 33, 34.
4. Clifford's Mesne, apparently. Yew Tree Brake. 7a. Hailes to Farmcote, off type.

b. var : **subinermis,** Rogers. 34.
3. Clifford's Mesne. 4. Lea Bailey, Ruardean, Ruspidge, Yew Tree Brake, Mitcheldean Meend. St. Briavels.

473. **R. silvaticus,** Wh. and N. 34.
4. Lydbrook.

474b. **R. myricæ,** Focke, var : **hesperius,** Rogers . 34.
4. Near St. Briavels.

475. **R. lentiginosus,** Lees. 34.
3. Clifford's Mesne and May Hill. 4. Parkend, Lydney, Cinderford. ? Tidenham Chase.

476. **R. macrophyllus,** Wh. and N. 34.
4. Bigsweir : Gatcombe Wd., Blakeney. 5. Clifton Down : Rangeworthy. 6. Woodchester Park.

b. var : **Schlechtendalii** (Weihe). 33, 34.
3. Newent to Taynton. 4. Ruspidge, Staple Edge Wd., Crabtree Hill, near Mitcheldean. 6. Near Box, Minchinhampton. 7a. Todenham ; Wyck Wd. Hailes to Farmcote, Ford, and Lower Guiting to Lower Swell.

× **rusticanus ?**
4. Gatcombe Wood, Blakeney.

c. var : **macrophylloides** (Genev.) 34.
4. St. Briavels ; Tidenham Chase.

d. var : **amplificatus** (Lees). 33, 34.
4. Tidenham Chase, Brockweir, Lydney to Blakeney. 7a. Oddington.

479. **R. Salteri,** Bab. 34.
4. Tidenham Chase, Hewelsfield.

480. **R. Colemanni,** Bab. 34.
4. Mitcheldean Meend ; Danby Lodge ; Blackpool Bridge, Staple Edge Wood.

481. **R. Sprengelii,** Weihe. 34.
4. Locally abundant in F. Dean, on the coal measures. 5. Yate Common.

482. **R. orthoclados,** Ley. 34.
4. Mitcheldean Meend.

× **gratus.** 34.
4. Mitcheldean.

483. **R. hypoleucus,** Lefv. and Muell. 33, 34.
4. Near Cinderford. 5. Clifton Down. 7a. Hailes.

484. **R. hirtifolius,** Muell. and Wirtg. 34.
3. May Hill : Newent to Dymock. 4. Mitcheldean Meend, plenty : Serridge : Tidenham Chase. 5. Stapleton.
c. var : **mollissimus** (Rogers). 33, 34.
3. May Hill. 4. Lydney? Lancaut. 6. Cooper's Hill.

485. **R. iricus,** Rogers. 34.
4. Plenty in woods, Tidenham Chase.

486. **R. pyramidalis,** Kalt. 33, 34.
4. Mitcheldean Meend ; Ruardean : Lydney : Lancaut : Tidenham Chase ; St. Briavels. 5. Six localities in "Bristol Flora" district. 7a. Sezincote Warren ; Ford ; Hailes ; Dowdeswell Wd. 7b. Lineover Wood.

487. **R. leucostachys,** Sm. 33, 34.
Abundant generally in Gloucestershire, but no records from district 1 ; very few from 2a and 2b ; in 3, only for a line across from May Hill to Bromsberrow ; in 7b, only scattered records.

× **rusticanus.** 33, 34.
2b. Arlingham. 4. Tidenham Chase, Lancaut, Lydney. 5. Kingswood Hill, Wyck Valley, Sneyd Park, Ivory Hill. 6. Minchinhampton Common; Amberley. 7a. Longboro.

× **pyramidalis.** 34.
4. Danby Lodge: Mitcheldean.

× **infecundus.** 34.
4. Lea Bailey.

b. var: **gymnostachys** (Genev.) 34.
5. Rodway Hill.

c. var: **leucanthemus,** P. J. Muell? 34.
4. Tidenham Chase, perhaps: Coldwell Rocks: Mitcheldean Meend.

488. **R. lasioclados,** Focke. 34.
4. Lydney. 6. Minchinhampton Common.

b. var: **angustifolius,** Rogers. 34.
3. Clifford's Mesne; May Hill. 4. Seven spots on the coal measures of F. Dean. St. Briavels: Tidenham Chase: Lancaut. 5. Clifton: near Winterbourne.

489. **R. criniger,** Linton. 34.
4. Symond's Yat.

492. **R. Boræanus,** Genev. 34.
4. St. Briavel's.

493. **R. cinerosus,** Rogers. 34.
4. Tidenham Chase.

494. **R. mucronatus,** Blox. 34.
5. In the Frome and Avon valleys, near Bristol.

496. **R. Gelertii,** Frider. 33, 34.
4. Clifford's Mesne. 7a. Longboro.

497. **R. anglosaxonicus,** Gelert. 34.
5. Hanham, *f.*

b. var: **curvidens,** Ley. 33, 34.
4. Bream to Lydney. 7a. Near Ford.

c. var : **vestitiformis,** Rogers. 33, 34.
4. Mitcheldean : Serridge. 7a. Hailes to Guiting Wd. ; near Bourton on Water : Wyck Wd. 7b. Very glandular *f.* on Birdlip.

d. var : **raduloides,** Rogers. 33, 34.
5. Westbury : Clifton Down : Hanham : Henbury : Kings Weston : Sneyd Park : Downend : Frenchay : Leap Bridge. 7a. Horns Leazor, Snowshill : Stanway to Snowshill.

e. var : **setulosus,** Rogers. 34.
3. May Hill. 4. Abundant in F. Dean, especially near Lydney. Woods by the Wye. 5. By Avon, Bristol. 6. Cherrington to Avening.

499. **R. infestus,** Weihe. 34.
4. Whitecroft, with ? × **rusticanus.**

500. **R. uncinatus,** P. J. Muell. 34.
4. Lea Bailey ; Foxes Bridge ; Serridge : Stempis Pool.

501. **R. Borreri,** Bell-Salt. 34.
3. Edge of Newent Wood : May Hill. 4. Mitcheldean Meend : Tidenham Chase. 5. Mangotsfield.

502. **R. Drejeri,** G. Jensen. 34.
5. Durdham Down.

b. var : **Leyanus,** Rogers. 34.
4. Tidenham Chase : Danby Lodge : near Mitcheldean.
5. Damery Bridge : Sea Mills, Clifton : Cromhall.

503. **R. radula,** Weihe. 33..
7a. Hailes ; near Horns Leazor, Snowshill : Ling Ground, Taddington. Two or three places near Cheltenham.

c. var : **echinatoides,** Rogers. 33, 34.
5. Stinchcombe Hill.
7a. *f* in wood at Todenham.

504. **R. echinatus,** Lindl. 33, 34.
'Generally distributed in the County,' but no records from 1, only four from 2, two from 3 ; ' not common '

in F. Dean: rather common in 5: one record from 6: frequent in 7a: three records from 7b.

505. **R. rudis,** Wh. and N. 33, 34.
3. Shaw Common, Flaxley Abbey. 4. Symond's Yat, Parkend, St. Briavel's. 5. Westridge Wood, Wotton-under-Edge: frequent about Stinchcombe Hill. 6. Uley: woods near Dursley. 7a. Near Cheltenham. 7b. Cirencester Park.

506. **R. oigoclados,** Muell. and Lefv. 34.
4. Redbrook, *f.*: Lydney: Cinderford, Sudeley Bridge, Blackpool. Near Speech House Rd. Station: between Coleford and Symonds Yat. 5. Kingswood, *f.*

b. var: **Newbouldii,** Rogers. 34.
4. Mitcheldean Meend.

507. **R. regillus,** Ley. 34.
3. Queen's Wood, Gorsley: Haywood.

508. **R. podophyllus,** P. J. Muell. 34.
4. Between Drybrook and Mitcheldean. 5. *f.* Durdham Down.

509. **R. Griffithianus,** Rogers. ? 34.
4. ? this on Mitcheldean Meend.

511. **R. melanodermis,** Focke. 34.
4. Buckstone near Staunton.

512. **R. Babingtonii,** Bell-Salt. 34.
3. Newent Wood. 6. Woodchester.

515. **R. cavatifolius,** P. J. Muell. 34.
3. Newent Wood. Flaxley Wood. 4. St. Briavels.

518. **R. fuscus,** Wh. and N. 33, 34.
4. Abundant in F. Dean, 'where it takes the place of **R. leucostachys.'** 5. Sneyd Park. 6. Buckholt Wd., Cranham: Cooper's Hill. 7a. Barrington Bushes: Todenham: Wolford Heath.

c. var: **macrostachys,** P. J. Muell. 33, 34.
4. Ruspidge, Mitcheldean Meend, Ruardean, Speech House Road. 6. Cranham.

d. var : **obscurus,** (Kalt). 34.
4. Lower Redbrook : Newnham to Upper Soudley.

519. **R. pallidus,** Wh. & N. 34.
4. St. Briavel's ; Lydney : Staple Edge Wood ; Cinder ford.

b. var : **leptopetalus,** Rogers. 34.
3. Clifford's Mesne, May Hill, Newent Woods.
4. Abundant in Forest of Dean.

520. **R. scaber,** Wh. and N. 33, 34.
4. Woods by the Wye : several places in F. Dean.
6. Woodchester Park : Slad Valley.

scaber × **setulosus.** 4. Woods opposite Tintern.

523. **R. longithyrsiger,** Bab. 34.
3. Kempley. 4. Tutshill : Symond's Yat.

524. **R. botryeros,** Focke. 33.
6. Cooper's Hill.

525. **R. foliosus,** Wh. and N. 33, 34.
3. Abundant in Woods between Newent and Dymock.
4. Ruardean : Symond's Yat, Brockweir ; Woolaston. Frequent in F. Dean. Eglandalar *f.* on Tidenham Chase. 6. Woods near Minchinhampton.
7a. Dowdeswell Wood.

foliosus × **infecundus.** 4. Wood opposite Tintern.

526. **R. rosaceus,** Wh. and N. 33, 34.
4. Tidenham ; Whitecroft, *f.* near **Powellii.**
7b. Redwood.

b. var : **hystrix** (Wh. and N.) 34.
4. Lea Bailey ; Cinderford ; Milkwall. 5. Stapleton : Wyck. 6. Woodchester Park.

c. var : **infecundus,** Rogers. 33, 34.
3. Pauntley ; May Hill ; Newent. 4. Common in F. Dean and all div. 4. 5. Locally plentiful and well distributed. 6. Gatcombe Wood : Nailsworth : Cranham : Haresfield Hill. 7a. Guiting ; Toddington : Hailes : Stanway Hill : Nottingham Hill. 7b. Lineover and other woods. Rodmarton, Coates, etc.

d. var : **Purchasianus,** Rogers. 34.
3. May Hill. 4. Abundant in N. part of F. Dean. Hewelsfield, Tidenham Chase, Lydney.

e. var : **adornatus,** (P. J. Muell.) 34.
3. Clifford's Mesne ; May Hill ; Newent Woods. 4. Near Mitcheldean. 5. Kingsweston : Sneyd Park.

528. **R. hostilis,** Muell. and Wirtg. 33, 34.
4. Near Lydbrook. 7a. Todenham, much.

529. **R. fusco-ater,** Weihe. ? 34.
4. F. Dean—*fide* T. R. Archer-Briggs, but not seen by Mr Rogers from No. 34.

530. **R. Koehleri,** Wh. and N. 33, 34.
4. Lea Bailey. 5. Wyck ; Frome Valley ; Sneyd Park. 7. Dowdeswell.

531. **R. dasyphyllus,** Rogers. 33, 34.
2a. Cheltenham ; Wormington. 2b. Arlingham. 3. ? Longhope. 4. Common in F. Dean, and in woods by the Wye. 5, 6 and 7a. Rather common. 7b. Leckhampton : Lincover and Chatcombe Woods.

532. **R. plinthostylus,** Genev. 33, 34.
4. Woods opposite Tintern : opposite Chepstow. 7a. *f.*, Stanway to Snowshill.

533. **R. Marshalli.** Focke and Rogers. 33, 34.
4. Plenty in N. part of F. Dean. 6. Haresfield Hill : Cranham : Cooper's Hill.

534. **R. viridis,** Kalt. 34.
4. St. Briavels ; Foxes Bridge ; ? Bicknor.

536. **R. divexiramus,** P. J. Muell. 34.
4. Symond's Yat : Staunton : Buckstone.

537. **R. Bellardii,** Wh. and N. 34.
4. Buckstone : ? Beachley.

538. **R. serpens,** Weihe. 34.
4. Probably this at St. Briavels.

539. **R. hirtus** Waldst. and Kit.
c. var : **Kaltenbachii** (Metsch.) 33, 34.
3. Newent Wood : Flaxley Abbey. 4. Locally

abundant. 5. Several spots by the Avon, in plenty. 6. Cranham ; Cooper's Hill : Whiteshill.

d. var : **flaccidifolius,** (P. J. Muell.) 33.
6. Plenty on Haresfield Hill.

545. **R. dumetorum,** Wh. and N. 33, 34.
Common in the county, especially on lower ground. But the records are few except in 5, 6, 7a.

a. **ferox,** Weihe. 33, 34.
3. Clifford's Mesne ; May Hill. 4. ? Mitcheldean. 7a. Guiting : Andoversford, etc. 7b. Kempsford.

b. **britannicus,** Rogers. 33, 34.
3. May Hill. 4. Symond's Yat. 7a. In Eastern half of district, plenty.

c. **diversifolius,** (Lindl.) 33, 34.
1. Pebworth. 3. May Hill. 4. Woods by the Wye : Ruardean : Mitcheldean Meend. 5. Frequent. 6. Cranham : Minchinhampton to Avening. 7a. Stanway to Snowshill.

f. **tuberculatus,** Bab. 34.
6. Woodchester Park.

h. **raduliformis,** Ley. 33, 34.
3. May Hill : Clifford's Mesne. 4. Tidenham Chase. 5. Stapleton. 7a. Toddington : Roel Gate to Sudeley Hill : Greet to Gretton, etc.

546. **R. corylifolius,** Sm. 33, 34.
1. Long Marston : Campden. 2b. Churchdown. 3. Upleadon : Longhope. 4. Symonds Yat : Longhope. 5. Widely distributed. 6. Fairly common, Cranham, Painswick, Cooper's Hill, Bussage, Toadsmoor, Slad, etc. 7a. Fairly common. 7b. Few records, but probably common.

a. **sublustris,** (Lees.) 33, 34.
5. Clifton Downs, Filton Meads, Stoke Gifford, Frenchay, Wyck, etc. 6. Woodchester : Cranham. 7a. Kingham : Stow : Stow to Burford : Bourton to Westcote : Puckham.

b. **conjungens,** (Bab.) 33, 34.
4. Tidenham Chase : Coldwell Rocks, English Bicknor. 5. Oldbury Park : Aust : Thornbury to Rockhampton and Hill. 7a. Stow to Burford : Stow to Bourton : Kingham : Guiting Grange. Andoversford : Hailes to Farmcote.

c. A form just intermediate between a and b. 33.
7a. Frequent ; prevalent *f.* of **corylifolius** in E. part of this district.

547. **R. Balfourianus,** Blox. 34.
3. Pauntley. 4. Mouth of Wye. 5. Westridge Wood.

548. **R. Bucknalli,** White. 34.
5. Westridge Wood.

549. **R. cæsius,** L. 33, 34.
Common in the county : records scarce from districts 2 and 3 (except N.W. part).

cæsius × corylifolius. ? 34. 5 ? this near Yate.

cæsius × idæus. 33.
6. Whiteshill, near Stroud.

cæsius × rusticanus. 33, 34.
6. Nailsworth : Cranham Wood. 7a. Lower Slaughter.

550. **R. saxatilis,** L. 33, 34.
4. Wooded rocks by the Wye, from Coldwell to Tutshill. 7a. Guiting Wood : Puckham Scrubs : Hauling Wood : Queen's Wood : near Woodhouse and near Round House : other Cotteswold Woods : Dowdeswell Wood.

ADDITIONAL NOTES
ON
THE LAND AND FRESH-WATER MOLLUSCA OF GLOUCESTERSHIRE

BY
CHARLES UPTON.

In a paper read before the Club on the 14th February, 1911, and printed in the *Proceedings*, vol. xvii., pp. 177-92, is set out a list of the Land and Fresh-water Mollusca of the County. That list—which is, in the following notes, referred to as " the former list "—comprised all the species and varieties which were known to me at that time. Since the former list was published I have made further researches and am now able to record additional species and varieties, and to give further information with regard to some of the forms enumerated therein, so as to bring the records up-to-date.

TESTACELLIDÆ.

Testacella maugei, Ferussac. In the former list this species is mentioned on the authority of the " Journal of Conchology," which states that it has been found in "Gloucester West," without mentioning the precise locality. Since that date I have found it fairly abundant in the garden of No. 26, St. Paul's Road, Gloucester. This is in " Gloucester East."

ARIONIDÆ.

Arion minimus, Simroth. Recorded from " Gloucester West " in " Journal of Conchology."

HELICIDÆ.

Helicella itala, var. lentiginosa. Moquin-Tandon. This well-marked variety has been found on the bank of the Gloucester and Berkeley Canal near Hardwick.

H. gigaxi, Charpentier. This form was, until recently, considered to be a variety of *H. caperata*. It has now, however, been given specific rank. I have taken it in the Slad Road, Stroud, at Randwick, and on the Canal bank near Stonebench.

H. barbara (Linné). Recorded from Gloucestershire West in " Journal of Conchology."

Hygromia granulata, var. albida. Tye. Amongst coarse herbage near Nicks' timber pond, Quedgeley.

H. rufescens (Pennant). This is now known as *H. striolata* (C. Pfeiffer).

Helicigona arbustorum, var. albina. Moquin-Tandon. One specimen on nettles at Shepscombe.

Helix aspersa, var. glabra (Calcara). This scarce form is distinguished by the absence of the wrinkled surface of the shell, which is such a marked feature of the species. I have one fine specimen from a garden in St. Paul's Road, Gloucester.

H. aspersa, var. lutescens, Cockerell. The colour of this shell is very pale yellow, almost white, with pale rufous banding. Two specimens from Tuffley Avenue, Gloucester.

H. aspersa, var. conoidea, (Picard). Occasionally in the neighbourhood of Gloucester.

H. aspersa, var. major, Pascal. One specimen on brambles, Tuffley Avenue, Gloucester, 39 mm. in diameter.

H. aspersa, var. minor, Picard. A colony of this form exists in Tuffley Avenue, Gloucester, near the Bristol Road end.

H. nemoralis, var. roseolabiata (Taylor). About a dozen specimens of this variety have been taken on brambles at one spot in Tuffley Avenue, Gloucester.

VERTIGINIDÆ.

Jaminia muscorum, var. bigranata (Rossm.) Under ivy on wall-top near Stroud Cemetery.

CLAUSILIIDÆ.

Balea perversa (Linné). In addition to the records given in the former list a considerable number have been taken from a limestone wall at Juniper Hill, near Stroud.

Clausilia biplicata (Montagu). Recorded from Gloucestershire East in "Journal of Conchology."

PHYSIDÆ.

Physa fontinalis, var. alba. Jeffreys. Several specimens from Nicks' timber pond, Quedgeley.

P. heterostropha, Say. This species, which is common in North America, has apparently been introduced into this country during recent years. It has been reported from several places in Lancashire and Staffordshire and also from Aylesbury. During the past few years I have taken it at Sharpness Docks, at first very sparingly, but latterly much more commonly and larger. During the autumn of 1916 I found it in the Canal at Packthorn Bridge, near Moreton Valence, and still more recently in the timber pond at Quedgeley. It is suggested in the "Journal of Conchology," vol. xiv., p. 178, that the mollusc may have been introduced with cotton. If by this is meant in the bales, I cannot think it possible, as it is a strictly aquatic animal. It is, however, I think, conceivable that it may have come in the water ballast taken up at ports whence cotton is shipped, and in this connection it may be noted that cotton seed is largely imported at Sharpness.

LIMNÆIDÆ.

Amphipeplea glutinosa, Bruguière. A note referring to the occurrence of this interesting form will be found in the Proceedings for 1913, vol. xviii., p. 99, but I have introduced it here in order that the list might be as complete as possible. In the autumn of 1913 some half-dozen specimens were taken by Mr E. J. Elliott, of Stroud, and myself from the Thames and Severn Canal near Chalford. In the following autumn we again visited the locality and found the number enormously increased, so much so that at one dip I took no fewer than eleven specimens. In the autumn of 1915 the mollusc was quite scarce again. The strange and unaccountable appearance and disappearance of this species has been observed by other conchologists.

VALVATIDÆ.

Valvata piscinalis, var. antiqua, Sow. This variety, which is more elevated than the type, occurs in considerable numbers in Nicks' timber pond at Quedgeley.

NERITIDÆ.

Neretina fluviatilis, var. trifasciata, Colbeau.

N. fluviatilis, var. nigrescens, Colbeau. Both of these varieties occur at Sharpness Docks with the ordinary form.

UNIONIDÆ.

Unio tumidus, var. ponderosa. Pascal. Old Docks, Sharpness.

Anodonta anatina. Linné. In the former list this form was described as *A. cygnæa var. anatina*. It is now, however, accorded specific rank, and is therefore given here. It occurs plentifully in the Canal at Hempsted, in the timber pond at Monkmeadow, and also at Sharpness.

CYRENIDÆ.

Sphærium corneum, var. pisidioides, Gray. This variety —considered by Dr. Gray to be a distinct species—has occurred in fair numbers in the Gloucester and Berkeley Canal near the Gas Works.

S. pallidum, Gray. In the former list this is stated to be rare at Sharpness. It appears to have increased rapidly as it is now quite abundant and very large. I have it also from the Gloucester and Berkeley canal near the Gloucester Gas Works.

Pisidium henslowianum (Shepp). Common in Nicks' timber pond, Quedgeley.

P. milium, Held. In pond near Midland Station, Stonehouse.

LOCAL NOTES

The 40-acre field gravel-pits at Barnwood, east to and adjoining the Irmin Street, have become not merely valuable to the owners, Mr and Mrs Clifford, and to the Government Munitions Department, but of very special interest to the palæontologist and the archæologist. I therefore venture to record some personal observations.

In a clear artificial pocket, about six feet beneath the present field-level, have been of late unearthed the remains of five Romano-British urns and water-jars, of which three are nearly perfect. These latter contained, when found, the incinerated bones of various individuals. No inscription occurred, nor are the pots anywise ornamented. The two specimens most complete are of dark buff with well-profiled tops. Their dimensions are :—

(1) HEIGHT, 6 inches
DIAMETER { at mouth, 5 inches
at base, 3 inches

(2) HEIGHT, 10 inches
DIAMETER { at mouth, $4\frac{1}{2}$ inches
at base, 3 inches

(3) HEIGHT, $8\frac{1}{4}$ inches
DIAMETER { at mouth, 5 inches
at base, 4 inches

Doubtless a great number of similar burials lie near both sides of this Romano-British road, under the modern gardens and orchards, and the vases may well belong to the late second century, or later.

Large fragments of the tusks and of the teeth of *Elephas antiquus* have been extracted from the 40-acre gravel pit (Barnwood) in the under measure, some nine feet below the present

PALÆOLITH (late Chellean),
Found in Barnwood Gravel Pits. Reproduced, with the permission of Mrs Clifford,
by Sydney A. Pitcher.

field-level, which I have carefully examined. I think, from the numerous lamellæ of the various teeth, that we have here the *antiquus*, not mammoth. A number of other remains, including the vertebræ and teeth, much-fossilized, of other animals of smaller dimensions (? Aurochs) are now being identified for me in London. I would recall the fact some time ago communicated to the Club by me of the identified remains of *Rhinoceros Tichorinus*, in the gravel-pit at Paradise, near Painswick, over 40 years ago, because this huge mammal was the frequent companion of the *Elephas antiquus* in these riverine deposits, and we may well look for its bones in the gravel-pits near Barnwood. The sand there is distributed in successive layers between the Oolite grit, abounding with worn-down Brachiopods and Echinus.

Palæolith, side view, full size.

A palæolith (*see photograph*) of the following dimensions has been found in the Upton Lane gravel-pit[1]: the point of it only having suffered fracture at its dislodgement by the workman's pick. It is boldly flaked off, or reduced to appropriate form and size, and of a rich yellow colour. Measurements at base :—

1¼ inches thick (at base)
4 inches in length
4 inches breadth (at base)

The palæolith is of Chellean (late) Period, and is of unusual interest, as possibly the first of such to be recorded in this County. The Club is indebted to Mrs Clifford for permission to illustrate it.

ST. CLAIR BADDELEY.

1 Mr T. G. Barnett informs me that the palæolith was found about 7-8 inches from the top of the deposit of gravel—this being some 18-20 feet in depth, and covered with some 2 feet of humus. R.A.

The County Flora

Field work in Gloucestershire has, on all hands, been reduced to a minimum in 1917 ; very few records of localities, and hardly any specimens, have been received by the Editor. The work of editing, however, is proceeding rather more quickly : the analysis of past records is being steadily carried out and a number of the Natural Orders are already practically ready (in summary) for the Preliminary or Tentative List. By the end of the winter it is hoped that a good proportion may be finished. If there is less to say about ' progress ' this year, the little that can be said brings us much nearer to the prospect of ' completion.'

As is well known, the Rev. Walter Butt had for some years before his death been engaged in building up the foundations of a County Herbarium. The herbarium contains many species of general interest from all parts of the British Isles—a necessary part even of a ' local ' herbarium ; but it concentrates and is strongly developed in the direction of Gloucester county specimens. It is very far from complete even in the latter respect : there are still lacking, for example, many species from one division of the County which are represented for the other division, for Mr Butt aimed at collecting specimens from both East and West Gloucester. (The two parts of the county so named are separated by the Stroudwater Canal as far as the Severn at Framilode, and thence by the Severn itself up to Tewkesbury.) Much besides requires to be done in critical species : *Rubus* is fairly well represented ; *Rosa* and *Hieracium* and *Batrachium* less well ; but *Salix*, *Euphrasia* and others have little to show.

The specimens are arranged according to the 10th edition of the London Catalogue, and are mounted on cartridge paper, the sheets being placed in strong cardboard boxes, each of which occupies a shelf inside the large case made for the purpose. This case is fitted with roller shutters, which complete a very efficient means of protection for the specimens. Placed in a dry room, and treated with ordinary care, botanical specimens so protected should last practically for ever.

H. J. Riddelsdell.

My botanical excursions this year have almost been confined to the Quedgley Munitions Factory and the Sneedham's Green shooting range. There is, or was, quite a good bog on the latter (I helped to drain it !), but it was not very productive. *Œnanthe pimpinelloides* grows at both these places, and round the Quedgley factory I found a few uncommon plants such as *Stachys arvensis*, *Asperula cynanchica*, and *Galium tricorne*. I have found the autumn dog's mercury, *Mercurialis annua*, in an office garden on the main street of Newnham, and traces of it in other parts of the town. *Bidens cernua* was particularly fine round a large pond at Sandhurst this summer. *Silene noctiflora* was another Newnham find. Parts of the forest round Upper Soudley grow good quantities of the not very common St. John's Wort, *Hypericum dubium*, indeed it seems the prevailing kind, just as *Hypericum pulchrum* is in other parts. In the same neighbourhood *Ornithopus perpusillus* is to be found growing to almost unusual height and size. Haresfield Hill grew plenty of the flea-bane, *Erigeron acris*, this year, and a fair quantity of the pretty little pearlwort, *Sagina nodosa*.

J. W. Haines.

Some of my observations this year are as follows :—On the 13th June I found in a corn field on Hewletts' Hill, near Cheltenham, a number of plants of *Carum Bulbocastanum* (Koch), the great Earth-nut, a plant of the Eastern Counties, which has never, I believe, been recorded previously for Gloucestershire. Mr H. H. Knight also found it there almost at the same time. It may be hoped that it will establish itself in the locality.

On the 17th July I found at the base of the Mythe Cliffs, Tewkesbury, some plants of *Anchusa officinalis* (Linn.), the ' common ' Alkanet, a rare plant, recorded in Druce's " Flora of Oxfordshire " as a casual in that county, but not, I think, known hitherto in Gloucestershire. In the same vicinity *Dianthus Armeria* (Linn.) was in good bloom in some quantity ; also *Astragalus glycyphyllos* (Linn.) and *Cardamine impatiens* (Linn.), the last I had not seen there before.

On the 10th August I came across a large patch of *Œnothera biennis* (Linn.), quite distinct from *Œ. Lamarckiana* (Seringe) naturalised on a railway bank near Dowdeswell, and on the same day found *Scrophularia alata* (Gilib.) in good bloom and very luxuriant in its known habitat near Andoversford station.

On a visit to Cirencester on the 2nd August in company with Mr J. W. Greenwood, I saw a quantity of *Lathyrus tuberosus* (Linn.) in a spot known to my companion for some years. This plant has hitherto generally been considered as confined to the Eastern Counties. The uncommon *Euphorbia platyphyllos* (Linn.) was also to be seen in corn fields close by.

In September I was told by Mr Kersey of his having seen an Elderberry bush with green berries growing by the side of the Chelt, near College Road, Cheltenham, and on viewing it at the spot, I found it to be the variety *virescens* (Koch), recorded by Druce as growing in Berkshire. This, I think, is very uncommon.

A. S. Montgomrey.

Obituary Notice

REV. WALTER BUTT

By the sudden death, on the 14th of July, 1917, of the Rev. Walter Butt, the Club loses a most enthusiastic supporter of the objects for which it was established, and also one of its most popular Members, whose vigorous personality and genial nature were felt alike in lecture theatre and at field meetings. Elected a Member in 1898, he became at once a keen attendant at all meetings, oftentimes at great personal inconvenience, and was always ready to impart as well as to receive information. He was above all a botanist and student of Nature. Of late years he had set his heart upon the compilation of a County Flora, to be published under the auspices of the Club, and took immense pains to this end, both by personal effort and in stimulating others to help. It is due to him that the Rev. H. J. Riddelsdell, his son-in-law, has consented to edit the Flora, and though the War has in this, as in so many directions, set back work, it progresses steadily. Mr Butt had a good herbarium (some particulars of which are given on page 236), and this his son, Mr Walter Butt, has presented to Gloucester Museum, thus carrying out the expressed wish of his father. It will be placed beside the St. Brody collection, well known to botanists, and for which the late Mr Butt provided a case.

Mr Butt was elected President on three separate occasions—in 1906, 1908, and 1912—and the services rendered by him during these terms of office will always be looked upon by Members as of the highest order. The day when he invited them to visit him at Oakwood, his beautifully-situated home on the Wye, near Chepstow, and his genial hospitality and evident affection for the place, must be fresh in the minds of all who were present. A constant reader of books, Mr Butt had accumulated a very considerable library on the many subjects in which he was interested, and he was always ready to place its resources at the service of enquirers.

R. A.

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