S. 11

PRICE SIXPENCE.

Reprint from the Proceedings which follow

ADDRESS

DELIVERED TO THE MEMBERS

OF THE

BATH NATURAL HISTORY

AND

ANTIQUARIAN FIELD CLUB,

On FEBRUARY 2nd, 1864,

BY THE

REV. LEONARD JENYNS, M.A., F.L.S., F.G.S.,

PRESIDENT OF THE CLUB.

BATH:

S. HAYWARD, "EXPRESS" OFFICE, GREEN STREET.

PRICE SIXPENCE.

ADDRESS

DELIVERED TO THE MEMBERS

OF THE

BATH NATURAL HISTORY

AND

ANTIQUARIAN FIELD CLUB,

On FEBRUARY 2nd, 1864,

BY THE

REV. LEONARD JENYNS, M.A., F.L.S., F.G.S.,

PRESIDENT OF THE CLUB.

BATH:

S. HAYWARD, "EXPRESS" OFFICE, GREEN STREET.

RULES OF THE

BATH

Natural History and Antiquarian Field Club.

INSTITUTED FEBRUARY 18th, 1855.

1.—The Club shall be called "THE BATH NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB," and shall consist for the present, of not more than Fifty Members; out of whom shall be chosen each year a Vice-President and Secretary, the latter acting also as Treasurer.

2.—The object of the Club shall be to make Excursions around Bath, with the view of investigating the Natural History, Geology, and Antiquities of the neighbourhood.

3.—There shall be Four Excursions during the Year, to be fixed at the Anniversary Meeting on the 18th February. A List of such Excursions, with the respective Places of Meeting, shall be suspended in the Vestibule of the Bath Literary and Scientific Institution. Such Members as feel disposed shall also meet every THURSDAY, at the Institution, at 11 a.m.

4.—An Excursion may be changed on the Morning of the Meeting for that day only, if agreed to by all the Members present, bnt not for any other times, unless agreed to by the whole Club—Six Members to form a Quorum.

5.—The Hour of Meeting shall not be changed, except for the convenience of taking particular Trains, when it is arranged to go by rail to any place; in which case the altered hour shall be posted at the Institution, not later than Twelve o'Clock on the Saturday previous.

6.—In arranging the Excursions, due regard shall be paid to Natural History and Antiquities, so as to secure an equal share of attention to each subject; with this view, when the same Excursion does not include them both, they shall, so far as practicable, be taken alternately.

7.—Meetings for the Election of Members, and for the transaction of other Business, shall take place Quarterly.

8.—Special Meetings shall be appointed for the Reading of Papers, or Exhibition of Specimens, notice being given to the Secretary at or previous to any one of the Quarterly Meetings, by Members having such communications to make to the Club.

9.—Persons wishing to join the Club, may send in their Names and Addresses through any of the Members, and be admitted when there is a Vacancy, after being proposed at a previous Quarterly Meeting, if approved of by all the Members present.

10.—Any Member of the Club may invite friends to accompany them on the proposed Excursions.

11.—It shall be the business of the Secretary to take Notes of the Day's Excursion, and to draw up a Summary of the Year's proceedings, previously to the next Anniversary; he shall also see that the proper Notices of Excursions are suspended at the Institution, and communicate with the Members by letter, when occasion shall require.

12.—A Subscription of Five Shillings shall be paid Yearly by each Member, to defray any expenses the Club may incur otherwise than by Journeys and Refreshments; this Subscription shall be considered due on the Anniversary.

President.

*Rev. LEONARD JENYNS, M.A., F.L.S., F.G.S.

Vice President.

*Rev. H. M. SCARTH, M.A.

Secretary and Treasurer.

Rev. H. H. WINWOOD, M.A.

LIST OF MEMBERS.

Rev. THOS. STEELE, D.D., 2, *Bathwick Terrace.*
*C. E. BROOME, Esq., *Elmhurst, Batheaston.*
Col. W. L. TUDOR.
*Capt. W. V. HEWITT, 24, *Daniel Street.*
*CHARLES MOORE, Esq., 6, *Cambridge Place.*
W. DOBSON, Esq., *Oakwood, Bathwick Hill.*
Rev. H. N. ELLACOMBE, *Vicarage, Bitton.*
H. WILLIAMS, Esq., 31, *Henrietta Street.*
JOHN BARRETT, Esq., F.R.C.S., 13, *Pierrepont Street.*
Rev. THOMAS JACKSON, 32, *Sydney Buildings.*
Rev. GEORGE BUCKLE, *Vicarage, Twerton.*
Rev. JOHN EARLE, *Rectory, Swainswick.*
JOHN JOHNSTON, Esq., 1, *Barnard Villas, Pulteney Road.*
Mr. J. P. TYLEE, 7, *Bridge Street.*
Mr. CHARLES EKIN, 8, *Argyle Street.*
A. B. BRABAZON, Esq., M.D., 12, *Darlington Street.*
Rev. THOS. FURLONG, 10, *Sydney Place.*
C. FOX, Esq., M.D., *Brislington, near Bristol.*
Capt. HARDY, R.N., *Kilkenny House, Sion Hill.*
W. LONG, Esq., 16, *Lansdown Place, E.*
Major NICKLE, 5, *Lambridge Place.*
W. WYNNE, Esq., 2, *Macaulay Buildings.*
Col. WYNDHAM BAKER, 12, *Green Park.*
H. J. HUNTER, Esq., M.D., 22, *Brock Street.*
General BURMESTER, *Keynsham, near Bristol.*
Rev. W. H. JONES, *Bradford, near Bath.*
C. J. PHIPPS, Esq., F.S.A., 5, *Paragon Buildings.*
Mr. S. HAYWARD, 3, *Bathwick Street.*
Rev. DE COURCY MEADE, *Erin Cottage, Sion Row.*
J. LEMARCHANT, Esq., 17, *Sion Hill.*
W. S. MITCHELL, Esq., *St. George's Lodge.*
J. E. DANIEL, Esq., 1, *Axford Buildings.*

Those marked thus * are original members.

Colonel ST. AUBYN, 7, *Great Bedford Street.*

ADDRESS.

GENTLEMEN,

Having been requested to furnish some paper for to-day's meeting of the Bath Natural History and Antiquarian Field Club (the first occasion of its meeting for the reading of papers) I thought I could not do better, as the Founder of the Club, than address you on the objects and advantages of such Institutions, at the same time suggesting any points for your consideration which it seems to me may add to the success of our own body, and lead to fruit of real value in a scientific point of view.

Field clubs are now so numerous, there being one in almost every county,—in some counties even more than one,—and they are so well known to that part of the public who take any interest in such gatherings, that it is quite unnecessary to particularize them individually. Ours is one of the last that has sprung up. The oldest of them, if I am not mistaken, and the one which has, perhaps, most to show in the way of results,—having published several volumes of Transactions,—and therefore, we may fairly assume, one of the best regulated, and deserving to be taken as a guide for others, is the Berwickshire Naturalists' Club, instituted in 1831, and which has been now three-and-thirty years in the field. Many years back I had the gratification of attending one of its field days, and I was much impressed with the advantages to be derived from such gatherings by naturalists and others who interest themselves in scientific pursuits, or who value opportunities of intercourse with men of inquiring minds meeting together,—to say nothing of the bodily health and exercise got by the excursion itself. I felt satisfied that the example thus set would soon be taken up in other places, and similar clubs instituted elsewhere, and such has been the event as already stated.

But though the Berwickshire Club is the oldest of our modern Clubs, it is interesting to find that the idea of thus enlisting men of the same taste for out-of-door natural history purposes is of more ancient date. In the life of the illustrious Swedish naturalist, Linnæus, there is an amusing account of his getting together "a caravan of naturalists"—students who had offered their services—to accompany him on a tour through Dalecarlia in the year 1734, with a view to explore its natural productions, and whom he marshalled under "certain laws and regulations, for the due observance

of which every member made himself answerable." He himself held the governorship of the whole party, superintended the enterprise, and took care that everybody discharged the functions of the office allotted to him. There were seven in number, besides Linnæus. The *first* "was to act as geographer, to give an accurate description of all the villages, mountains, lakes, rivers, roads, and districts, &c.—to say morning and evening prayers, and to preach on Sundays." The *second*, as general naturalist, "was to make observations on the quality of the water, on mineral springs, on the snow and height of the mountains, the weather, the fruitfulness or sterility of soil, &c. &c. He was also charged with digesting, as secretary, the transactions of the Society in proper written form." The *third*, as mineralogist (or metallist as he is there called), "besides collecting stones, minerals, earths, all kinds of petrifactions, &c., was further employed as groom, to saddle, water, and attend the horses." The *fourth*, "a student of physic, as botanist or herbalist, was to examine and to preserve as well as possible all the trees, plants, herbs, grasses, and fungi, which occurred to his view. He was moreover appointed to precede the company as a quartermaster, to procure them good lodgings, and to provide every necessary for their reception." The *fifth*, "as zoologist, was to describe and depict the quadrupeds and all the animals living as well in the water as on the land, such as fishes, birds, worms, &c. His collateral occupation consisted in shooting the game, which was necessary for the support of the company, and in fishing and angling whenever it was deemed expedient." The *sixth* "companion was commissioned to act as economist, to examine the dress of the Laplanders, their dwellings, their way of preparing provisions, their matrimonial and funeral rites, their knowledge of medicine, mode of living, diet, &c., and to describe with the pen or pencil such objects as were most worthy his attention. His additional employment was to communicate to his companions the dispositions and regulations of the president,—in the same manner as the adjutant of a regiment announces the orders of the general to his corps,—and to call them together whenever it was required, especially in the evening when an account was always given of the transactions of the day; he was also to take care that every companion went to bed and rose again to continue the journey at the time appointed." The *seventh* companion did the duty "of a steward and treasurer; he had the chief care of the fodder, cattle, wood, buying and selling, and discharged the expenses of the whole company."

"Owing to these excellent regulations and their due observance, the tour was continued and terminated with the

greatest ease and convenience. When the president discovered a village, it was not necessary for all the company to ride thither, but the geographer alone was sent to enter it. If some particular stone or fossil was found on the way, the metallist was directed to alight; at the sight of some curious plant or insect, the botanist or zoologist did his duty; they took the respective objects with them, and prepared a description to be inserted at night in the Transactions, besides the name of the place where they had been found. The above regulations being thus uniformly observed, the president had nothing to do upon the road, but remind his companions of what they were to set down in the diary."

"At night they all met together, the president then dictated to the secretary the memoranda collected by each companion, in a regular turn from the geographer to the steward; and if he happened to forget any remark, the companion to whose office that part of the service belonged refreshed his memory. The president was quite surprised at the readiness and diligence with which his attendants discharged the duties of their respective offices. In the short space of a few weeks, they appeared to him as if they had been accustomed to it for whole years together."*

Such is the account left us of what may be called the Dalecarlian Field Naturalist's Club in the days of Linnæus. I have given it in some detail from its being probably unknown to most of my hearers. If our Club is not organized with the same military precision, nor instituted for exactly the same purpose, viz., that of exploring a new country in one continuous tour, still the account may supply us with a few hints. At any rate, it is not without interest to find this plan of enlisting a number of men of congenial pursuits to co-operate in working out the natural history, &c., of a particular district, carried out no less than 130 years back, at a time when the natural sciences were generally in little favour, and when the few who studied them were left almost entirely to their own individual resources —with little help from others, especially in the field.

To confine ourselves now to our own body; there are two especial objects which a Club such as ours has, or ought to have, in view. One is the thorough investigation of the neighbourhood in which it carries on its researches, as regards its natural history and antiquities; the other the bringing together men of the same pursuits, with the addition of those who—without following up any particular branch of science themselves—may yet enjoy the society and conversation of those who do,—or who may like to join the Club for the sake of its excursions, the health and exercise they afford; the

* Stoever's Life of Sir Charles Linnæus; by Trapp, p. 395.

pleasure of rambling over new ground, especially in a neighbourhood like that of Bath, where there is so much diversity of landscape and beautiful scenery to engage the attention, irrespectively of its natural productions and other matters of interest. With regard to the first of these objects, I think there should be an earnest endeavour made on the part of the members of our Club—whether they work together on field days, or prefer working quietly by themselves at other times —to ascertain as far as possible what the neighbourhood of Bath really produces. One advantage to be derived from having a large body of members, is the better chance thereby afforded of the several departments of Natural History being all equally well looked after. We are more likely to find men ready to take up its different branches respectively, and to give them their exclusive attention. And there is a call for work everywhere. Though the Flora of Bath, at least as regards the phanerogamous plants, has been carefully got together by Professor Babington, who was formerly connected with the place,—of its Fauna we know very little indeed. There are records of certain species of shells and insects being inhabitants of the district, but, so far as I am aware, that is all. I think we ought to try to enrol among our members, if such are not already to be found in the list, working naturalists who are disposed to fill up this blank, and to supply us in time with complete catalogues of the mammals, birds, insects, shells, &c., occurring within a radius of eight or nine miles round Bath, — availing themselves of every opportunity of having the species properly determined by those most competent to give an opinion. Even the list of plants contained in "Babington's Flora Bathoniensis" might probably be much increased, while in the Cryptogamic department, with the exception of the Fungi which have received, and are still receiving, so much attention from Mr. Broome, one of our original members, we have a field entirely untrodden, and one, from the multitude of forms which it embraces, almost of unlimited research.

Natural History was the main subject of inquiry to which it was intended this Club should devote itself when first instituted. The subject of Antiquities was afterwards added, and I think very properly. For, although there is no very close connection between the two, it still often happens that those who take an interest in the one subject, take an interest in the other also, and the two can be well prosecuted together in a field excursion,—parties either joining,—or, if preferred, separating for a time to follow up their respective pursuits, and coming together again at the end of the day's work. It is a question, indeed, whether, whenever there is a large company in the field, it

might not be desirable to break up into even more than two sections, according to the prevailing tastes of the members present, and the objects they have in view.

If Antiquities have of late years attracted the attention of the Club more, perhaps, than other subjects,—it has been mainly due to the circumstance of the whole number of members having been hitherto small, with very few naturalists among them. But now that the number seems to be increasing, we may fairly hope that Natural History will in proportion have an increased number of followers. I need not dwell here upon the rich stores which are open to the Antiquary in this neighbourhood,—especially in Bath itself and the immediate precincts, —where so much has turned up, carrying us back to the days of occupation of this place by the Romans,—altars, portions of the great temple of Minerva, sepulchral remains, coins, and various other articles of interest;—nor need I stop to point out the numerous ancient mansions, churches, &c., to be met with in more distant rambles from the city. They are too well known to require mention, and they have been mostly already visited by the Club, and in many instances well described and illustrated by our valuable member, the Rev. H. M. Scarth, to whom the public are so much indebted for his labours in this department.

But leaving the subject of Antiquities, I pass on to other matters of which I think the club might take cognizance. I conceive everything connected with topography (taking a hint from the caravan of Dalecarlian naturalists before spoken of) —everything which throws light upon the manners of the people and their mode of life, either now or at any former period,—provincial words—etymology of the names of places —local sayings—obsolete customs—superstitions and so forth, —all this might be followed out as a legitimate object of inquiry,—in addition to what relates to the physical features of the district, its geology, or its natural history. And there is yet another subject I would recommend to the notice of any members of this Club, who are inclined to take it up,—and that is the climate of Bath and its meteorology. When we consider how much Bath is resorted to by invalids—availing themselves, in the winter especially, of its undoubtedly milder climate at that season—it is of much importance that we should know on far better data than any we possess at present, or which at least have been made public, what is the exact difference between its mean temperature and that of other places lying farther either to the E. or W.—not merely in winter, but at each respective season of the year—taken in connection with its mean rainfall and humidity, nor overlooking the position of the city, situated as it is in a bason

surrounded nearly on all sides by lofty hills, which must have some effect upon the circulation of the air and the state of the atmosphere, in a sanatory point of view. It would take me too much away from the immediate purpose of this address to go into details on this subject:—I will simply remark that very erroneous notions are entertained respecting the climate of Bath, persons often imagining that because it is milder than many other places in winter, it must necessarily be very hot in summer, attributing its relaxing character at that time to a higher temperature than it really possesses—instead of to other causes, which, in my opinion, exercise a more decided influence that way.

I have thus touched upon the principal matters of inquiry which I think might fairly come under the consideration of this Club. I proceed now to speak of the second object these Clubs have in view, viz., the bringing together men of the same pursuits. I presume it will be generally allowed that men's minds profit much by a mutual interchange of ideas on subjects they study in common. Each learns something from the others, or has his mistakes corrected, while he imparts something to them in return. Advantage arises even out of the collision of opposite opinions which sometimes takes place on the comparison of their respective views. Truth is never so surely elicited as when those who have long held by opinions, which in their own estimation rest upon a firm basis of facts, are compelled to reinvestigate questions, and to judge by the light thrown on them by others. But it is especially to students of science that this intercourse with others is so valuable. When working alone, we know how apt they are to flag at times from the want of fellow-workers to encourage them in their researches;—or if, from an ardent love of the pursuits they have taken up, they need no such stimulus to keep them to the mark, they yet fall short of what they might accomplish, if they had others at hand to direct or assist them in any particular inquiry. These Clubs (and the remark applies equally to Natural History Societies, and all gatherings for scientific purposes) have sometimes been the means of bringing men into notice, who might otherwise have remained all their life in obscurity, unknown perhaps even to some following up the same pursuits in the same neighbourhood. This is one of the good results that has arisen out of the yearly meetings of the British Association. Almost in every town in which that body has met for the first time, men, whose names were before quite unknown in the ranks of science, have come forward on the occasion of the meeting being held in their native place,—have attached themselves to the section that dealt with the particular subjects they studied, and gained for themselves

a standing and reputation which they have kept ever afterwards, and greatly to their advantage in the further prosecution of their researches. It is by being thus brought into contact with the scientific world, that men see and learn what others are about as well as themselves; that they discover, in some instances, that what they had supposed new is well known,—that they are made more thoroughly acquainted with the present state of our knowledge in any given department of science, and that they are kept back from putting forth views and opinions not thoroughly matured, or which need further sifting, such as can in no way be got better than by being made the subject of public discussion.

They also get enlarged views by having their attention drawn to other branches of Science beside that which they themselves study.

These are days in which the sciences are fast advancing towards higher generalizations than they have ever yet attained to. The most intimate connection is found to exist amongst them, so that a student cannot successfully follow up one without knowing something of the others. There is a correlation of the physical sciences, and there is a correlation of the natural sciences. Even the physical and the natural sciences seem to find a bond of union in chemistry, which has to deal with inquiries relating to both. For while chemistry investigates the nature and constitution both of organic and inorganic substances, it has at the same time to consider the influences of those subtle agents,—light, heat, electricity and magnetism, —upon the ultimate particles of matter, employing, too, formulæ of an algebraical character, by which to express more precisely the results of its analyses. Chemistry, again, is closely connected with mineralogy; insomuch that the latter is now considered by many as more properly a branch of chemistry than as a distinct science: yet mineralogy, in all that relates to crystalline forms, is dependent upon geometrical laws, and requires, on the part of the student, some knowledge and application of mathematical reasoning as indispensable.

With the Physical Sciences this Club has nothing to do. But confining ourselves to the Natural Sciences, all who attend much to them must be struck with the mutual bearing they have on each other. From Mineralogy, already spoken of, there is an easy passage to Geology. But Geology is entirely dependant upon zoology for ascertaining the true characters and structure of those fossil organic forms, which abound more or less in all rocks and strata from the highest nearly to the lowest, and which help mainly to determine the relative ages of that succession of beds which form the crust of our earth. With respect to the affinities existing between the

several classes of animals, as also between the several families of plants,—and what is yet more between plants and animals themselves,—it is enough to say that the species, and even the higher assemblages of forms, often pass so insensibly into each other, that it is hardly possible to determine where one group ends and another begins; and when we come down to the lowest forms of all, we find the two kingdoms so closely connected, that there are instances of the same forms having been regarded, first as animals, and afterwards as vegetables, or the contrary. There are some mammals allied to reptiles in certain parts of their internal organization, others taking much after the form of fish and allied to them in habits; —there are birds possessing some of the characters of mammals, and departing considerably from the ordinary type of the ornithic structure;—there is the *Lepidosiren*, so completely intermediate between reptile and fish, as to have led to a controversy among naturalists as to the class to which it really belongs, and, joined with other considerations, to have induced one of our first authorities, Professor Owen, to propose the actual uniting of these two classes, on the ground of their having so many characters in common. Lastly, there is that most extraordinary fossil form, only recently discovered—the *Archæopteryx*, from the Solenhofen beds of Pappenheim—at first considered by Wagner as a feathered reptile, but now thought by Professor Owen to be a bird, though exhibiting characters which separate it from all birds known hitherto, it having a long vertebrate tail, and apparently other characters equally exceptional, but which are not at present capable of being defined with accuracy, from the imperfect state of the remains of the only specimen hitherto examined.

The above remarks are in reference to the vertebrate division of animals; but they apply equally to the invertebrate, the several classes of which seem in like manner to be all connected by osculant forms, while there is a genus of fishes,—the *Amphioxus* of Yarrel found on our own shores,—so low in its organization, and with the vertebral column so imperfectly developed, as to present more the appearance of a mollusk than a fish, and actually to have been classed with the mollusca by one naturalist (the celebrated Pallas); thus shewing that even the two great divisions of Vertebrata and Invertebrata have no such clearly-defined boundary between them as might have been supposed.* We know yet further the bold hypothesis of one of the most philosophical naturalists of our day,—not entirely unsupported by facts, nay with a large body of facts in its favour, though certainly not proved, nor

* The above remark applies to outward form alone, for there is no doubt as to the *Amphioxus*, in internal structure, being a true Vertebrate.

capable of being proved,—that all the different forms of animal and vegetable life may have sprung originally from at most but a very few primitive germs, which, by continued development under constantly altering conditions of life through a long succession of ages, have given rise to all the different species and varieties we see at the present day, whether in the fossil or living state. Into these speculations we will not enter. I only mention them in connection with what I previously stated,—to show how necessary it is for the student of any particular department of Natural History to be acquainted in a general way with all the other departments. Whether the several species of animals and plants have had an independent origin or not, they shew mutual affinities often of the closest kind. It is quite impossible to string them all together in one straight line reaching from the lowest to the highest as was formerly supposed: they rather form a complicated network, radiating and branching out in all directions, each species showing relationships more or less striking to a multitude of others. They are all subject to the same general laws of organization; and there are certain first principles of life and structure, as well as of classification, which apply to all alike, and which must be understood by him who desires to investigate their natural history with any hope of success.

A general knowledge of science in all its branches is advantageous to the student in another way. It is calculated to remove that narrow-mindedness which sometimes attaches to those who confine themselves to one department of it exclusively. The physicist has occasionally looked down upon the naturalist as devoting his attention to objects of inferior consideration to those which he himself studies. Even among naturalists, those who have chosen for themselves the study of the higher animals have sometimes underrated the labours of the conchologist and entomologist, and yet more the researches of others, who, perhaps, give all their time and attention to the investigation of the minute infusoria, or of those most repulsive of all animated forms—the entozoa.

It may be true that, at the present day, feelings such as these are not entertained so much as formerly, and that men of whatever rank who devote themselves to science at all, are considered but as fellow-workers in a common field. But still there is a narrow-mindedness, which, without any reference to others, may hinder us in our own studies, when too confined, in respect of the method in which we conduct them and the judgments we form. Naturalists, especially, who are only acquainted with one particular class of animals, have been frequently led to entertain erroneous estimates of the importance of certain organs and characters, from taking a too limited view

of structure in general,—or they have given their whole attention to little matters of detail which, though having a certain value, if too closely followed out, prevent their rising to those more general views of the relations of things which should ever be the aim of the philosophical student of nature.

I have spoken of the bond of union among the sciences in general, and among the natural sciences in particular. But not forgetting that this Club interests itself with the subject of Antiquities, as well as Natural History, it may be serviceable to show that even Antiquities,—though belonging more properly to the domain of history than science,—are not entirely disconnected from the researches of the naturalist. In all at least that relates to the antiquity of man, considered in himself, and in connexion with the rude dwellings and the rude implements which he provided for the supply of his necessary wants, sooner or later after his first appearance on this earth—one of the great questions of our day—the subject is closely mixed up with that of the relative ages of the beds in which remains of such occur,—and it is necessary to have the geologist at hand in some cases to determine the true position of these beds in the geological series. It was but the other day, as we are aware, that a discovery was made in the immediate vicinity of this city, which might have been lost to science, or its value much lessened from want of accurate knowledge of the facts of the case, but for an immediate inquiry into the circumstances by those whom we are accustomed to look up to as the first authorities in geology and antiquities in this place. I allude to the finding of a very ancient kyst containing portions of a human skeleton, buried at the depth of between four and five feet in the middle lias, above which there was a deposit of peat of the thickness of eighteen inches, and over that six feet of gravel. It is difficult, perhaps, to fix the date of the interment of these remains with any accuracy, but the long period of years required for the slow accumulation of the peat and gravel above the lias, which must have been the top soil when the burial took place, throw it back to a very remote age, and give it an interest that leads us to hope it may shortly be made the subject of a separate communication to the Club.

And having, now, said thus much respecting the particular researches which this Club should endeavour to carry on, with a view to collecting materials for a complete Natural History of Bath and the surrounding country,—having also made some remarks on the sciences in general, and the advantages of association in our respective pursuits,—it is time that I should pass on to the consideration of the practical working

of the Club—the way in which we may hope most successfully to conduct our labours, the way, also, in which we may best deal with the results obtained.

The plan which has been of late adopted respecting the excursions may, I think, still be kept to, viz., that of having from four to six (as judged desirable) field-days in the year, when we may hope for the largest attendance of members, the attendance of those especially who, from their professional engagements or other business, are unable to attend oftener, and more frequent meetings—weekly or fortnightly, as preferred—of the few who may wish, and who have it in their power, to join in a common ramble on the days appointed. On all these occasions the party, as I observed before, might either keep together, or break up into sections, for more unrestrained work in their respective departments, re-uniting at the end of the day, as thought convenient. The places to be visited on the field-days, and the objects in view, should be arranged beforehand, and notice of the same suspended, as now, at the Literary and Scientific Institution, for the information of all. The directions which the walks may take on other days may be left to be fixed at the time by those who join in them, and they may carry out any plan, for the occasion, they please. Only I should hope they would always remember they are to use their influence in promoting any inquiries which may add to our knowledge of this neighbourhood in respect of the objects for which the Club is formed, and lay their results before it at its appointed sittings. To-day is the first occasion on which the Club has ever met for the reading of papers, independent of its ordinary quarterly meetings for mere routine business, and a question has sometimes been raised at these latter meetings as to the best way of bringing before the public any communications made to the Club which may deserve to have a wider circulation. On each of these points I will make a few remarks. The practice of the Berwickshire Club, I believe, with respect to papers, has been to have such as may have been prepared beforehand by any of the members read at the termination of each day's excursion, these excursions being five in the year;—and then, at the end of the year, the retiring President delivers an address, giving a general summary of what has been done, with a notice of the different places visited, at each meeting. This address, along with a selection of the papers read as above, furnishes matter for a yearly number of their Transactions, enough being collected in time in this way to make up a volume, which is printed by the Club for the use of its own members. I should say that all these papers, in respect of the subjects treated of, are more or less connected with the district, which forms the field of the Club's labours. It may be long before our Club arrives at

this stage of activity; and perhaps it may never get to it. In the meantime, I should suggest that members who read papers which it is desirable to publish, be invited to send them to one of the periodicals of the day treating of that particular department of knowledge to which the papers relate, while any others—at least those which respect our own district—after being read to the Club, be carefully preserved by it for future reference. Members of the Club who, however they may like to join the excursions occasionally, prefer carrying on their own pursuits quietly by themselves, or who find they can do so best when unfettered by the movements of a large body,—should be requested still to bring their results forward, to go towards a general collection of such materials as may, we hope, one day serve for a complete illustration of the Natural History, &c., of this neighbourhood.

I think, however, instead of adopting the practice of the Berwickshire Club, of reading papers at the end of each day's excursion, it would be preferable, for several reasons, to have independent meetings held for the purpose, as on this very day, and at this Institution, or elsewhere, and as often as thought desirable. We hardly know yet to what extent such papers may come in. If, with an increasing number of members, there should seem to be an increasing interest taken in the objects of the Club, and communications made to it more frequently, the Club might merge into a Bath Natural History and Antiquarian Society,—still keeping up its field days, and everything going on as it does now, with the simple addition of a certain number of other days, fixed at the Anniversary or at the quarterly meetings, for the purpose alluded to. I think, at these sittings, preference should be given to papers relating to the Bath district, but after these have been read, or in the event of none such being brought forward, it might be left to members to make any communication to the Club they pleased, though not of a local character, or to exhibit any specimens of Natural History or Antiquities, which they thought might interest it, accompanied by remarks. With regard to the excursion days—whether the excursions be in or beyond the Bath neighbourhood—some notes should be kept by the Secretary of what is seen or done by the party collectively, and these might either be embodied into an address by the retiring President, delivered at the end of his year of office, as in the Berwickshire Club,—or they may continue to be read by the Secretary from his Journal of Proceedings each quarter, as done hitherto.

Gentlemen, I fear I have detained you rather long; and there are still other matters to which I would have alluded had the time permitted,—especially the desirableness of having any

PROCEEDINGS

OF THE

BATH NATURAL HISTORY

AND

ANTIQUARIAN FIELD CLUB.

VOL I

BATH:
UBSICK AND LEECH, "CHRONICLE" OFFICE, KINGSTON BUILDINGS.
1867-69

PROCEEDINGS

OF THE

BATH NATURAL HISTORY

AND

ANTIQUARIAN FIELD CLUB.

VOL I

BATH:

BLEECH AND LEECH, "CHRONICLE" OFFICE, KINGSTON BUILDINGS.

1867-69

VOL. I. NO. 1. REPRINTED BY
LEWIS, SONS AND TYTE, HERALD OFFICE, BATH.
1884.

TABLE OF CONTENTS.

VOL. I. No. 1.

No. 2.

No. 3.

An Address by the Rev. Leonard Jenyns, M.A., F.L.S., F.G.S., *President of the Club.*

(Read February 2nd, 1864.*)*

Gentlemen,

Having been requested to furnish some paper for to-day's meeting of the Bath Natural History and Antiquarian Field Club (the first occasion of its meeting for the reading of papers) I thought I could not do better, as the Founder of the Club, than address you on the objects and advantages of such Institutions, at the same time suggesting any points for your consideration which it seems to me may add to the success of our own body, and lead to fruit of real value in a scientific point of view.

Field Clubs are now so numerous, there being one in almost every county,—in some counties even more than one,—and they are so well known to that part of the public who take any interest in such gatherings, that it is quite unnecessary to particularize them individually. Ours is one of the last that has sprung up. The oldest of them, if I am not mistaken, and the one which has, perhaps, most to show in the way of results,—having published several volumes of Transactions,—and therefore, we may fairly assume, one of the best regulated, and deserving to be taken as a guide for others, is the Berwickshire Naturalists' Club, instituted in 1831, and which has been now three-and-thirty years in the field. Many years back I had the gratification of attending one of its field days, and I was much impressed with the advantages to be derived from such gatherings by naturalists and others who interest themselves in scientific pursuits, or who value oppor-

tunities of intercourse with men of inquiring minds meeting together,—to say nothing of the bodily health and exercise got by the excursion itself. I felt satisfied that the example thus set would soon be taken up in other places, and similar clubs instituted elsewhere, and such has been the event as already stated.

But though the Berwickshire Club is the oldest of our modern Clubs, it is interesting to find that the idea of thus enlisting men of the same taste for out-of-door natural history purposes is of more ancient date. In the life of the illustrious Swedish naturalist, Linnæus, there is an amusing account of his getting together "a caravan of naturalists"—students who had offered their services—to accompany him on a tour through Dalecarlia in the year 1734, with a view to explore its natural productions, and whom he marshalled under "certain laws and regulations, for the due observance of which every member made himself answerable." He himself held the governorship of the whole party, superintended the enterprise, and took care that everybody discharged the functions of the office allotted to him. There were seven in number, besides Linnæus. The *first* "was to act as geographer, to give an accurate description of all the villages, mountains, lakes, rivers, roads, and districts, &c.—to say morning and evening prayers, and to preach on Sundays." The *second*, as general naturalist, "was to make observations on the quality of the water, on mineral springs, on the snow and height of the mountains, the weather, the fruitfulness or sterility of soil, &c., &c. He was also charged with digesting, as secretary, the transactions of the Society in proper written form." The *third*, as mineralogist (or metallist as he is there called), "besides collecting stones, minerals, earths, all kinds of petrifications, &c., was further employed as groom, to saddle, water, and attend the horses." The *fourth*, "a student of physic, as botanist or herbalist, was to examine and to preserve as well as possible all the trees, plants, herbs, grasses, and fungi, which occurred to his view. He was moreover appointed to precede the company as a quarter-master, to procure

them good lodgings, and to provide every necessary for their reception." The *fifth*, "as zoologist, was to describe and depict the quadrupeds and all the animals living as well in the water as on the land, such as fishes, birds, worms, &c. His collateral occupation consisted in shooting the game, which was necessary for the support of the company, and in fishing and angling whenever it was deemed expedient." The *sixth* "companion was commissioned to act as economist, to examine the dress of the Laplanders, their dwellings, their way of preparing provisions, their matrimonial and funeral rites, their knowledge of medicine, mode of living, diet, &c., and to describe with the pen or pencil such objects as were most worthy his attention. His additional employment was to communicate to his companions the dispositions and regulations of the president,—in the same manner as the adjutant of a regiment announces the orders of the general to his corps,—and to call them together whenever it was required, especially in the evening when an account was always given of the transactions of the day; he was also to take care that every companion went to bed and rose again to continue the journey at the time appointed." The *seventh* companion did the duty "of a steward and treasurer; he had the chief care of the fodder, cattle, wood, buying and selling, and discharged the expenses of the whole company."

"Owing to these excellent regulations and their due observance, the tour was continued and terminated with the greatest ease and convenience. When the president discovered a village, it was not necessary for all the company to ride thither, but the geographer alone was sent to enter it. If some particular stone or fossil was found on the way, the metallist was directed to alight; at the sight of some curious plant or insect, the botanist or zoologist did his duty; they took the respective objects with them, and prepared a description to be inserted at night in the Transactions, besides the name of the place where they had been found. The above regulations being thus uniformly observed,

the president had nothing to do upon the road, but remind his companions of what they were to set down in the diary."

"At night they all met together, the president then dictated to the secretary the memoranda collected by each companion, in a regular turn from the geographer to the steward; and if he happened to forget any remark, the companion to whose office that part of the service belonged refreshed his memory. The president was quite surprised at the readiness and diligence with which his attendants discharged the duties of their respective offices. In the short space of a few weeks, they appeared to him as if they had been accustomed to it for whole years together."*

Such is the account left us of what may be called the Dalecarlian Field Naturalist's Club in the days of Linnæus. I have given it in some detail from its being probably unknown to most of my hearers. If our Club is not organised with the same military precision, nor instituted for exactly the same purpose, viz., that of exploring a new country in one continuous tour, still the account may supply us with a few hints. At any rate, it is not without interest to find this plan of enlisting a number of men of congenial pursuits to co-operate in working out the natural history, &c., of a particular district, carried out no less than 130 years back, at a time when the natural sciences were generally in little favour, and when the few who studied them were left almost entirely to their own individual resources—with little help from others, especially in the field.

To confine ourselves now to our own body; there are two especial objects which a Club such as ours has, or ought to have, in view. One is the thorough investigation of the neighbourhood in which it carries on its researches, as regards its natural history and antiquities; the other the bringing together men of the same pursuits, with the addition of those who—without following up any particular branch of science themselves—may yet enjoy the

---

* Stoever's Life of Sir Charles Linnæus; by Trapp, p. 395.

society and conversation of those who do,—or may like to join the Club for the sake of its excursions, the health and exercise they afford; the pleasure of rambling over new ground, especially in a neighbourhood like that of Bath, where there is so much diversity of landscape and beautiful scenery to engage the attention, irrespectively of its natural productions and other matters of interest. With regard to the first of these objects, I think there should be an earnest endeavour made on the part of the members of our Club—whether they work together on field days, or prefer working quietly by themselves at other times—to ascertain as far as possible what the neighbourhood of Bath really produces. One advantage to be derived from having a large body of members, is the better chance thereby afforded of the several departments of Natural History being all equally well looked after. We are more likely to find men ready to take up its different branches respectively, and to give them their exclusive attention. And there is a call for work everywhere. Though the Flora of Bath, at least as regards the phanerogamous plants, has been carefully got together by Professor Babington, who was formerly connected with the place,—of its Fauna we know very little indeed. There are records of certain species of shells and insects being inhabitants of the district, but, so far as I am aware, that is all. I think we ought to try to enrol among our members, if such are not already to be found in the list, working naturalists who are disposed to fill up this blank, and to supply us in time with complete catalogues of the mammals, birds, insects, shells, &c., occurring within a radius of eight or nine miles round Bath,—availing themselves of every opportunity of having the species properly determined by those most competent to give an opinion. Even the list of plants contained in "Babington's Flora Bathoniensis" might probably be much increased, while in the Cryptogamic department, with the exception of the Fungi which have received, and are still receiving, so much attention from Mr. Broome, one of our original members,

we have a field entirely untrodden, and one, from the multitude of forms which it embraces, almost of unlimited research.

Natural History was the main subject of inquiry to which it was intended this Club should devote itself when first instituted. The subject of Antiquities was afterwards added, and I think very properly. For, although there is no very close connection between the two, it still often happens that those who take an interest in the one subject, take an interest in the other also, and the two can be well prosecuted together in a field excursion,—parties either joining,—or, if preferred, separating for a time to follow up their respective pursuits, and coming together again at the end of the day's work. It is a question, indeed, whether, whenever there is a large company in the field, it might not be desirable to break up into even more than two sections, according to the prevailing tastes of the members present, and the objects they have in view.

If Antiquities have of late years attracted the attention of the Club more, perhaps, than other subjects,—it has been mainly due to the circumstance of the whole number of members having been hitherto small, with very few naturalists among them. But now that the number seems to be increasing, we may fairly hope that Natural History will in proportion have an increased number of followers. I need not dwell here upon the rich stores which are open to the Antiquary in this neighbourhood,—especially in Bath itself and the immediate precincts,—where so much has turned up, carrying us back to the days of occupation of this place by the Romans,—altars, portions of the great temple of Minerva, sepulchral remains, coins, and various other articles of interest;—nor need I stop to point out the numerous ancient mansions, churches, &c., to be met with in more distant rambles from the city. They are too well known to require mention, and they have been mostly already visited by the Club, and in many instances well described and illustrated by our valuable member, the Rev. H. M. Scarth, to whom the public are so much indebted for his labours in this department.

But leaving the subject of Antiquities, I pass on to other matters of which I think the Club might take cognisance. I conceive everything connected with topography (taking a hint from the caravan of Dalecarlian naturalists before spoken of)—everything which throws light upon the manners of the people and their mode of life, either now or at any former period,—provincial words—etymology of the names of places—local sayings—obsolete customs—superstitions and so forth,—all this might be followed out as a legitimate object of inquiry,—in addition to what relates to the physical features of the district, its geology, or its natural history. And there is yet another subject I would recommend to the notice of any members of this Club, who are inclined to take it up,—and that is the climate of Bath and its meteorology. When we consider how much Bath is resorted to by invalids—availing themselves, in the winter especially, of its undoubtedly milder climate at that season—it is of much importance that we should know on far better data than any we possess at present, or which at least have been made public, what is the exact difference between its mean temperature and that of other places lying farther either to the E. or W.—not merely in winter, but at each respective season of the year—taken in connection with its mean rainfall and humidity, nor overlooking the position of the city, situated as it in a bason surrounded nearly on all sides by lofty hills, which must have some effect upon the circulation of the air and the state of the atmosphere, in a sanatory point of view. It would take me too much away from the immediate purpose of this address to go into details on this subject:—I will simply remark that very erroneous notions are entertained respecting the climate of Bath, persons often imagining that beeause it is milder than many other places in winter, it must necessarily be very hot in summer, attributing its relaxing character at that time to a higher temperature than it really possesses—instead of to other causes, which, in my opinion, exercise a more decided influence that way.

I have thus touched upon the principal matters of inquiry which I think might fairly come under the consideration of this Club. I proceed now to speak of the second object these Clubs have in view, viz., the bringing together men of the same pursuits. I presume it will be generally allowed that men's minds profit much by a mutual interchange of ideas on subjects they study in common. Each learns something from the others, or has his mistakes corrected, while he imparts something to them in return. Advantage arises even out of the collision of opposite opinions which sometimes takes place on the comparison of their respective views. Truth is never so surely elicited as when those who have long held opinions, which in their own estimation rest upon a firm basis of facts, are compelled to reinvestigate questions, and to judge by the light thrown on them by others. But it is especially to students of science that this intercourse with others is so valuable. When working alone, we know how apt they are to flag at times from the want of fellow-workers to encourage them in their researches;—or if, from an ardent love of the pursuits they have taken up, they need no such stimulus to keep them to the mark, they yet fall short of what they might accomplish, if they had others at hand to direct or assist them in any particular inquiry. These Clubs (and the remark applies equally to Natural History Societies, and all gatherings for scientific purposes) have sometimes been the means of bringing men into notice, who might otherwise have remained all their life in obscurity, unknown perhaps even to some following up the same pursuits in the same neighbourhood. This is one of the good results that has arisen out of the yearly meetings of the British Association. Almost in every town in which that body has met for the first time, men, whose names were before quite unknown in the ranks of science, have come forward on the occasion of the meeting being held in their native place,—have attached themselves to the section that dealt with the particular subjects they studied, and gained for themselves a standing and reputation

which they have kept ever afterwards, and greatly to their advantage in the further prosecution of their researches. It is by being thus brought into contact with the scientific world, that men see and learn what others are about as well as themselves; that they discover, in some instances, that what they had supposed new is well known,—that they are made more thoroughly acquainted with the present state of our knowledge in any given department of science, and that they are kept back from putting forth views and opinions not thoroughly matured, or which need further sifting, such as can in no way be got better than by being made the subject of public discussion.

They also get enlarged views by having their attention drawn to other branches of Science beside that which they themselves study.

These are days in which the sciences are fast advancing towards higher generalisations than they have ever yet attained to. The most intimate connection is found to exist amongst them, so that a student cannot successfully follow up one without knowing something of the others. There is a correlation of the physical sciences, and there is a correlation of the natural sciences. Even the physical and the natural sciences seem to find a bond of union in chemistry, which has to deal with inquiries relating to both. For while chemistry investigates the nature and constitution both of organic and inorganic substances, it has at the same time to consider the influences of those subtle agents,—light, heat, electricity and magnetism,—upon the ultimate particles of matter, employing, too, formulæ of an algebraical character, by which to express more precisely the results of its analyses. Chemistry, again, is closely connected with mineralogy; insomuch that the latter is now considered by many as more properly a branch of chemistry than as a distinct science: yet mineralogy, in all that relates to crystalline forms, is dependent upon geometrical laws, and requires, on the part of the student, some knowledge and application of mathematical reasoning as indispensable.

With the Physical Sciences this Club has nothing to do. But confining ourselves to the Natural Sciences, all who attend much to them must be struck with the mutual bearing they have on each other. From Mineralogy, already spoken of, there is an easy passage to Geology. But Geology is entirely dependent upon zoology for ascertaining the true characters and structure of those fossil organic forms, which abound more or less in all rocks and strata from the highest nearly to the lowest, and which help mainly to determine the relative ages of that succession of beds which form the crust of our earth. With respect to the affinities existing between the several classes of animals, as also between the several families of plants,—and what is yet more between plants and animals themselves,—it is enough to say that the species, and even the higher assemblages of forms, often pass so insensibly into each other, that it is hardly possible to determine where one group ends and another begins; and when we come down to the lowest forms of all, we find the two kingdoms so closely connected, that there are instances of the same forms having been regarded, first as animals, and afterwards as vegetables, or the contrary. There are some mammals allied to reptiles in certain parts of their internal organisation, others taking much after the form of fish and allied to them in habits; —there are birds possessing some of the characters of mammals, and departing considerably from the ordinary type of the ornithic structure;—there is the *Lepidosiren*, so completely intermediate between reptile and fish, as to have led to a controversy among naturalists as to the class to which it really belongs, and, joined with other considerations, to have induced one of our first authorities, Professor Owen, to propose the actual uniting of these two classes, on the ground of their having so many characters in common. Lastly, there is that most extraordinary fossil form, only recently discovered—the *Archæopteryx*, from the Solenhofen beds of Pappenheim—at first considered by Wagner as a feathered reptile, but now thought by Professor Owen to be a bird, though

exhibiting characters which separate it from all birds known hitherto, it having a long vertebrate tail, and apparently other characters equally exceptional, but which are not at present capable of being defined with accuracy, from the imperfect state of the remains of the only specimen hitherto examined.

The above remarks are in reference to the vertebrate division of animals; but they apply equally to the invertebrate, the several classes of which seem in like manner to be all connected by osculant forms, while there is a genus of fishes,—the *Amphioxus* of Yarrel found on our own shores,—so low in its organisation, and with the vertebral column so imperfectly developed, as to present more the appearance of a mollusk than a fish, and actually to have been classed with the mollusca by one naturalist (the celebrated Pallas); thus showing that even the two great divisions of Vertebrata and Invertebrata have no such clearly defined boundary between them as might have been supposed.* We know yet further the bold hypothesis of one of the most philosophical naturalists of our day,—not entirely unsupported by facts, nay, with a large body of facts in its favour, though certainly not proved, nor capable of being proved,—that all the different forms of mineral and vegetable life may have sprung originally from at most but a very few primitive germs, which, by continued development under constantly altering conditions of life through a long succession of ages, have given rise to all the different species and varieties we see at the present day, whether in the fossil or living state. Into these speculations we will not enter. I only mention them in connection with what I previously stated,—to show how necessary it is for the student of any particular department of Natural History to be acquainted in a general way with all the other departments. Whether the several species of animals and plants have had an independent origin or

---

* The above remark applies to outward form alone, for there is no doubt as to the *Amphioxus*, in internal structure, being a true Vertebrate.

not, they show mutual affinities often of the closest kind. It is quite impossible to string them altogether in one straight line reaching from the lowest to the highest as was formerly supposed: they rather form a complicated network, radiating and branching out in all directions, each species showing relationships more or less striking to a multitude of others. They are all subject to the same general laws of organisation; and there are certain first principles of life and structure, as well as of classification, which apply to all alike, and which must be understood by him who desires to investigate their natural history with any hope of success.

A general knowledge of science in all its branches is advantageous to the student in another way. It is calculated to remove that narrow-mindedness which sometimes attaches to those who confine themselves to one department of it exclusively. The physicist has occasionally looked down upon the naturalist as devoting his attention to objects of inferior consideration to those which he himself studies. Even among naturalists, those who have chosen for themselves the study of the higher animals have sometimes underrated the labours of the conchologist and entomologist, and yet more the researches of others, who, perhaps, give all their time and attention to the investigation of the minute infusoria, or of those most repulsive of all animated forms—the entozoa.

It may be true that, at the present day, feelings such as these are not entertained so much as formerly, and that men of whatever rank who devote themselves to science at all, are considered but as fellow-workers in a common field. But still there is a narrow-mindedness, which, without reference to others, may hinder us in our own studies, when too confined, in respect of the method in which we conduct them and the judgments we form. Naturalists, especially, who are only acquainted with one particular class of animals, have been frequently led to entertain erroneous estimates of the importance of certain organs and

characters, from taking a too limited view of structure in general,—or they have given their whole attention to little matters of detail which, though having a certain value, if too closely followed out, prevent their rising to those more general views of the relations of things which should ever be the aim of the philosophical student of nature.

I have spoken of the bond of union among the sciences in general, and among the natural sciences in particular. But not forgetting that this Club interests itself with the subject of Antiquities, as well as Natural History, it may be serviceable to show that even Antiquities,—though belonging more properly to the domain of history than science,—are not entirely disconnected from the researches of the naturalist. In all at least that relates to the antiquity of man, considered in himself, and in connexion with the rude dwellings and the rude implements which he provided for the supply of his necessary wants, sooner or later after his first appearance on this earth—one of the great questions of our day—the subject is closely mixed up with that of the relative ages of the beds in which remains of such occur,—and it is necessary to have the geologist at hand in some cases to determine the true position of these beds in the geological series. It was but the other day, as we are aware, that a discovery was made in the immediate vicinity of this city, which might have been lost to science, or its value much lessened from want of accurate knowledge of the facts of the case, but for an immediate inquiry into the circumstances by those whom we are accustomed to look up to as the first authorities in geology and antiquities in this place. I allude to the finding of a very ancient kyst containing portions of a human skeleton, buried at the depth of between four and five feet in the middle lias, above which there was a deposit of peat of the thickness of eighteen inches, and over that six feet of gravel. It is difficult, perhaps, to fix the date of the interment of these remains with any accuracy, but the long period of years required for the slow accumulation

of the peat and gravel above the lias, which must have been the top soil when the burial took place, throw it back to a very remote age, and give it an interest that leads us to hope it may shortly be made the subject of a separate communication to the Club.

And having, now, said thus much respecting the particular researches which this Club should endeavour to carry on, with a view to collecting materials for a complete Natural History of Bath and the surrounding country,—having also made some remarks on the sciences in general, and the advantages of association in our respective pursuits,—it is time that I should pass on to the consideration of the practical working of the Club —the way in which we may hope most successfully to conduct our labours, the way, also, in which we may best deal with the results obtained.

The plan which has been of late adopted respecting the excursions may, I think, still be kept to, viz., that of having from four to six (as judged desirable) field-days in the year, when we may hope for the largest attendance of members, the attendance of those especially who, from their professional engagements or other business, are unable to attend oftener, and more frequent meetings—weekly or fortnightly, as preferred—of the few who may wish, and who have it in their power, to join in a common ramble on the days appointed. On all these occasions the party, as I observed before, might either keep together, or break up into sections, for more unrestrained work in their respective departments, re-uniting at the end of the day, as thought convenient. The places to be visited on field-days, and the objects in view, should be arranged beforehand, and notice of the same suspended, as now, at the Literary and Scientific Institution, for the information of all. The directions which the walks may take on other days may be left to be fixed at the time by those who join in them, and they may carry out any plan, for the occasion, they please. Only I should hope they

would always remember they are to use their influence in promoting any inquiries which may add to our knowledge of this neighbourhood in respect of the objects for which the Club is formed, and lay their results before it at its appointed sittings. To-day is the first occasion on which the Club has ever met for the reading of papers, independent of its ordinary quarterly meetings for mere routine of business, and a question has sometimes been raised at these latter meetings as to the best way of bringing before the public any communications made to the Club which may deserve to have a wider circulation. On each of these points I will make a few remarks. The practice of the Berwickshire Club, I believe, with respect to papers, has been to have such as may have been prepared beforehand by any of the members read at the termination of each day's excursion, these excursions being five in the year;—and then, at the end of the year, the retiring President delivers an address, giving a general summary of what has been done, with a notice of the different places visited, at each meeting. This address, along with a selection of the papers read as above, furnishes matter for a yearly number of their Transactions, enough being collected in time in this way to make up a volume, which is printed by the Club for the use of its own members. I should say that all these papers, in respect of the subjects treated of, are more or less connected with the district, which forms the field of the Club's labours. It may be long before our Club arrives at this stage of activity; and perhaps it may never get to it. In the meantime, I should suggest that members who read papers which it is desirable to publish, be invited to send them to one of the periodicals of the day treating of that particular department of knowledge to which the paper relates, while any others—at least those which respect our own district—after being read to the Club, be carefully preserved by it for future reference. Members of the Club who, however they may like to join the excursions occasionally, prefer carrying on their own pursuits quietly by

themselves, or who find they can do so best when unfettered by the movements of a large body,—should be requested still to bring their results forward, to go towards a general collection of such materials as may, we hope, one day serve for a complete illustration of the Natural History, &c., of this neighbourhood.

I think, however, instead of adopting the practice of the Berwickshire Club, of reading papers at the end of each day's excursion, it would be preferable, for several reasons, to have independent meetings held for the purpose, as on this very day, and at this Institution, or elsewhere, and as often as thought desirable. We hardly know yet to what extent such papers may come in. If, with an increasing number of members, there should seem to be an increasing interest taken in the objects of the Club, and communications made to it more frequently the Club might merge into a Bath Natural History and Antiquarian Society,—still keeping up its field days, and everything going on as it does now, with the simple addition of a certain number of other days, fixed at the Anniversary or at the quarterly meetings, for the purpose alluded to. I think, at these sittings, preference should be given to papers relating to the Bath district, but after these have been read, or in the event of none such being brought forward, it might be left to members to make any communication to the Club they pleased, though not of a local character, or to exhibit any specimens of Natural History or Antiquities, which they thought might interest it, accompanied by remarks. With regard to the excursion days—whether the excursions be in or beyond the Bath neighbourhood —some notes should be kept by the Secretary of what is seen or done by the party collectively, and these might either be embodied into an address by the retiring President, delivered at the end of his year of office, as in the Berwickshire Club,—or they may continue to be read by the Secretary from his Journal of Proceedings each quarter, as hitherto done.

Gentlemen, I fear I have detained you rather long; and there

are still other matters to which I would have alluded had the time permitted,—especially the desirableness of having any specimens of particular interest or value met with in the Bath district, and relating either to its Natural History or Antiquities, deposited in the museum of this Institution. But I have said enough already; and to treat of this matter as it requires would necessitate my dilating a little on the subject of museums in general, which I reserve for another occasion, when I may perhaps bring it under your notice. What I have stated now is offered simply in the way of suggestions—so far as my suggestions may be of any service,—towards placing the Club upon a good footing so as to insure its usefulness, and stimulating its members to do what they can for promoting the objects for which it was originally established.

And let us not be discouraged if, for a time at least, we reap but little fruit:

"Est quadam prodire tenus si non datur ultra."

It is observed by the great Cuvier, that the "natural sciences are but collections of facts, and our theories only formulæ for embracing a large number of them: hence it follows, that the smallest fact, if well-ascertained, ought to be preserved,—since, if new, it may serve to modify our most approved theories; the most simple observation may overthrow the most ingeniously-constructed system, and open our eyes to a long train of discoveries, which had previously been concealed from view by received formulæ."*

With these words I conclude. We may not any of us attain to that high position in the ranks of science which Cuvier occupied, and which so many other distinguished men have earned by their respective discoveries as well in our own day as in times past. But we may do enough to entitle us to the thanks of those who

---

* Hist. des Prog. des Sci. Nat. tom. 1, p. 5.

take a common interest with ourselves in scientific pursuits. We may throw our mite into the common stock. We shall at least reap the satisfaction which never fails to attend the study of Nature; and even if our labours should not conduct to any great or important results, they will yet have the means of opening to us an inexhaustible fund of rational occupation and amusement.

RULES OF THE

BATH

Natural History and Antiquarian Field Club.

INSTITUTED FEBRUARY 18TH, 1855.

1.—The Club shall be called "THE BATH NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB," and shall consist for the present, of not more than Fifty Members; out of whom shall be chosen each year a Vice-President and Secretary, the latter acting also as Treasurer.

2.—The object of the Club shall be to make Excursions around Bath, with the view of investigating the Natural History, Geology, and Antiquities of the neighbourhood.

3.—There shall be Four Excursions during the Year, to be fixed at the Anniversary Meeting on the 18th February. A List of such Excursions, with the respective Places of Meeting, shall be suspended in the Vestibule of the Bath Literary and Scientific Institution. Such Members as feel disposed shall also meet every THURSDAY, at the Institution at 11 a.m.

4.—An Excursion may be changed on the Morning of the Meeting for that day only, if agreed to by all the Members present, but not for any other times, unless agreed to by the whole Club—Six Members to form a Quorum.

5.—The Hour of Meeting shall not be changed, except for the convenience of taking particular Trains, when it is arranged to go by rail to any place; in which case the altered hour shall be posted at the Institution, not later than 12 o'Clock on the Saturday previous.

6.—In arranging the Excursions, due regard shall be paid to Natural History and Antiquities, so as to secure an equal share of attention to each subject; with this view, when the same Excursion does not include them both, they shall, so far as practicable, be taken alternately.

7.—Meetings for the Election of Members, and for the transaction of other Business, shall take place quarterly.

8.—Special Meetings shall be appointed for the Reading of Papers, or Exhibition of Specimens, notice being given to the Secretary at or previous to any one of the Quarterly Meetings, by Members having such communications to make to the Club.

9.—Persons wishing to join the Club, may send in their Names and Addresses through any of the Members, and be admitted when there is a Vacancy, after being proposed at a previous Quarterly Meeting, if approved of by all the Members present.

10.—Any Member of the Club may invite friends to accompany them on the proposed Excursion.

11.—It shall be the business of the Secretary to take Notes of the Day's Excursion, and to draw up a Summary of the Year's proceedings, previously to the next Anniversary; he shall also see that the proper Notices of Excursions are suspended at the Institution and communicate with the Members by letter, when occasion shall require.

12.—A Subscription of Five Shillings shall be paid Yearly by each Member, to defray any expenses the Club may incur otherwise than by Journeys and Refreshments; this Subscription shall be considered due on the Anniversary.

President.

*Rev. LEONARD JENYNS, M.A., F.L.S., F.G.S.

Vice-President.

*Rev. H. M. SCARTH, M.A.

Secretary and Treasurer.

Rev. H. H. WINWOOD, M.A.

LIST OF MEMBERS.

Rev. THOS. STEELE, D.D., 2, Bathwick Street
*C. E. BROOME, Esq., Elmhurst, Batheaston
Col. W. L. TUDOR
*Capt. W. V. HEWITT, 24, Daniel Street
*CHARLES MOORE, Esq., 6, Cambridge Place
W. DOBSON, Esq., Oakwood, Bathwick Hill
Rev. H. N. ELLACOMBE, Vicarage, Bitton
H. WILLIAMS, Esq., 31, Henrietta Street
JOHN BARRETT, Esq., F.R.C.S., 13, Pierrepont Street
Rev. THOMAS JACKSON, 32, Sydney Buildings
Rev. GEORGE BUCKLE, Vicarage, Twerton
Rev. JOHN EARLE, Rectory, Swainswick
JOHN JOHNSTON, Esq., 1, Barnard Villas, Pulteney Road
Mr. J. P. TYLEE, 7, Bridge Street
Mr. CHARLES EKIN, 8, Argyle Street
A. B. BRABAZON, Esq., M.D., 12, Darlington Street
Rev. THOS. FURLONG, 10, Sydney Place
C. FOX, Esq., M.D., Brislington, near Bristol
Capt. HARDY, R.N., Kilkenny House, Sion Hill
W. LONG, Esq., 16, Lansdown Place, E.
Major NICKLE, 5, Lambridge Place
W. WYNNE, Esq., 2, Macaulay Buildings
Col. WYNDHAM BAKER, 12, Green Park
H. J. HUNTER, Esq , M.D., 22, Brock Street
General BURMESTER, Keynsham, near Bristol
Rev. W. H. JONES, Bradford, near Bath
C. J. PHIPPS, Esq., F.S.A., 5, Paragon Buildings
Mr. S. HAYWARD, 3, Bathwick Street
Rev. DE COURCY MEADE, Erin Cottage, Sion Row
J. LEMARCHANT, Esq., 17, Sion Hill
W. S. MITCHELL, Esq., St. George's Lodge
J. E. DANIEL, Esq., 1, Axford Buildings
Col. ST. AUBYN, 7, Great Bedford Street

Those marked thus * are original members.

Natural History Museums. *By the* Rev. Leonard Jenyns, M.A., F.L.S., F.Z.S., F.G.S.

(Read February 21st, 1865.)

Gentlemen,

In my address to the Club last year, I stated that it seemed to me very desirable that any specimens of interest or value which the Members should meet with in their excursions, relating either to the Natural History or Antiquities of the neighbourhood, should be deposited, parties being willing, in the Museum of the Bath Literary and Scientific Institution. I added, however, that in connexion with this matter it would be fitting to speak more at large upon the subject of Museums in general than I had time for then, which, consequently, I deferred to another occasion.

I propose now to treat of this subject, so far as it affects ourselves, and the interests of the Local Museum with which we are connected. In these days, in which Natural History pursuits meet with so much more favour than formerly, and collectors are so numerous, and almost every provincial town, nay, many a small village, has its own Museum,—it cannot be without its use to make more generally known the principles which have of late years been suggested, with respect to the formation and arrangement of Museums, by those who have had most experience in the management of such institutions. These principles have been adopted, and carried out with great success, in a few cases, and they recommend themselves to the notice of all persons wishing to establish Museums in their own neighbourhoods.

It may be well to preface this subject with a few remarks respecting the beginning of Museums, at least in this country, so far as history has handed it down to us,—the feelings and motives which seem to have originally led to collecting objects of Natural History,—and the changes which have gradually come over Museums, due to the progress made in the Natural Sciences in modern times. This of itself will assist in forming our ideas respecting the best plan for a Museum, and the rules that should guide us in the selection of objects to be exhibited in it.

I need hardly remind my hearers that the word Museum, which is of classic origin, has a much wider meaning now than it had at first. The term literally signifies "a place dedicated to the Muses;" and it seems to have been applied in the first instance to buildings set apart for literary purposes, either for study or for the reception of such literary works as the ancients possessed. In more modern times the word came generally to signify respositories of art, or any institutions, whether public or private, in which were to be found collections of statuary, paintings, antiquities, or other objects, serving to illustrate different branches of knowledge and research. And it was probably so used before any special collections of Natural History had been yet formed, or any taste for collecting in this department of science had yet shown itself. Now, however, as we are aware, the word is more commonly understood in reference to assemblages of natural objects, though still occasionally applied to collections in the fine arts, &c., as formerly. Indeed nature and art have often been united to give interest and value to some of our public institutions, as in the case of the British Museum.*

When collectors first turned their attention to objects of

---

* See more on this subject in an Essay read to the Ashmolean Society, by the late Mr. Philip Duncan, entitled "History of Museums," from which assistance has been derived here.

Natural History is rather uncertain. It is not unlikely that a taste for collecting natural curiosities first arose out of the circumstance of so many different animal and vegetable substances having been got together for medical purposes at an age when all the kingdoms of nature were alike ransacked to find ingredients for the nostrums then in vogue. The more rare any thing was, and even sometimes the more nauseous and revolting in regard of the source whence it was derived—the more it was valued for its supposed occult virtues in the healing of diseases. Hence the study of Natural History, so far as it was studied at all, to a certain extent came to be associated with that of medicine, and it is remarkable how many of the older naturalists in this country, more especially botanists, or herbalists as they were not unfrequently called, were medical men. The contents of the Apothecary's shop seem to have furnished the first nucleus for a Museum; as in like manner the garden of simples grew up into what was afterwards termed the Physic Garden, this latter giving rise to our modern Botanic Gardens. Thus the gardens at Chelsea, founded by the Company of Apothecaries, in London, in 1673, were formerly so called. The same name of Physic Garden was, within the memory of many now living, given to the Botanic Garden at Cambridge, it being for the more especial use of medical students. The same in the cases of the gardens at Oxford and Edinburgh.

We remember Shakspeare's description of the Apothecary,

> "in whose needy shop the tortoise hung,
> An alligator stuff'd, and other skins
> Of ill-shaped fishes, and about his shelves
> A beggarly account of empty boxes,
> Green earthen pots, bladders, and musty seeds,
> Remnants of pack-thread, and old cakes of roses,
> Were thinly scatter'd to make up a show."
>
> *Romeo and Juliet.*

This description was probably characteristic of the age in which Shakspeare lived, and a taste for amassing such curiosities may

have afterwards extended itself, dissociated from the purpose for which they were stored up in the apothecary's shop. Persons may have been struck with the objects and specimens thus incidentally brought under their notice, and have taken a fancy to collecting such things for their own amusement.* Most of the old collectors seem to have been of this class. The more rare and extraordinary the specimens were the more they were prized, and absurd sums often paid to get possession of them. No wonder that such pursuits, taken up without any reasonable end in view, should have sometimes met with ridicule from the rest of the world. Many of my hearers must be familiar with the humorous description of the will of a virtuoso in one of the papers of "The Tatler," written the beginning of the last century.† The writer after commenting upon "a sort of learned men, who are wholly employed in gathering together the refuse of nature, if we may so call it, and hoarding up in their chests and cabinets such creatures as others industriously avoid the sight of"—proceeds to mention how the virtuoso disposed of all his natural rarities and curiosities,—to whom he bequeathed his butterflies and shells,—who was so fortunate as to get possession of his receipt for preserving dead caterpillars, and his preparation of embryo-pickle,—who had his last year's collection of grass-

---

* This was probably the case in foreign countries as well as in England. Flourens, in his life of Blumenbach, remarks—"the old Germany, with its old chateaux, seemed to pay no homage to science; still the lords of these ancient and noble mansions had long since made it a business, and almost a point of honour, to form with care what were called Cabinets of Curiosities." And he speaks of Blumenbach as having come "and reclaimed these treasures in the name of science;" Natural History beginning everywhere from that time (in Germany) to have its Museums.—"Life and works of Blumenbach," edited for the Anthropological Society, p. 55.

† Vol. IV. No. 216. August 20th, 1710.

hoppers,—who his English weeds pasted on royal paper,—who his skin of a rattlesnake, and mummy of an Egyptian King, besides other rarities enumerated, the names of which would hardly suit modern ears.

This satire is perhaps still applicable to a few persons, who, even at the present day, have a passion for collecting curiosities, without a thought or purpose beyond getting together every thing uncommon or odd-looking that comes within their reach. But the mere virtuoso, in the department of Natural History, is now comparatively of unfrequent occurrence. The scientific naturalist has taken his place. Since the sciences have been more generally cultivated, men's minds have become enlarged, and they have felt a desire to know something more of nature's works than is to be obtained by idly gazing upon a motley heap of strange objects accumulated in the cabinets of the curious. Hence the formation of Museums on strictly scientific principles. By a display of the various productions of nature, arranged according to their structure and affinities, or with a view to some useful or educational purpose, they become valuable accessories to our knowledge, while they tempt men of inquiring minds to enter upon a study, having great advantages to recommend it, which otherwise they might never have been led to take up.

The first person said to have "made any considerable collection of objects of Natural History in this country" was John Tradescant, "by birth a Dutchman, who is supposed to have come to England about the end of Queen Elizabeth's or the beginning of James the First's reign." His Museum, which attracted much notice, and which was enriched by the donations of various benefactors, went by the name of Tradescant's Ark. On his death, it was inherited by his son of the same name, who seems to have taken as great interest in Natural History as his father, and by whom the Museum was exhibited to the public

at South Lambeth, a catalogue being published of its contents, a small volume now of considerable rarity.*

On the death of the younger Tradescant, which took place in 1662, this Museum passed by bequest into the hands of Elias Ashmole, who had lodged in Tradescant's house, and who gave it to the University of Oxford. There it has long been preserved under the name of the Ashmolean Museum, kept for many years in a separate building raised on purpose for it "under the superintendence of Sir C. Wren," but now finding a place, at least the Natural History portion, in the new Museum which the University has lately erected, and where various other collections have a standing with it. Thus the first Museum got together in this country still exists, retaining its original reputation, though the name of its founder should never have been set aside for that of Ashmole, its subsequent possessor.

Another collector of note in the 17th century, and deserving mention from the circumstance of his having been an apothecary, and thus affording an instance of the study of Natural History being associated with that of medicine, was James Petiver. He is thought to have been a native of London. He was apothecary to the Charter House; and he is said to have been "one of the very few after the Tradescants who made any considerable collection in Natural History. He engaged the captains and surgeons of ships to bring home specimens and seeds of plants, birds, stuffed animals and insects; and he directed their choice, and enabled them to judge, in some measure, of proper objects, by distributing printed lists and directions among them."†

The celebrated Sir Hans Sloane, who combined the same two pursuits, being both a physician and a naturalist, belongs to this period. He bought Petiver's Museum, for which he is said to

---

* Museum Tradescantianum, or a Collection ef Rarities preserved at South Lambeth, near London. 12mo., p.p. 183. London, 1656.

† Pulteney's History of Botany, vol. 2, p. 32.

have given £4,000, thereby showing its great value; to this he afterwards added those rich collections which he had amassed in every department of Natural History, besides artificial curiosities, all which, being bequeathed by him to the public, along with his extensive library of books and manuscripts, formed the basis of our great national establishment,—the British Museum.

But it is not my intention to enumerate the various Museums got together for private use, or for the advantage of the public, since the time we have been speaking of to the present day. The principal among those existing during the latter part of the last century, or the early part of this, were that of the Duchess of Portland, an "eminent patroness of Natural History," among whose treasures of art was the celebrated Barberini vase, now in the British Museum, and more generally known by the name of the Portland Vase,—Sir Ashton Lever's Museum in London, which some still living may remember as one of the largest assemblages of natural objects ever before exhibited in this country,—William Hunter's "formed between 1770 and 1800, and now at Glasgow, the not less celebrated Museum of his brother, John Hunter, now at the College of Surgeons, Lincoln's Inn Fields,"—a Museum of British Zoology, collected by Donovan, author of several illustrated works on our native animals,—another by Sowerby, consisting of shells, minerals, and other objects,—Brookes's Museum of the skeletons of animals, birds, &c., in addition to stuffed specimens,—and lastly, Bullock's, comprising a large collection of natural and foreign curiosities, and especially rich in the birds and animals of South America. Of late years, as we are aware, Museums have become so general that there is scarce a provincial town in this country or abroad, entirely without one, whilst almost every working naturalist has his own private collection in illustration of that particular department of Natural History which he chiefly studies.

It is time then to pass from this part of our subject to the principles which should guide us in the formation and arrange-

ment of Museums intended for public exhibition, so as that they may yield the greatest possible amount of useful information, as well as entertainment, to the spectators.

And here I shall for the most part confine myself to remarks on Museums in country towns, which must be always more or less limited as to funds and space,—being dependent on a comparatively small number of persons for support and encouragement. I distinguish them from such large national institutions as the British Museum, in which more extensive collections can be got together, though in some measure the ends and objects of both are the same. These ends are—first, to assist those who are already more or less students of nature; secondly, to invite to the study of Natural History those who have any inclination to take it up, or who only need such an occasion as the sight of a well-ordered Museum affords to have their attention drawn to it; thirdly, to diffuse useful information on that branch of science to the public generally. Now in National Museums we expect to find, and we ought to find, everything known to exist in the several classes of the Animal, Vegetable, and Mineral Kingdoms, so far as they can be acquired. There ought to be one such establishment at least in the country to which scientific naturalists can resort for examination and comparison of specimens illustrating any particular researches in which they are engaged. It may be a question, in the case of such large Museums, how far it is desirable to have everything in full view properly arranged on suitable shelves, or whether it may not be preferable,—as well for the saving of room, as in respect of such plan serving equally well for scientific purposes,—simply to display the more striking and remarkable specimens, such as may be considered typical of all the larger groups of species, down to the genera or sub-genera, reserving for drawers and close cabinets all those closely-allied species, sub-species and varieties, which are separated from each other by such nice shades of difference as only the most practised eye can estimate, and which to the public generally must appear

almost like mere repetitions of the same form, serving only to distract the attention by their multitude. No doubt it is of great importance to collect and preserve the latter, however numerous they may be, for study and comparison; indeed we shall never otherwise be able to approach the solution of that vexed question as to what is really a species and what is not. But such a collection is only of use to naturalists who go into all the details of the science; and by them it can be consulted much better, when stored away in drawers as above alluded to, than when all the specimens are mounted in glass cases, conveying to the minds of ordinary spectators no definite ideas profitable for their instruction.

But it is unnecessary to pursue this inquiry, as also to speak of the method of arrangement of such select specimens, as it may be thought desirable to expose to the public view;—whether it be better to have them all on separate stands in large wall-cases with glass fronts, as in the Bird Gallery of the British Museum, —or in cases of a more limited size, each case containing a particular group, or adapted to the special purpose of illustrating certain species having a particular interest, from circumstances connected with their history, mode of life, the country to which they belong, or in some instances from their economic uses.

The whole of this subject was considered in full detail by Dr. Gray in an excellent address delivered by him as President of the Natural History Section of the British Association at its late meeting in Bath, and to it* I would refer all who interest themselves in the management of large public Museums, having for their object a general display of the animals of all countries, the only selection being that of the specimens to be brought forward, or kept back from open view, as it may happen, upon the plan suggested above.

---

* The above Address may be found in the volume containing a Reprint of the *Bath Chronicle* Reports of the Meeting, p. 52.

But there never can be more than a very few establishments on anything like the scale of the British Museum, with the zoological portion of which Dr. Gray is connected, and from which his experience is derived. If, therefore, we multiply Museums, and they cannot be multiplied too much, it is clear the generality of them must aspire to something less than a collection of all the productions of nature, animate and inanimate.

What, then, is to guide us in the formation and arrangement of those smaller Museums, which we may wish to set up in provincial towns and villages? It would seem that we must do one of two things; either get together everything we can without discrimination, until our building is full, and we give out to those who would be contributors that it will hold nothing more, or we must select certain objects and specimens, or certain classes of such, to the exclusion of others. Still it will not do, perhaps, to dismiss the first question in so summary a way. We must bear in mind with what motives and feelings persons are led primarily to enter Museums. And clearly the majority, at least among the uneducated classes, enter from curiosity. It has been stated above how formerly virtuosos formed collections of whatever they deemed curious in nature or art, apparently taking pleasure in the possession of strange or uncommon objects, apart from the consideration of any other of their characteristics. Now what shewed itself generally in the age in which Natural History was only just beginning to be studied as a science, will still shew itself for a time, we must remember, in individuals whose minds have not yet been trained to scientific research. Hence if we wish to attract men to the study of nature,—still more if we wish to wean them from other pursuits of a frivolous, or it may be of a debasing character, by engaging their attention with objects calculated to raise their ideas above those which have hitherto occupied their thoughts,—to ennoble and elevate their hearts also as well as their minds, we must in the first instance find something to excite their curiosity.

It was in this way that the late Professor Henslow acted in his parish of Hitcham in Suffolk, where, on first coming to reside, he found a large population of agricultural poor, not merely wholly uneducated but debased in morals, a large portion of them living in idleness and crime, or, if not joining in the misdemeanours of others, indulging together in the coarsest amusements. Where religious lessons would have utterly failed and have been thrown away, he worked an amendment by his resources as a naturalist. After talking to them kindly for some time, he persuaded them to come and see some of the natural and artificial curiosities which he had brought out of his Museum for them to look at. Of course, in the first instance, they stared not a little, as all ignorant and uneducated persons would, at the strange things set before them, such as they had never seen before. But this did not last long. The vacant stare gradually gave way to something better. After a few inspections of the Rector's curiosities, they began to take more interest in them, and felt a desire to know something about their history and uses. Thus the first difficulty was got over. From that time his people grew to be ameliorated in their habits as well as morals. In a few years these same poor not only became orderly, and alive to every kind of intellectual entertainment which the Professor served up for them, but they accompanied him in crowds in his parochial excursions to the Ipswich Museum (of which more presently), listened with eagerness to his "Lecturets," or short lectures of a few minutes each, which here, as on other occasions, he would deliver from time to time in explanation of what was shown them, until he received from their own mouths testimony as to the good effects wrought on them by such exhibitions, by their saying that their "heads would not be so full of drink, if they oftener had such things as these to occupy their minds."

Now these facts supply us with a useful hint. They suggest to us that in the first forming of our Museums we need not be over

fastidious as to what we admit into them. If curiosities—mere curiosities—are offered to us, it would be unwise, perhaps, to pass them over entirely, because of little or no scientific value, or not in keeping with the main objects for which our Museum is designed, —at least until we have something better to supply their place. We know not what may arise out of the preservation, for a time, of such specimens. The mere gazing at a stuffed alligator, a monstrous lamb, the tattoed head of a New Zealand Chief, or a relic of the Royal George, may lead to the development of a taste for the works of nature or art, which, but for such accident, might never have been called out. But evidently we must not stop here. Our aim should be not merely to gratify the curiosity, but also to instruct the understandings of those who frequent our Museums. Having therefore once got a few things together by way of beginning, we must, as soon as practicable, consider of a plan by which we can make our Museums of real service, as well to the public generally as to professed naturalists and the interests of science. We must set about introducing method and arrangement into them;—method, as regards the principle upon which, in the main, we are to form our collections; and arrangement, as regards the best displaying of our specimens for scientific and educational purposes. Our principle may vary with circumstances; or it may be carried out into more or less of detail, according to our means and according to the room at our command.

Let us suppose, which is the most common case, that we wish to have something to show in each of the three great departments of nature. What should we first endeavour to get together with this view? Now I think it will be generally allowed, as regards provincial Museums, we ought to make it our especial aim, in the first instance, to collect the productions of our own neighbourhood. These are what would have most attraction for residents in the district who are disposed to take up the study of Natural History, as well as what would most assist them in their pursuits. The first thing a man does who wishes to be more of a naturalist than

books can make him, is to go abroad and hunt the woods and fields and ditches within a walk from his house. What an advantage it is to such a man to have the animals and plants, the fossils and minerals, of the country around all brought together as much as possible in a public Museum, to which he can have free access, as well for the purpose of ascertaining what the neighbourhood produces, as for that of comparing the specimens he obtains with those preserved there. A man is seldom long a naturalist before he becomes a collector, and nothing helps him more in the naming and arranging of his own specimens than having a well-arranged collection at hand to consult; the same is also a great stimulus to him to endeavour to find something which is not in it, and which therefore may be supposed new.

But apart from the assistance thus rendered to local naturalists, is not a local collection just what strangers would expect to find in a provincial Museum? That is to say, whatever else the Museum might contain, would they not at least expect to see in it as complete an assemblage of the animal, vegetable, and mineral productions of the neighbourhood as could possibly be formed? Such undoubtedly ought to be found there. And if every provincial Museum were to make this its first and leading object,—to obtain well-preserved specimens of all the species and varieties of mammals, birds, reptiles, fishes, shells, insects, plants, &c., found within a certain distance of the town in which it is placed,—we should soon have, not only the very best materials for a complete Natural History of Great Britain, but, what is of further value, correct data for marking out the respective limits of distribution of our native animals and plants, a subject to which so much attention is now being paid. I need hardly add how greatly the Natural History Field Clubs, so numerous throughout the kingdom in these days, have it in their power to contribute to this end,—or rather how manifestly they seem called upon to do so,—the very title by which they are designated indicating the professed purpose for which they are associated.

What we do in the case of provincial Museums beyond getting together a local collection must of course depend on our resources. In very small towns and villages this is all that can be looked for. Perhaps it may be thought that no village is likely to attempt having a Museum at all. Yet there is an instance (and I believe not a solitary instance) of one in the village of Wimbledon, where a Museum was started a few years back on the very best principles, strictly confining itself to local objects, and giving great care to the proper arrangement of the specimens; with which, moreover, has been associated a small library of books on Natural Science, a record of interesting facts in the subject, and a Meteorological Register. I have not seen this Museum myself, but I have been told by those acquainted with it that it works well and fully carries out the purposes it has in view. The Treasurer of the Museum has also published a small work, in which he has detailed the plan upon which it has been established, given the rules laid down by the Committee, as well as furnished hints for the formation of Local Museums in general, which deserves to be consulted by all who are connected with such Institutions when necessarily on a small scale.*

Instead of being confined to the productions of the neighbourhood, a provincial Museum may be extended to the productions of Great Britain in general, if space allow, though it would be always desirable to keep the local specimens separate, or specially ticketed, so that they may be at once distinguished from the others. These are what naturalists from a distance visiting the place would most desire to see, in order to trace their relationships to the animals and vegetables of their own districts, and they would see them to more advantage if not mixed up with other collections.

---

* The title of the work is "Hints on the Formation of Local Museums." 12mo. London, 1863. One of the rules is that—"No object be received into the Museum, unless found within a radius of five miles from the parish Church."

But in respect to any more general collection, including foreign as well as native species, the principle upon which we ought to act, with a view to educational purposes, is to select from the immense field which nature opens to us, those specimens only which are severally characteristic or typical of the higher groups, —classes, orders, families,—taking in one or more of these groups thus represented according as our space allows,—but excluding all groups of lower value. Or, having formed a British collection, we may intercalate in the arrangement of it type-forms of those larger groups which contain no British representatives. Any considerable number of closely-allied exotic species would be here out of place. They only take up room which might be turned to a more useful account. It is very important that a commencing student of Natural History should have a general knowledge of the whole subject before entering upon any particular branch of it, but that is all he wants. And nothing could be more instructive than a Museum containing a well-arranged series of specimens, by which he might trace the various relationships existing between the larger and well marked groups of animals,—relationships of time as well as of affinity,—not only indicating, as we pass from one to another, the chief modifications of structure upon which are based our principles of classification, but exhibiting likewise, associated with living forms, those lost forms which preceded them in the earlier days of this earth. Or, if we wished to give a general idea of the geographical distribution of animals at the present day, we might select a single species of each class, order or family, in a given country, and then show their several representatives in other countries, thus affording a glance of the productions of the whole earth.

Dr. Whewell has remarked that it is classification, conducted on scientific principles, by which we "obtain fixed characters of the kind of things," that "renders exact knowledge and general propositions possible."* Bare "facts are" but "the materials of

* See "History of the Inductive Sciences," vol. iii., pp. 188 and 227.

science." Until they have been brought under some arrangement by which we can point out and rightly explain the several relationships between them, they are like raw material in the arts, as yet unworked up or fit for use. They add nothing to our scientific knowledge. Science consists in a due subordination of all natural phenomena to laws, rising continually to still higher generalizations until every observed fact shall find its place in the system.

Now this reasoning is not inapplicable to the objects in a Museum, collected, as we may suppose, for the advancement of the science of Natural History. Viewed apart from its congeners, a single specimen or species tells us nothing with respect to its affinities, its place in the creation, its mode of subsistence, or to what degree it is dependent for its support upon other species; these latter perhaps being themselves in like manner linked with others again, which play a more or less direct part in the economy of their life. If we would know all about an animal, we must see it in connection with a rightly-ordered series of other animals, some of which supply it with food, others with a habitation, or with the materials with which it constructs its own habitation;—we must have before us its friends and its enemies, the former indirectly tending to its preservation, the latter either ruthlessly attacking it from without, or inwardly consuming its vitals by concealed parasitism. And we only get a clear view and understanding of the ways and works of nature, when we see the mutual bearing in this way which one group of animals has upon another, and the marvellous balance, which notwithstanding the complexity of the whole system, is still so surely maintained, that it is only in the most gradual manner that particular species die out from time to time, retiring from the struggle of life when no longer wanted for the general good, and giving place to others adapted to the altered conditions of things under which their predecessors could no longer exist. Perhaps no plan for a Museum, or considered as part of its plan, would be more interesting or instructive, where practicable, than to get together in separate cases all that

helps to illustrate the history of the more remarkable animals, those especially which are serviceable to man in any way, or on the contrary destructive to himself, his crops, or some other of his possessions. Many such cases are to be seen in some of our Museums relating however chiefly to the class of insects; cases for instance, exhibiting the silk-worm moth in its stages of growth and transformation, along with other allied species likewise yielding silk of different qualities; cases of insects injurious to corn or timber, showing every part of their history, side by side with that of other insects appointed to keep them in check; insects forming the different kinds of galls, with specimens of the galls annexed; a series of the different species of moths that attack woollens; other cases got up in illustration of the habits of peculiar species, their mode of building their nests, &c. These cases, and others that might be suggested relating to the higher animals as well, would fall under the head of "special purpose" cases before alluded to. If, in addition to such cases, the student could see a general systematic arrangement of the productions of nature, not in all their details, but as represented by those type-forms which serve best to characterise respectively the chief groups, —so as to see the place which any particular species as above illustrated occupies in the system,—he would have Nature's book laid open before him in such a way as that he could hardly fail to read a large portion of its contents.

Reference has been made above to the Ipswich Museum; and if we would see a Museum in which the principles here advocated are carried out, perhaps more admirably than in any other existing similar institution, we should go there and inspect the well-chosen series of natural objects to serve for the instruction of beginners in Natural History, and the excellent arrangement of the whole establishment. "Beginning with the elements, so far as these are capable of exhibition in a Museum, the collection proceeds with the most important and characteristic simple minerals, models of crystals, rocks, fossils, and other geological

specimens, all chosen so as best to illustrate the order of strata, and arranged according to age; from these it passes on to the vegetable and animal kingdoms, every group being represented in its turn as far as practicable, and a model or drawing, or a tracing from some published figure, being introduced as a substitute in those cases in which no specimens of the required typical species could be procured." This was the work of Professor Henslow, a labour of love to which he devoted much of his time and attention; and his master mind has left us the Ipswich Museum as—itself a *type Museum*—a specimen of what other Museums should be, or should at least aim at. For the further guidance of those who assist in the formation or management of provincial Museums, he "drew up, at the request of the Natural History Section of the British Association, a Report 'on Typical Series of objects in Natural History adapted to Local Museums,' in which a list is given of such species and objects as form the best selection for such a purpose, the same having been supplied to him by different naturalists who had made different departments of the subject their particular study."*

The instruction to be derived from a Museum will depend much, in addition to the arrangement, upon the proper labelling of the specimens. This is a point not sufficiently attended to. We generally see specimens with nothing more on the labels than the bare name, or the country from which they come; whereas a few additional facts respecting their affinities, structure, or uses, or a short statement of anything remarkable in their history, would add greatly to their value, as well as to the amount of information obtained respecting them by visitors to the Museum. The Kew Museum of economic botany is an excellent example of such teaching, as applied to the various vegetable products available in the arts, and to the manufactures

* The above Report will be found in the volume of Reports of the British Association for 1855.

in which they are employed. And a similar plan might be adopted in every Museum, suited to the particular collections which it contains. Little gleanings of knowledge obtained in this way have the effect of stirring up the mind to further inquiries—either at home by the help of books, or in the fields by interrogation of nature herself.

In suggesting the above principles for the formation of local Museums, that I may not be supposed to set up my own judgment alone in this matter, it may be well to state that the same principles have been inculcated by men occupying a high position in the natural sciences, and that they are becoming yearly more and more assented to, as well as acted upon. Two other Professors, Forbes and Phillips, besides Henslow, have raised their voices against suffering our local Museums to become mere depositaries of whatever can be got together by gift or purchase, "until a heterogeneous assemblage of natural objects is amassed," serving no purpose beyond that of furnishing amusement for an idle hour, innocent amusement no doubt, but teaching nothing,—adding nothing to our real knowledge of nature. The late Edward Forbes, in a letter written in 1852 to the late Dr. Drew, of Southampton, "On the subject of Museums and the teaching of the Natural Sciences," after speaking of lectures, says:—"Much may be done in the way of imparting knowledge (of Natural History) by Museum arrangements alone, but very rarely do we find this systematically attempted. Provincial Museums are too often ambitious attempts at general collections, and, necessarily, failures. Too many of them are little better than curiosity shops. In their best aspect they are, with very few exceptions, far more costly and far less useful than they ought to be. I would have a provincial Natural History Museum (he adds), to consist of three departments, for which three spacious rooms, if properly constructed, would suffice:—1. *A local collection*, illustrative of the zoology, botany, and geology of the county or district. This, if done with

judgment, would attract visitors from far and near, and be equally interesting to residents and strangers.—2. *A teaching collection*, consisting of carefully-selected, well-arranged, and thoroughly labelled types of the classes, orders, families and leading genera of animals and plants, of the series of geological formations and their characteristic fossils, and of minerals—no superfluous specimens to be admitted.—3. *A miscellaneous collection*, including fine or rare specimens of exotic productions not necessary for the teaching collection, remarkable curiosities, and ethnological illustrations. There might be included, to render this division useful as well as curious, a classified trade collection, displaying the natural productions or sources of production used in commerce."*

Professor Phillips, writing on the geology of the Malvern Hills, in 1856, gives the following advice to the Malvern and other Field Clubs at Worcester :—"I would, if it were necessary, urge all persons belonging to Field Clubs, not selfishly to retain the specimens they gather, but to deposit them where they may be of use to their fellow-explorers. My experience of the friendly disposition of the officers and members of those clubs, assures me that here it is not necessary. But I feel justified in proposing a mode by which their liberality may become more effectually and permanently beneficial; I earnestly advocate and petition for the formation of an entirely local Museum at Malvern. Such an institution there would prove of the utmost value ;—it is not so easy to be established as may be imagined. Whoever has the charge of it will have difficulty except it be made a fundamental law, an invariable statute, to keep the Museum to its narrow but useful purposes. You will be offered curiosities from every land, trifles from every sea. I entreat you to refuse all but what is the growth of your own beautiful Malvernia, or the gift of your Palæozoic and Mesozoic seas.

* Life of Edward Forbes, p. 513.

Resolutely refuse to contend with larger communities, to adopt less definite objects. Have the courage to decline to accept any specimens whatever that do not actually belong to your own district. There is surely no reason why the British Museum should swallow up all the provincial institutions, and a district so exceedingly rich as Malvern ought to have a Musuem of its own."*

More recently, on the occasion of the Cambridge meeting of the British Association in 1862, Professor Huxley introduced the same topic, in his address from the chair as President of the Natural History Section, referring at the same time to the Ipswich Museum, which he designated as one of the best Museums in the world, from its carrying out the right principles upon which provincial Museums should be formed, and from its having avoided the errors of almost all similar establishments.

It will be noticed that the greater part of what has been said above is in reference to the formation of new Museums just rising into existence. It will generally be difficult to apply the same principles to Museums of long standing, where we already find large collections not in strict keeping with the rules laid down, and the building perhaps nearly full. All that we can do here is to make the best of the circumstances of the case, and to regulate what shall and what shall not be admitted into the Museum hereafter. Such is in great measure the case with the Museum of the Bath Literary and Scientific Institution, into which I invited the Members of this Club to bring the specimens they obtained in their field excursions. At the same time that Museum is not without some very valuable collections in illustration of certain departments of Natural History. I need but mention Mr. Moore's extensive series of palæontological specimens, acquired, for the most part, I believe, either in the

* The above is quoted in "Hints on the formation of Local Museums," p. 50.

Bath district, or at least in Somersetshire;—a geological collection in illustration of the beds characterizing the country round Bath, made and arranged by the late Mr. Lonsdale;—Mr. Field's well-arranged collection of Minerals;—and a very fair general collection of Birds, in which most of the leading groups are represented by a limited, but not badly selected, number of species. I have myself placed in the Museum a Cabinet of British Shells, and have lately obtained, as another addition, a small collection of the chief typical forms of British Zoophytes, through the kind help of a gentleman in the North of England, who has paid especial attention to the marine animals of our shores.

The Roman Antiquities of Bath, lately so well described by our Vice-President, the Rev. H. M. Scarth, occupying the porch and Vestibule of the Museum, find also a most suitable place in a local Institution of this nature.

What we most want in this Museum—I speak now of the department of Zoology—is a collection of the mammals, reptiles, fishes, and insects of the neighbourhood: a general collection of British insects I should never recommend, from the extent to which it would reach, and the difficulty in getting such a collection properly arranged and attended to. There should also be a series of the land and freshwater shells of Bath, which would occupy but little room, and which it would be desirable to keep distinct from the British collection above mentioned; likewise specimens of all other invertebrate animals belonging to the district, not referable to the classes of insects and shells.

Besides what has been enumerated, there is in the Museum of the Institution a large number of miscellaneous articles and specimens, admitting of little scientific arrangement, and having no connection with the neighbourhood. My own opinion is that these should not be suffered to increase, lest every available space in the building be lost for future collections, more serviceable to science and more appropriate to the place. Some

of them may hereafter be turned to good account, if it be ever found possible to get up a general series of type specimens; but for the present they must remain as they are—though all duplicates should be carefully weeded out, and either sold, or exchanged, or given away, as circumstances suggest.

It is some indication of the altered opinion at the present day about Museums, and of its being generally agreed that, except in the case of large national establishments, unless kept within certain fixed limits so that they can be properly displayed, or devoted to some special purpose, they serve little for the advancement of science—that many of the chief Natural History Societies in London, which, when first instituted, made it a part of their plan to have a Museum, have since abandoned the idea, and parted with the greater portion of what they once possessed. Even the Royal Society, when first established, had in view as one of its objects the formation "of a Museum of Natural Curiosities." With this end, the Society employed a collector, Thomas Willisel, a cotemporary with Ray, to search out for them "natural rarities, both animals, plants, and minerals;" for which purposes he is said to have been "the fittest man in England both for his skill and industry."* This Museum, which was preserved at Gresham College, and of which a Catalogue and Description were published in 1681, by Nehemiah Grew, one of the Fellows of the Society of that day, a curious old book illustrated by plates, and now not often met with,†—has been long since scattered.

Of recent years, the Zoological, the Entomological, and the

---

* Pulteney's History of Botany, vol. 1, p. 349.

† Its title is—"Museum Regalis Societatis; or, a Catalogue and Description of the Natural and Artificial Rarities belonging to the Royal Society, and preserved at Gresham College." Fol. pp., 386. Plates 22. Lond. 1681.

Linnean Societies, have all adopted the course of giving up either the whole or the greater part of their collections.

The Zoological Society began by restricting their collection, which had been originally intended "as a general collection of species," "to the illustration of genera only." This was in 1853; and accordingly portions of the Museum were from time to time disposed of as occasions offered. Subsequently, however, in 1857, they determined to "dispose of the entire residue," in consequence of the limited space in the Society's building, added to the conviction that since "the remarkable development for some years past of the Natural History department in the British Museum," "a second Zoological Museum in London was unnecessary."*

In 1863, the Entomological Society, though restricting its inquiries to the single class of Insects came to the resolution of parting with their entire collection, from the consideration that their funds were insufficient to enable them to form such a collection as should be "worthy of the Society, and for maintaining the same in a satisfactory state." Their insects were consequently all sold by public auction, with the exception of the type-specimens, which were transferred to the British Museum.

The very same year the Linnean Society also came to the determination of parting with their Museum, with the exception of the Herbarium, and other collections formerly belonging to the celebrated Linnæus (the whole of which came into the possession of the Society many years back), and a few other collections of special value, mostly botanical. Of the collections parted with, some were presented to the British Museum, others to public bodies in the provinces or abroad, and the rest sold.

Some parts of the statement put forth by the Council of the Linnean Society, embodying the reasons for adopting this course,

---

* Reports of the Council and Auditors of the Zoological Society of London. 1853, 1856, 1857.

may be usefully recorded here. They remark that "in the earlier years of the Society, numerous objects of Natural History, and several collections were presented to the Society, and received with the general and somewhat vague idea of forming a Museum. After a time, however, as the increasing number and bulk of these collections were rapidly filling up the Society's apartments, without any prospect of rendering the majority of them available for use, it became necessary seriously to consider the question of how these accumulations should be dealt with. It was at once evident that, with the extent to which investigations in Natural History are now carried out, the arrangement and maintenance of a general Museum of Zoology and Botany, in such a manner as to be really useful, would require a building, a staff of curators, and other expenditure, far beyond the means of the Society. Ten years ago, therefore, the Council, after much deliberation, laid it down as a rule for their guidance, that the income of the Society should be applied chiefly" to the more immediate purposes for which the latter was established; "and they thenceforward not only gave it to be understood that it was not the Society's object to form such a general Museum, but they actually declined several large collections which had at different times been offered. It having, nevertheless, again been brought to the notice of the Council, that in addition to the old stores, a gradual accumulation had taken place of isolated objects and small collections, and that the attics and garrets were full of parcels and cases which neither were, nor could be, of any practical use in their present state,"—the statement then adds—they determined to part with the main portion of their collections as above mentioned.*

Now, I trust it will not be supposed that I have entered into these details, respecting what has been done by other Societies, with the view of throwing any discouragement on the formation of Museums. I would simply wish, except in the case of large

* Proceed. of Linn. Soc., Apr. 16, and June 4, 1863.

National Museums, to see them restricted to certain specified objects, and so kept within manageable limits. It should be remembered that for Museums to be of any real value, the collections must be properly arranged in a building of sufficient size to show them to advantage. Unless this can be done,—unless, too, there are funds for keeping up the collections after they have been acquired, which can only be efficiently undertaken by a paid curator, competent to superintend, and able to give his whole time to the Museum, space and money are alike thrown away in vainly attempting more than our resources allow; whereas, on the contrary, by confining ourselves to what we might do, and do well,—and, moreover, as regards a collection of the productions of our own neighbourhood, ought to do,—our Museum may be of the greatest possible utility for the advancement of science.

And it is satisfactory to think that the establishment of provincial Museums has kept pace with the increased interest taken of late years in the natural sciences. As I remarked before, few towns are now without a Museum of some kind. If these institutions are not always faultless in principle and arrangement, still there are many deserving high commendation from the care and attention that has been bestowed upon them. Such Museums have undoubtedly had an influence in disseminating a taste for Natural History, and to them we must especially look for what remains to be done towards completing our knowledge of the Natural History of these Islands. To the middling and to the lower classes, and to young persons generally, Museums offer great attractions; and if, in addition to the rational amusement they afford, they serve, by a well-ordered arrangement of their contents and by a judicious labelling of the specimens, to convey instruction and useful information to the mind, they will assist in raising the intellectual standard of the age, and tend powerfully to do away with the gross ignorance still so prevalent in some districts. It is ignorance of the true habits of animals that encourages that wholesale destruction of them, which of late has been so prom-

inently brought before the public ;—in some cases, supposing them to be injurious when they are really of the greatest service to our gardens and crops ;—in other cases, accounting them as poisonous when they are quite innocuous ; inducing gamekeepers, in particular, too often with the full approbation of their employers, to shoot and trap, under the name of vermin, many animals which seldom or never touch game of any kind,—or wantonly and without any object whatever, to kill almost everything that comes to hand, which has led nearly to the extirpation of many fine and interesting species formerly abundant in this country.

But to enumerate all the mistakes so commonly made, and the vulgar errors so pertinaciously defended, even by persons well educated in other respects, with regard to animals and plants ;—the prejudices that exist against some species traceable to nothing but to popular dislikes handed down from generation to generation ; —the superstitions entertained about others,—their power to cause or cure certain diseases,* or to act as charms in keeping off evil spirits,—their being influenced by human prayers,—their foreboding good or evil according to the circumstances under which they appear,—would take up more room here than we can devote to the subject. It is sufficient to express a belief that these and such like lamentable fruits of ignorance would be greatly lessened by a little plain knowledge of Natural History, combined with a few other matters of useful instruction.

And to advance another step in setting forth the utility of Museums. If they serve not merely to remove ignorance, but to encourage a taste, in young persons especially, for the study of Natural History, so as to induce them to take it up, what a field of entertainment is thus set before them through life. It is the charm of science generally that it opens a way to the most

---

* See, as one instance, White's Natural History of Selborne, Letter xxviii to Daines Barrington. This superstition is said still to prevail in some places.

unalloyed happiness, from the agreeable occupation it affords the mind irrespective of outward circumstances. It furnishes a relief from the cares and anxieties of life,—a palliative to grief in seasons of affliction,—an escape from the depressing passions to which so many are victims who have no regular employments to engage their attention. And how especially true is this of a branch of science which throws open to its followers the whole domain of nature, from which to gather materials for study and research. Woods and fields,—rivers and swamps,—every pond and every ditch,—the mountain, and even what to others seems but a barren wilderness,—alike spread for the naturalist an intellectual treat rich in objects of interest to an inquiring mind. Amid these he finds his highest enjoyment. He is never alone,—never tired; though away from the haunts and society of man, he finds companions in the many marvellous forms of animated life around him,—they remove all feeling of solitude,*—they take away all sense of ennui and fatigue. There have been those whose lot it was to reside in the most inhospitable regions of the globe, and who declared that nothing but the study of Natural History, and its inexhaustible supply of entertainment, could have reconciled them to the place. How much more must such studies add to the enjoyment of life when they can be followed up in the society and fellowship of those having the same taste as ourselves, and with the advantage of a well-stored Museum to aid us in our pursuits. How far superior are they to the ordinary amusements of the world; and if we can get the artisan or labourer to take them up—as why should we not,—will they not provide a healthy recreation in the place of those vicious pleasures which working men too often have recourse to fill up their vacant hours.†

* See Kingsley on the Study of Natural History. "Miscellanies," vol. 2, p. 366.

† See this subject taken up and illustrated in a popular way for young persons, in a small useful publication entitled—"The Village Museum; or how we gathered Profit with Pleasure." By the Rev. G. T. Hoare.

We may hope yet further that such pursuits might have a tendency to raise the mind to the contemplation of that Great Being, whose works laid before us in such profusion and variety, it is our pleasure to look into. It seems hardly possible to know much of the creation without caring to know anything of the Creator. If the study of science has not always been accompanied by devout feelings towards Him in whom all knowledge and wisdom originate,—if, in a few rare instances, it has even been associated with infidelity or atheism, it is surely not science itself that has led to this perversion of the understanding. The cause is to be sought elsewhere ;—in the natural disposition,—in the pride of intellect, fed no doubt by every accession of human knowledge, but not the knowledge of science more than that of other things,—in passions that have had their sway in biassing the mind towards unbelief,—in wrong training, or entire want of religious education in early life. Infidelity fostered in any of these ways might shew itself under any circumstances, and science may even here have an influence in ameliorating the heart and affections in other respects. We must judge of things by their general tendencies for good or for evil ; not by occasional deviations from what is right in the effects they produce, or seem to produce, any more than we judge of the normal structure of animals and plants by the accidental monstrosities we sometimes witness. Few, we apprehend, will dispute that the study of Natural History has a tendency in the right direction. It may be carried too far,—it may take up too much of our time and thoughts, and so lead us away from concerns of higher import. But the same is true of every earthly pursuit not immediately connected with the subject of religion. We have, moreover, the highest encouragement to enter upon this study. We read that " the works of the Lord are great, sought ont of all them that have pleasure therein." And when sought out in a right spirit ;—when we are not morally blind to discern the hand of Providence still watching over and sustaining the things that

it has made—a Providence without which "not a sparrow falleth to the ground;"—the study of those works can hardly fail to give us more enlarged views of the wisdom and goodness and power of the Almighty,—to prepare the heart for better and higher aspirations than any to which the world prompts, and to cause it to look forward in hope to the not distant day when all things shall be created anew, and when unmixed good and happiness shall flow from our ever-increasing knowledge of "Him, in whom we live and move and have our being."

Summary of Proceedings of the Bath Natural History an Antiquarian Field Club for the years 1865-6.

Mr. President, Vice-President and Gentlemen,

The continued increase in the number of members indicates that there is no lack of interest in the proceedings of the Club. Whether the object for which it was founded has been attended to—viz., the investigation of the Natural History, Geology and Antiquities of the neighbourhood—the summary of proceedings for the past year, which the Secretary presents to you, can alone show.

The four Excursions fixed at the last Anniversary have all been carried out, with the exception of that to Silchester, which at the wish of the members expressed at one of the Quarterly Meetings was indefinitely postponed. The first of the season, to Wantage, the Berkshire White Horse, and Uffington, was a success in every way, due chiefly to the admirable arrangements made by Mr. Wasbrough for the transit and conveyance of the members. Under this gentleman's guidance the chief points of interest in the birth place of King Alfred were visited,—the fine Church with its massive Early English piers supporting the Tower—the bedroom in which Bishop Butler was born—and King Alfred's well (a crystal bath worthy of a King). Leaving Wantage the members proceeded in carriages to the foot of the Downs, and essayed a blast upon the blowing stone (a mass of perforated silicious sandstone, said to have been formerly used for sounding an alarm over the neighbouring country). The united efforts of all Bath were unable to produce a sound from the trumpet shaped hole. A native trumpeter, however, being found was more successful, and satisfied all present that when in its original place on the top of the Downs a most effective alarm could be raised. Taking the Ridgeway on the right, a

short walk along the broad and grassy Roman road conducted the members to Uffington Camp, a large space of ten acres enclosed in a parallelogram with deep ditch and steep vallum. Close at hand on the N. slope of the down was seen the White Horse renowned in story; the effect produced at a distance is entirely lost by close proximity, and it required more than a vivid imagination to discern the attitude of galloping, or even that it represented a horse at all. From the camp to the Cromlech called Wayland Smith's Cave, three-quarters of a mile; thence to the fine cruciform Church at Uffington with its octagonal Tower and consecration crosses on the exterior, and the train was taken at Uffington Road for Bath. The unusual beauty of the day, the fine air of the Downs, and the hospitality of Mr. Wasbrough, much enhanced the pleasure of the excursion.

The second excursion to Southern-down though attended by fewer members than usual was certainly by no means the least enjoyable of the season. An early start from Bath having been made, the swift little *Taff* conveyed the members through the grand Limestone gorge of the Avon, past the wooded slopes of Portishead, across the Severn to Penarth Roads, a glimpse being afforded of the Penarth beds on the left hand. After a short inspection of the Bute Docks under stifling dust and heat, the members took train for Llantrisaint and were only too glad to find themselves on the Welsh Hills inspecting the iron mines of Mwyndy; the richness of the hœmatite ore cropping up in such profusion around, indicating the wealth concealed only by the thick capping of New Red Sandstone above. The old Church of Three Saints (whence the name Llantrisaint) on its wind swept hill, having been inspected, the members joined the train for Bridgend, slept there that night, and the next day crossed the Ogmore for Southern-down, 5 miles distant. Ewenny Priory with its fine Norman Church was seen off the road to the left, nestling at the foot of the hills. A picturesque Limestone ravine, reminding one of the Mendips, led up to the elevated table land;

and the little hamlet of Southern-down perched on the high cliffs with its fine sea-ward expanse was reached. The remaining portion of a magnificently fine day was spent with our cicerone, Mr. Moore, in unravelling the geological problems which there abound. The members were taken by that gentleman to the "Sutton Stone" beds, which make their first appearance between the mouth of the Ogmore and Southern-down. Here was seen a rugged coastline of Carboniferous Limestone, with numerous sea-polished Producti, Spirifers, and Corals of that age. Resting unconformably on this ancient Limestone are thick-bedded Conglomerates, in which are numerous organic remains, consisting of several species of Corals, Pectens, Ostrœa, Cypricardia, Discina, &c., which were stated to be all new to science. Above the "Sutton Stone" proper was finely displayed along the coast section to the East a great thickness of thinly bedded stratified Conglomerates, but rarely containing organisms. Although lithologically so unlike what has usually been known as Lower Lias, Mr. Moore stated that these beds were really only abnormal conditions of the Lima series of that formation, and therefore of the same age as the Liassic beds of Weston and Twerton, near Bath. Passing from this point to the beds under Southern-down, the Lima beds in their usual condition are exposed, containing Ammonites Bucklandi, A. angulatus, and Lima gigantea, characteristic shells of that formation. To the Eastward of the point under Dunraven Castle, the "Sutton Stone" is again brought up, resting as before on Carboniferous Limestone, and in beds immediately above Mr. Moore again pointed out the presence of a Liassic fauna. The abnormal condition of the Secondary beds where they come in contact with the Carboniferous Limestones on the Mendips was alluded to, more particularly a section at Shepton Mallet, where Liassic beds, identical in lithological structure with those of the "Sutton Stone," are to be found; and as there were organic remains of the same species common to the two districts, the Shepton beds

help to unravel the difficulties which otherwise would have attended the determination of the age of the remarkable sections of Southern-down.

The energies of even the most active amongst the members being fairly exhausted, a halt was called on the sloping banks beneath Dunraven Castle, and the botanists enriched themselves with some rare plants, amongst others the Lithospermum purpuro-cæruleum (or purple grooms-well) and the Erodium maritimum, sea storkes bill (Witches point); and at Southern-down the Triticum loliaceum. At Bute docks, the Lepidium ruderale, Lepidium draba, and the Carduus tenuifolius were also found. A walk through the grounds of the Castle (which is a misnomer for a modern house) gave more leisure for the enjoyment of the fine views of sea and cliff, which stretch away on either hand. The intense heat of the day, scarcely modified even by the elevation of the Downs, was not however sufficient to detract from the pleasure of this the second of the year's excursions.

The third and last, which took place in the Autumn, to Montacute and Stoke-sub-Hamden, though well attended, cannot be classed among the pleasantest of the Club's Excursions. It will suffice to mention that the magnificently restored Church at Yeovil, and the general effect of Hardman's translucent glass windows were much admired. The brass pre-Reformation lectern delayed the members in decyphering the following Latin inscription :—

"Precibus nunc precor nunc eja rogate.
Frater Martinus Forester vita vigiletque beate."

The Abbey Grange at Priston, now a Farm House, on the way from Yeovil to Montacute, was visited. Ample opportunity was given to the members of most fully inspecting the imposing façade of the Elizabethan House, and meditating on the motto over the doorway :—

"Thro' this wide opening gate
None come too early, none return too late."

The remains of the Priory of Black Cluniac Monks, with its Gateway Tower covered with American creeper, tinged with autumn brown, was passed on the road to Stoke Sub-Hamden. Mr. Walters, an octogenarian antiquary of the neighbourhood, was the expositor of the peculiar features of the most architecturally interesting Church in the County of Somerset; and pointed out with the fondness of one who had spent many an hour inside and outside its walls, all the curious and multifarious details. A wet afternoon permitted only a glance at the well-known Ham Hill quarries, or the extensive Roman Camp on the summit of the hill—amphitheatre, vallum and ditch were, however, inspected under umbrellas by one or two of the more energetic—but the geological portion of the day was a blank; an amusing adventure on the road to Martock Station scarcely compensating for the dampness on spirits and outer garments from the persistent down pour.

The minor excursions and walks of the Club have been well sustained and of varied interest.

Amongst others may be briefly ennumerated a few of the principal ones :—

The White Horse, near Westbury, second only to that on the Berkshire Downs, was visited. Bratton Camp, close at hand, supposed to be British, with its double rampart and deep ditch, and the large oblong barrow in its midst, was crossed on the way to the grand old Abbey Church of Edington, the members returning to Bath *vid* Rood Ashton and Trowbridge. The Railway cutting at Pensford was the object of another walk, to inspect some bones of ox, dog, and horse, recently discovered in the Red Marl, twenty feet below the surface, and in the old bed of the river, during excavations carried out for the piers of a railway bridge, the bones of the ox and horse were remarkable for their small size; a curious brass thumb ring was also found here with two letters engraved, supposed to be Saxon. Bury Ditches or Bury Camp, near Colerne. At Bury Camp a curious

ornamented iron ring, overlaid with bronze, supposed to be Roman and to be the portion of some horse trappings, was picked up by one of the members, and is now deposited in the Museum of the Royal Literary and Scientific Institution. Ditteridge and the Box quarries, Monkton Farleigh (where the Secretary pointed out an "infilling" of rolled and angular flints in the Great Oolite, near Brown's Tower), the old Manor House at South Wraxall, Berkeley Church and Castle, and Keynsham, have all been seen; at the latter place, remains of the old Abbey, founded in 1170, have lately come to light, and a great quantity of carved stone work, finials, canopies, and fragments of the 13th century statuary with the gilding still remaining, have been found by the workmen and preserved by a builder close at hand, A portion of the Abbey with its encaustic tiles in good preservation, the beautiful green bordering as fresh as when laid down, still remains *in situ*.

The report of some astonishing discoveries of bones in the railway cutting under Maes Knoll led to an excursion in that direction, and the members were enabled to record the fact that they were the remains probably of some Roman soldiers, a Roman red earthenware vessel being found associated with them. The interments, three in number, were made about two feet beneath the surface, in the clay of the Upper Lias, which attains a considerable thickness in that part. The workmen considered one of the skeletons to be of unusual size.

And finally, the Club has been enabled through the kind assistance of antiquarian friends and others to uncover an extensive Roman Villa at Cold Harbour Farm, near Tracey Park, the proprietor of which had kindly given his consent to the work. Portions of two Hypocausts were exposed but no tesselated pavement. The villa, judging from the style of the masonry, appears to have been of very late date. Many curious articles have been found and much pottery, all of which are deposited in the Museum of the Literary and Scientific Institution of Bath. As our Vice-President, with the aid of Mr. Irvine, has promised us a paper on this subject further details are unnecessary.

A new feature has been introduced into the proceedings—viz., that of a ladies' day, which must not be omitted in the summary. The proprietor of Dyrham Park having kindly given permission, a party of the members and their lady friends were most hospitably and courteously entertained, shown the arcana of the house, and spent the rest of the day in wandering through the park and grounds, all the members returning to Bath with pleasant recollections of the "Ladies' Day." The Secretary takes this opportunity of stating that the reminiscences of that day having proved so agreeable, if the Members are desirous that it should be repeated, he will be most happy to make the necessary arrangements.

That Churches of architectural interest have been visited during the year, the following enumeration will show. The list comprises those of Westbury, Bratton, Edington, West Ashton, Trowbridge, Wantage, Uffington, Montacute, Yeovil, Stoke-sub-Hamden, Priston, Publow, Pensford, Camerton, Keynsham, Whitchurch, Ditteridge, Colerne, Box, Cold Ashton, Marshfield, Monkton Farleigh, and several other more distant ones.

At the Afternoon Meetings for reading papers and the exhibition of specimens several valuable communications have been made. The President commenced with an instructive address on Natural History Museums, with especial regard to those in country towns.

One of our members, Mr. Daniel, communicated a paper on the "Atax ypsilophorus," a parasite found in the river mussle which inhabits our canal, there being associated with it specimens of what Mr. Daniel considered a distinct and new species.

These Meetings being so thinly attended, it was thought advisable to change the time of meeting. Through the kind consent of the Committee of the Literary Institution and the co-operation of that of the Philosophical Association, the Members have been permitted to hold four Evening Meetings during this session in the large room of the Institution. The first evening

conversazione was held last month, when a very able and interesting paper was read by the President on the "Migration of Birds." The attendance was very fair considering the state of the weather, and several members took part in the conversazione afterwards.

Bath, March, 1866.

On the Phosphatic Nodules obtained in the Eastern Counties, and used in Agriculture. By the Rev. L. Jenyns, M.A., F.L.S., F.G.S., &c., *President.*

Gentlemen,

When you see some of the specimens I have here to illustrate the lecture, which I have the honour of delivering to you this evening, you may be disposed to regard them as mere lumps of indurated marl or small stones which might be picked up anywhere, and be led to ask of what value they can be, or of what use to anyone. But when I tell you that they have been the means of putting many thousands of pounds into the pockets of landed proprietors in the Eastern Counties,—that they have, at the same time, not only improved the value of land, but, in many instances, the condition of the labourer,—moreover, that, in certain districts, they have altered the whole face of the country, honeycombed it with pits and trenches for the excavation of these nodules, leading to the temporary erection of steam-engines and mills to facilitate the various processes by which they are obtained and prepared for the uses to which they are to be put; thereby giving the country quite another character in the eyes of those who remember it as it was formerly,—when you hear all this you will begin to think these small stones have a story to tell worth listening to, and you will, I trust, be ready to hear what I have to say respecting them.

The subject of these nodules,—which have been termed *phosphatic* from their containing a large per centage of phosphate of lime,—may be considered in two points of view, a geological one and an economic or industrial one. In reference to the first, I shall not say much more than is necessary to give you an understanding of the sources whence they are obtained, being chiefly anxious to state under what particular circumstances they were first brought into notice, and the important results to which they have led in some of the eastern counties, more especially Cambridgeshire and Suffolk.

The discovery of these nodules, or rather the application of them to Agricultural purposes, is due to the scientific acumen of the late professor Henslow, whose name was so familiar to the naturalists of his own day, and who was so deservedly esteemed for his many excellent qualities by all who had the happiness of knowing him.

Professor Henslow had the living of Hitcham in Suffolk. He was a most watchful observer of nature, one whose eyes were always on the look out for anything new, and whose mind was especially set towards utilizing and turning to account what he met with, for the good and improvement, moral as well as intellectual, of those among whom he lived. His parishioners naturally came in for the full benefit of his varied and extensive knowledge, and he took an especial interest in his farmers, often bringing his science to bear on their operations in the field.

It was as long back as in 1842 that Professor Henslow first had his attention drawn to these nodules, of which I am about to speak. Going down with his family, in the autumn of that year, to spend a few weeks at Felixstow, a small watering place not many miles from the extreme southern point of the Suffolk coast, he naturally on his arrival, as an old geologist, was led to examine the Red Crag, a bed largely developed in that neighbourhood.

For the sake of such of my hearers as are not geologists, I may observe here that this formation is one of the Tertiary beds, the newest, with the exception of the Post Tertiary and those alluvial beds in course of formation at the present day.

The Tertiary beds are subdivided into Eocene, Meiocene, and Pleiocene—these names indicating their respective characters as derived from the proportion of recent shells found in them (or species still living) compared with the number of those which are now extinct.

In the Eocene, or oldest of these beds, the per centage of recent shells is extremely small; in the Meiocene, the recent species are rather more numerous, but are still in a minority; in the Pleiocene they are so much increased as to constitute the majority.

The Red Crag of Suffolk is one of the older beds of the Pleiocene formation. "It consists chiefly of quartzose sand, with "an occasional intermixture of shells, for the most part rolled, "and sometimes comminuted, and is distinguished by its deep "ferruginous or ochreous colour from an older and lower bed of "Crag, commonly called the White or Coraline Crag."

It was in this Red Crag that Professor Henslow first noticed the occurrence of certain nodules or concretions, abundantly interspersed among the comminuted shells which form the upper part of the cliff. They were extremely hard, and presented external indications of an animal origin. He was much puzzled to account for them; and on a second visit to Felixstow, during the summer of 1843, he gave them a further examination. The December following, at a meeting of the Geological Society, he exhibited a series of specimens of these nodules, pointing out their several peculiarities, and the various forms under which they appear.*

---

* Proceed. Geological Society, 1843, p. 281.

As I before intimated, Professor Henslow was not the first to discover these nodules; in fact they abound throughout the Tertiary formations of the Eastern Counties, and had been long known to geologists. Nor was he the first to analyse them; this had been already done by Mr. Potter. But it is believed that he was the first to see the uses to which they might be put in agriculture.

This idea was brought forward in a communication to the British Association in 1845, three years after his first visit to Felixstow, in which he suggested that they might take the place of bones, from which the phosphate of lime used as a manure had up to that time been obtained, but of which the supply of late years had become insufficient. After reverting to the subject of the Crag nodules, he goes on in this memoir to say that "Mr. "Brown, of Stanway, had subsequently obtained several analyses "of these pebbles, and also of similar nodules obtained from the "London clay (one of the older Eocene beds) in the vicinity of "Euston Square; and that he had found the same amount of "phosphate of lime in all, viz., 50 or 60 per cent. in each. The "Crag pebbles (he adds) occasionally contain remains of small "crabs and fish, like those in the London clay, leading Mr. Brown "to the conclusion that they were derived from the destruction "of certain beds of that series. The Crag nodules were so "abundant that a gentleman had obtained two tons of them, "which after being prepared, were found upon analysis to "contain 53 per cent. of phosphate of lime, 13 of phosphate of "iron, and the remainder carbonate of lime and volatile "matter."*

Two years later (1847) Professor Henslow read a second paper to the Geological Section of the British Association on the subject of the Crag nodules having been derived from the London clay. He says: "he had at first considered them as of

* Report of British Association, 1845, Sect. p. 51.

"Coprolitic origin, but that it had since been satisfactorily "shewn that they were detrital materials from the bed just "mentioned. The Crag nodules (he states) only differ from "those of the London clay in having been slightly rolled and "somewhat modified by having had a portion of iron pyrites "converted to oxide of iron." Professor Henslow then goes on to say, that the "Cetotolites described by Professor Owen, numerous "fragments of bones, and many highly mineralized fossils found "in the Crag, must be classed as detrital materials from the "London clay. The genuine Crag fossils are readily separable "from those of the Eocene period by their not being mineralized, "and such is the case with fish bones, crustacean and other "remains, as well as the testacean shells so abundant and well-"known in the Crag."*

As I have no knowledge from any observations of my own respecting the true origin of these nodules, I have thought it better to state what I have just mentioned, in Professor Henslow's own words. The formation of the nodules themselves, to whatever bed they rightly belong, is due to the aggregation of earthy particles round the organic remains with which they are mixed up, at the time the bed was deposited, these animal remains serving as a nucleus (like the sponges, &c., in flints) and favouring the aggregation by the chemical changes attending decomposition. The Cetotolites alluded to in Professor Henslow's paper just quoted, have a degree of interest in connection with this subject, from the circumstance of their having been discovered by him at the time that he was examining the Red Crag in search of these nodules. They are the petro-tympanic bones of whales' ears in a fossil state, as the name signifies, and specimens having been sent up by him to Professor Owen, the latter gentleman pronounced them to have belonged to no less

---

* Rep. Brit. Asso., 1847, Sect., p. 64.

than three, and probably four species of whales, then for the first time added to the list of British Fossil Mammalia.*

My purpose, however, is more with the uses to which these phosphatic nodules have been put, along with others obtained from an entirely different bed in the Geological series, the Upper Green-sand, to which I would now turn your attention, and which were also first brought into notice by Professor Henslow.

He shall here again speak for himself. In a communication to the *Gardener's Chronicle*, in 1848, he writes as follows:—

"It occurred to me that possibly certain nodules of an "anomalous character, abounding in the Upper Green-sand in "the neighbourhood of Cambridge, were in some respects allied "to those in the Crag, and would possibly be found to contain "phosphate of lime. Upon directing the attention of Mr. Deck, "of Cambridge, who is a practical chemist, engaged in making "analyses for agricultural purposes, to these nodules, he readily "detected in them the presence of earthy phosphates, in pro-"portions varying from 57 to 61 per cent. Whether these "various nodules, thus abounding in phosphate of lime, can be "made available for agricultural purposes, must depend upon the "possibility of their being collected at a cheaper rate than an "equal quantity of bones can be."

He little thought, when he wrote this, to what extent, within a few years after, these nodules would come to be used in agriculture, and the value that would be set upon them. The stratum of Green-sand in which they are found, "although never more than a foot thick, occurs near the surface over many square miles in the vicinity of Cambridge," and the land is now in places, as before observed, scored with the deep trenches dug to get at them, finding employment for large numbers of labourers,

* They are described and figured in Professor Owen's "History of British Fossil Mammals and Birds," p. 526.

and bringing in immense profits both to the farmers and the proprietors of the soil.

I will now proceed to speak of the way in which these nodules are obtained, saying a few words first in reference to the particular bed in which they are found in Cambridgeshire. The Upper Green-sand (as well known to geologists) is a much older bed than either the Crag or the London clay, and belongs to the Upper Cretaceous beds among the secondary rocks. Its position is between the Chalk and the Gault; the Chalk in Cambridgeshire occupying the higher lands, and the Gault—a stiff dark blue clay —underlying the fens. The Chalk thins out gradually as it approaches the level of the fens, and it is near the fens, and where the thin bed of Green-sand intervening between it and the Gault is most accessible, that the chief diggings are carried on.

The usual practice of landlords—after ascertaining that their land is rich enough in these nodules to be worth turning over—is not to work it themselves, but to lease it out for a term of years, say three, to some other party;—this party often making it a business to farm perhaps several of these diggings under different proprietors. The lessee is under covenants, one being that the land shall be levelled and restored at the end of the three years just as it was at the commencement.

A friend of mine, who has had these nodules dug on his own estate in Cambridgeshire, and who kindly sent me many particulars, informs me that at one time it was the practice for the lessee to give a royalty of so much per ton—perhaps 8s. or 10s.—but that this practice is now going out from the difficulty of ascertaining the precise number of tons sold. The ordinary way at present is to lease the land at so much per acre—the price depending upon the probable yield of nodules as ascertained by trials in different spots, what conveniences of carriage there are at hand, and at what depth below the surface the nodules lie.

The highest price mentioned is £120 per acre, where the yield would be from 300 to 350 tons, the nodules lying at a

depth of from eight to ten or twelve feet below the surface. This price would fall to £100 or £70 if the depth of the bed was fourteen or eighteen feet, in which case the labour and cost of procuring them would be much increased.

The deeper the vein, the better in general the nodules in quality and value; there is also less labour in washing them clean, there not being so much silt and gravel mixed up with them as when they lie shallower.

The work is done sometimes by the day, but more generally by the piece.—A body of forty or fifty labourers will appoint a ganger and an accountant from the cleverest among themselves, and take the work, digging and washing at so much; for *fleet* digging, as the term is there, or *shallow*,—(eight to ten or twelve feet below the surface)—at 14s. to 18s. per ton;—over that depth (seventeen to twenty feet)—at 20s. to 25s. per ton. Beyond twenty feet the digging is seldom attempted, the market value, now about 30s. to 33s. per ton, not being sufficiently high to remunerate. At one spot, however, near Cambridge, the digging goes down to twenty-two feet, where the nodules are of a very unusual size, being as large as the fist.

The process of getting these nodules is exactly that of "double trenching" on a large scale. The men begin an acre by digging a trench of the requisite depth and barrowing away the material to the further extremity of the land, where they mean to finish. After the nodules have been obtained from the bottom of this trench, a second is dug parallel to it, the material from which serves to fill up the first; then a third is dug, the material from this filling up the second; and so on to the end, the last trench being filled up with the material barrowed from the spot where the digging commenced. In each case, the top soil, after removal, is carefully packed up in ridges, to be replaced at the top of the trenches when filled up again, as agreed upon with the landlords.

The trenches vary in length from thirty to fifty yards. The

breadth at top is ten or twelve feet, but contracted at bottom to four and a half, one side sloping gradually downwards, the other, where the nodules are obtained, being undermined, the refuse material being thrown backwards. This method of working shortens the labour, and allows the trench when done with to be filled up quicker.

The stratum of nodules is generally from six to nine, occasionally twelve, inches in thickness; the nodules sometimes forming an even layer on the Gault, but not unfrequently being found in "pockets," or small basons, hollowed out here and there in the Gault, in which case, from being more mixed up with grit and gravel, they are not so clean and good for the market as when more evenly distributed. I am informed that on the borders of Bedfordshire children are much employed in picking the grit out.

Water at places is a great difficulty. The trenches soon get full, steam-pumps being employed, and often kept working during the night or early morning, in order to have the trenches ready for the men the next day. Where parties cannot afford steam, hand-pumping has to be done at a great cost. Wells in the neighbourhood are observed to ebb and flow in a remarkable manner during these disturbances of the ground; the effect being felt at some distance from the works.

The layer of nodules in all cases is mixed up more or less with clay, forming hard lumps. Clay and nodules together are thrown up by the shovel from the bottom of the trench, where the men stand working in a row,—the men getting accustomed to throwing it up, even from a depth of ten or twelve feet, on to a clean shelf or board, from which it is barrowed away to the mill—always close at hand—for washing. This mill consists of a mound of earth, at the top of which is placed a circular iron trench, four feet or so in width and two or three deep, in which is dragged round and round, by a horse on the outside, a heavy iron-toothed harrow. The trench being filled with the material,

water is poured in, and by continued attrition the mud and clay are separated from the nodules, the latter being left clean at the bottom. The refuse water, which the workmen call "slurry," is conducted away by channels cut in the slope of the mound upon which the mill is erected, to pass off into a drain or pool on the surface of the land prepared to receive it. There it lies for a year to dry up, when the mud at the bottom is ready for carting away, and mixing as manure with the soil after spreading.

The nodules thoroughly cleansed in this way form a heavy mass, three pecks and a quarter going to the hundred weight, and a bushel making about ten stone. Among them are many shells and other fossils in an entire state, though the large proportion consist only of fragments of animal remains, worked up with clay and other earthy particles.

After drying and weighing, they are taken to the Railway Station and sent up to London. Whole strings of trucks full of them may often be seen at Cambridge, the trucks being kept for this traffic and labelled accordingly, the number of them indicating the largeness of the business for which they are set apart.

Arrived in London, the nodules undergo the process of grinding, after which they are dissolved in sulphuric acid, and then mixed up with other ingredients to form an artificial manure, or "super-phosphate," coming back again to the farmers in bags, and sold at prices varying from £8 to £12 per ton.

The manure thus obtained, I am told, is used for drilling in with turnips and other root crops, and also usually for barley. Care, however, must be taken that sufficient burnt earth and ashes are mixed with it, lest it should "burn" and destroy the seed instead of encouraging it to grow.

The details above given relate exclusively to the Green-sand nodules found in Cambridgeshire. With the Suffolk diggings, which, though considerable, I believe are not quite so extensive, —I am less acquainted. Mr. Rodwell, however, a Member of

our Club, and himself a Suffolk man, has been kind enough to obtain for me a few particulars respecting these, which I will give in addition to what I have already said.

The diggings in Suffolk are confined entirely to the Crag formation, which extends inland from the Coast to the distance—in some cases—of ten or twelve miles, the largest quantities of nodules, however, being found nearer the sea. The Suffolk nodules are of rather less value than those of Cambridgeshire, averaging a less per centage of the phosphate of lime. The cost of raising them is said to be from 8s. to 15s. per ton. The present price at Ipswich is about 28s. per ton, but it has been as high as 65s. or 70s. In some cases the landlords sell the royalty :—in others they raise them on their respective estates and sell them. In one instance, in which a Suffolk landlord raised them on his own estate for sale, he is said to have realized £8,000 on one farm, after paying the tenant 15s. per ton for raising, washing, and carting.

Besides the diggings in the Eastern Counties, I believe there are some other parts of England in which these phosphatic nodules have been obtained for agricultural purposes ; but of these diggings I have no particular knowledge. None occur in this neighbourhood. Mr. Charles Moore, who is so well acquainted with the Geology of the Country round Bath, informs me that the Upper Green-sand is very continuous at the base of the chalk escarpment throughout the Counties of Wilts, Dorset, Somerset, and Devon, its greatest superficial area being between Great Bedwin and Devizes, and again in the neighbourhood of Warminster. In many other localities to the West it is often not more than from a quarter to a half-a-mile in breadth. For this reason, and owing also to the general physical and well cultivated character of the districts in which the beds occur, they are but seldom opened up, and not very readily detected. When, however, they are opened, the phosphatic nodules, as at Cambridge, are usually found present though more widely

diffused through the bed. In consequence of this, and owing to their being more silicious, and therefore containing less phosphatic matter, Mr. Moore thinks it doubtful if the beds would ever repay the labour of working in the South-West of England.

I have all along in this lecture used the term "phosphatic nodules," or simply "nodules," but it would be an omission not to mention that in the Eastern Counties these concretions are universally called *coprolites*, and are entirely unknown by the above name. This has arisen from the circumstance of Professor Henslow having, as already mentioned, first thought them to be of "coprolitic origin," and the name having got about before this was found to be a mistake. It is a curious instance how words originating in error become sometimes stereotyped by use beyond possibility of change. Not only are the nodules themselves called "coprolites" in Cambridgeshire and Suffolk, but the men employed in working for them are called "coprolite diggers," though sometimes also "fossilers," and the trucks at the Cambridge station, used for conveying the material to London, have the word "coprolites" painted on them in large letters. It would be vain now to attempt to recall the wrong word, and to substitute the right one for it in that part of England.

I spoke, at the beginning of my lecture, of the condition of the labourer, as scarcely less affected than that of their employers by all these novel operations going on in the Eastern Counties. As in many analogous cases the change has acted both for their advantage and their disadvantage. It has led to a manifest improvement of their condition in some respects, while it has had an unfavourable influence upon it in others. The introduction of a new kind of labour, which may be carried on all through the winter, brings the men plenty of work, and, from the nature of that work, higher wages than they were formerly used to. And this is greatly to the advantage of those men who are steady and provident. Earning from 15s. to 20s. a week,—even

young boys of fourteen years getting 10s. for barrow work,—they not only live better, and are visibly better clothed on Sundays, but they are able to save. Further, some of the more intelligent labourers have become good mechanics, and have got to having the charge of steam-engines and other machinery; while the genius of the men generally has been much stimulated by endeavouring from time to time to discover the best and most advantageous methods of digging out the nodules, washing them, and carrying on other operations.

The unfavourable result of these diggings is that drinking has increased. The men work very regularly their own time, and have their allotted beer—two or three pints a day—whilst engaged in it, which is not much more perhaps than the labour requires. But leaving work every day at four in the afternoon, and on Saturdays always at twelve at noon, they have much time at their disposal, inducing idle habits, and tempting them to sit long at public houses on their way home.

The diggings have also, to a certain degree, operated unfavourably for ordinary farm work. The labour-market is considerably affected in some places, though the scarcity of men, at first much felt, has been partly corrected by immigration, families coming from the woodland parts of the county to settle where the hands are most wanted. Formerly the price of labour was regulated by the price of wheat; now, in the neighbourhood in which my informant lives, he tells me, for the last six or eight years, it has been affected simply by the supply and demand for labour, a principle before unknown in that part of the country. All the able-bodied go "a fossiling" as it is called; and they scarcely ever go back to their former employments. The farmers, consequently, are obliged not only to pay a higher rate of wage than formerly, but to put up, in many instances, with the old and very young, the latter being taken away from school at a proportionately early age, and thereby receiving detriment to their education. Boys of fourteen years get to consider

themselves men in all their habits, and to assume an air of independence, not favourable either to their manners or morals, before they are much more than half grown up.

Such are the points of chief interest connected with the diggings for these phosphatic nodules in the Eastern Counties, relating, however, more especially to Cambridgeshire. How long these operations may continue to be carried on, it is impossible to say. Immense tracts of land in the neighbourhood of Cambridge, reaching in some places quite to the borders of the county, have now been turned over, and of course the diggings must one day have an end. But with the future I have nothing to do. I have simply attempted to give you, as far as my information goes, some idea of what has been now, for several years back, going on in that part of England; and I think, as originating under the circumstances I alluded to at the beginning of my lecture, the story of these nodules is not uninstructive nor entirely without a moral.

It impresses us with a sense of the vast and important results following, in some cases, from what might be considered trifling and unimportant incidents. It hints to us what may arise out of an accidental discovery—or, as in this instance, a mere suggestion—founded upon thoughtful observation and experiment, but thrown out at hazard, in the uncertainty whether if acted upon it would be found to answer or not. Professor Henslow saw clearly to what purposes these Crag and Green-sand nodules might be applied, provided only they brought in a sufficient remuneration for the cost and labour of procuring them. This he left to be ascertained by others. And with what results we have seen.

Naturalists are not unfrequently taunted with the question —*Cui bono?* Of what use all this close looking at objects which the world in general neither knows nor cares anything about? This picking at rocks—collecting rare specimens—and analysing with such nicety and precision their structure and quality?

Have we not the answer, in part at least, to these questions, in what has been stated in this room this evening?

The Naturalist's researches are not always profitless even to those who are most inclined to hold them in cheap estimation. In many cases, too, the world has the advantage of discoveries, while wholly ignorant of those who made them, and not over solicitous to inquire to whom it is indebted for a large share of the good fortune it enjoys.

No acknowledgment was ever made to Professor Henslow for the benefits conferred by him on agriculture in the way we have described; and probably very few of those who reaped, and who are still reaping those benefits, have the slightest idea with whom they originated.

This, however, mattered nothing to him. It was not his habit to work for reward or for the sake of being known. The fruits of his researches he gave freely to the world. He was satisfied with having made a useful discovery, and it was no sooner made than he at once gave it the widest circulation in the local papers, without reservation of any kind, not looking for recompense here, "but casting his bread upon the waters," in the belief that he would "find it after many days."

And this whole subject is not altogether without a local bearing, though the details into which it has led us have no connection with this neighbourhood. We here assembled are a Field Club instituted for purposes of scientific research in the district round Bath. This is the last occasion of our meeting in this room for evening entertainment and instruction this present season. The winter is past, and our members will soon be going on their summer excursions, each to glean what he may find to interest him in that particular department of inquiry to which he devotes himself.

Let none of us think our time thrown away, or our attention misdirected, while carrying on our respective investigations. We want a large number of facts to construct a theory, or even

to start a hypothesis, but a very few may serve to impart usefulness to our labours. A single fact, carefully ascertained, may sometimes be sufficient for this. We know not what amount of good may come of it in the end; what it may lead to, however barren and unprofitable it appear at the moment. It may open out a wide field for the energies of others to tread and turn to account; it may, perchance, even prove a source of wealth and happiness to which we can set no limits. And whatever we do or attempt in this way, however imperfectly, for the good of our fellow-men, is, at the same time, we humbly hope, done to the glory of God.

On the Bath Flora. By REV. L. JENYNS, M.A., F.L.S., F.G.S., &c., President.

(Read December 5th, 1866.*)*

GENTLEMEN,

By the Flora of any country or district we mean its native plants, (or such as may be regarded, if not indigenous to the soil, at least naturalised), considered collectively. In taking the Bath Flora as a subject for this evening's lecture, I have complied with the request of friends,—though it is a subject not easily made interesting to a mixed audience like that I am addressing. It would be a very meagre affair merely to give you a list of the plants that grow about Bath, even with the addition of the localities in which they are to be found. This, too, has been done already in the "Flora Bathoniensis" of Professor Babington. Neither would it do to go into details respecting their structure and affinities, which to those unacquainted with the first elements of the science of Botany would be dry, and in some measure unintelligible. It appeared to me, therefore, that the best plan would be to speak of the plants of this neighbour-

hood in connection with the subject of the distribution of the plants of Great Britain generally, prefacing our lecture with just so much on this latter head, as might serve to a certain extent to explain the circumstances under which a given number of species are found growing in any particular locality.

We may begin by observing that the far greater portion of our British plants—not to say all—are identical with species found on the Continent; and assuming that each species originated—without saying anything as to the *mode* of its origin—in one particular spot, or centre, as it is called, and not in several places at once, this being the hypothesis best supported, and the one most generally adopted, they have clearly come to us from thence in the first instance.

But when we set ourselves to consider the way in which they have arrived on our shores, we find a difficulty. There is a wide sea between us and the continent, and no natural transport, such as often serves to disseminate plants and carry them from one part of the country to another, is sufficient in all cases to explain how they may have passed this barrier. The difficulty, too, is greatly increased when we take the case of *endemic*, or very local plants, which instead of being more or less generally diffused over the British Islands, are confined to particular stations, or occupy very limited areas, being cut off by considerable intervening spaces from any assemblages of the same species in countries beyond Britain.

It was with an especial view to these local plants, and to shew how such assemblages of individuals, though now so far asunder, may still have sprung originally from one and the same centre, that the late Professor E. Forbes put forth, as is well known, an ingenious theory. He supposed that the areas in which they are found growing, though now disconnected, with the sea rolling between them, were once united by lands that have since gone down and been submerged through the agency of those causes, by which the relative distribution of land and

water on the surface of our globe has been in so many instances modified from time to time in the course of ages. In this way the bridge, as it were, by which these particular plants arrived at their present localities having been broken down, they have necessarily become isolated from the rest of their species.

It would be foreign to the subject of this lecture to speak at all in reference to the arguments which have been brought forward either in support of this theory or the contrary; I will therefore simply state his general view respecting the original sources of the great mass of our British plants, founded on this theory, assuming it to be correct.

He remarks that the vegetation of the British Islands may be said to consist of five Floras:—"1st. A West Pyrenean, confined to the west of Ireland, and mostly to the mountains of that district," the plants of which "have the nearest portion of their specific centres in the north-west of Spain." He considers this as "the oldest of the Floras; its very southern character, its limitation, and its extreme isolation, being evidences of its antiquity, and pointing to a period when a great mountain barrier extended across the mouth of the Bay of Biscay, from Spain to Ireland." "2ndly. A Flora related to that of the south-west of France, extending from the Channel Isles, across Devon and Cornwall, to the south-east and part of the south-west of Ireland. This is the next in point of probable date, its distribution having depended on the extension of a barrier, the traces of which (he says) still remain, from the west of France to the south-west of Britain, and thence to Ireland." "3rdly. A Flora common to the north of France and south-east of England, and especially developed in the chalk districts. Its distribution depended on the connexion, generally allowed by geologists, of the coasts of France and England towards the eastern part of the Channel." "4thly. An Alpine Flora, developed in the mountains of Wales, north of England, and Scotland; its distribution having been effected during the glacial period, when

the mountain summits of Britain were low islands, extending to the area of Norway through a glacial sea, and clothed with an arctic vegetation, which in the gradual upheaval of the land and consequent change of climate, became limited to the summits of the new-formed and still existing mountains." "5thly. A Germanic Flora, resulting from the upheaval of the bed of the glacial sea and the consequent connexion of Ireland with England, and of England with Germany, by great plains. This Flora, which includes the great mass of our native plants, extends over the greater part of Great Britain and Ireland, mingling with the other Floras, and diminishing, though slightly, as we proceed westward, indicating its easterly origin and relation to the characteristic Flora of northern and western Germany."*

I have given the above theory for the most part in Professor E. Forbes's own words, and shall not stop to say more respecting it. Having got our plants, let us proceed now to consider what influences they will be subject to after their arrival, to favour or retard their spreading as the case may be, some gradually taking root everywhere, others settling down in a given spot, or appearing perhaps in more localities than one, with wider or narrower intervals between these localities in which they are not found These influences are mainly soil and climate, and the relative advantages possessed by certain species over others growing beside them. Some plants grow only on particular rocks, or on alluvial soils formed in great measure by the disintegration of such rocks; others are less fastidious, and will grow almost anywhere. Such is the character of many weeds which obtrude themselves on our notice go where we will. Where there is the greatest variety of soils, there will be, *cæteris paribus*, the greatest variety of plants; where one character of soil prevails chiefly, there may be a strong and luxuriant

* Rep. Brit. Assoc., 1845. (Trans. of Sects.) p. 97.

vegetation, but consisting of fewer species. So too with respect to climate, some plants like a moderate climate, others a more extreme one. In the west of England, the summers are for the most part cooler, and the winters milder, than in the eastern counties, and accordingly, though many species of plants may grow indifferently on both sides of the kingdom, each side has certain species not found in the other. Some plants again thrive best in a humid atmosphere, while others are able to maintain themselves on the most barren spots—even on the tops of walls. Some species are altogether aquatic, growing in rivers, or pools, or marshes. Many species again grow only by the sea, or where they can have the influence of sea breezes or brackish water.

Such then being the various conditions required by plants for their proper growth and development, let us suppose a particular species to have gained a footing in some country, the requisite conditions of which are favourable to its diffusion. If it had that country entirely to itself it would quickly overrun it. This, however, is never likely to be the case. Other species are at liberty to enter in with it, as when our own islands were first stocked with plants, according to the theory above alluded to; it then has to contend with these others, all striving together for the possession of the soil; and any advantages the former possessed, had it been alone, may be counteracted by greater advantages possessed by the latter. The climatal and other conditions of the country may be yet more favourable for its companions than for itself. Or the former may be plants of larger size and quicker growth, or of more robust habit, soon overpowering the smaller and weaker species. Or they may have fewer enemies to contend with whilst in a seedling state. Mr. Darwin, "on a piece of ground three feet long and two wide, dug and cleared, and where there could be no choking from other plants, marked all the seedlings of our native weeds as they came up, and out of the 357 no less than 295 were destroyed, chiefly by slugs and insects." Thus we see there is constantly

going on a struggle for the mastery, or even for life itself, and the weaker necessarily succumb. Some species no sooner spring up than they are smothered or devoured; others just manage to live, but in a half-starved state; or they may thrive sufficiently to retain possession of certain spots, but not be able to extend themselves to any distance. These circumstances will in part account for some plants being so very common and generally distributed, whilst others are local and rare. Or it may happen in the case of certain plants that, though they cannot spread far where they were first located, the seeds may be transported by winds, or water, or birds, or some other means, to more distant parts, where they are under fewer disadvantages. We then have the case of local plants, growing perhaps in several different localities, but these localities more or less far removed from each other. Sometimes, as we know, seeds carried in one of the above ways, will lie dormant for years, springing up, whenever, from some change in the circumstances under which they are placed, growth becomes possible. I will not here dwell upon the various means employed by nature for the dissemination of the seeds of plants—some depending upon the structure of the seed itself—as they are familiar to many of us, and it would take us too far from our subject. But I will just state one fact recorded by Darwin in his "Origin of Species," in connexion with the dispersal of aquatic plants, which have generally wide ranges, and the seeds of which he thinks are occasionally transported long distances through the mud of ponds, &c., adhering, sometimes in considerable quantities, to the feet and beaks of aquatic birds. He says, "I do not believe that botanists are aware how charged the mud of ponds is with seeds: I have tried several little experiments, but will here give only the most striking case. I took in February three table-spoonfuls of mud from three different points, beneath water, on the edge of a little pond; this mud when dry weighed only $6\frac{3}{4}$ ounces; I kept it covered up in my study for six months, pulling up and counting each plant as it grew; the plants were

of many kinds, and were altogether 537 in number; and yet the viscid mud was all contained in a breakfast cup."*

Having thus briefly mentioned the chief circumstances connected with the diffusion of plants, after having once found their way into any country, and the contingencies which arise to favour or check that diffusion, let us now turn to the more immediate consideration of our own Flora of Bath.

Though we call Bath in the west of England, there are yet very few, perhaps not more than two or three, plants found in its vicinity which can strictly be considered as west country species. Such are more characteristic of Cornwall, Devon and Wales, and hardly extend into Somerset. Climate, therefore, has probably had but little influence on the Bath Flora. The geological features of the district, which I scarcely touch upon, hoping they will be brought before you by Mr. Charles Moore, on another occasion, have had more to do with it at least in one locality: I refer to Wick. For the most part the tops of the hills round Bath consist of the Great Oolite, while the Lias occupies the valleys; and there is nothing in the vegetation of either calling for particular notice. Certain species find their proper place on the hills, while others find theirs lower down, but they are the same species met with in similar situations in various other parts of England. At the Wick Rocks, however, we have the Carboniferous Limestone, almost the only place about Bath where this rock comes to the surface, and the plants are in some measure peculiar compared with the rest of the Bath Flora. There are at least a dozen species found here, which are not recorded as growing anywhere else about Bath,† while there are others met with only in one or two localities besides. These plants, however, though confined with us to one spot, are many of them common about Bristol, where indeed there is a larger

---

* Origin of Species, p. 386.

† Some of them, however, may be mistakes, or are now extinct.

intermixture of the older rocks than about Bath, giving rise, in accordance with what was before stated, to a more varied Flora. The number of plants found about Bristol exceeds the number about Bath by fifty species or more. This is partly due to the greater variety of soils, and partly to the proximity of Bristol to the Channel, the tide flowing up to the town, and affording stations for several maritime species not met with at Bath, though there is one, a kind of rush *(Scirpus maritimus)*, that often travels inwards some little distance from the sea, said to grow on the bank of the river near the gas-works. I have not, however, seen it there myself.

The Bath Flora has received attention from different botanists for a considerable number of years back. A few species are mentioned in Collinson's "History of Somerset," published in 1791. A longer list, but consisting of the rarer species only, was appended to Warner's "History of Bath" by Mr. Sole, formerly a resident in this town, of whom I can find no biographical notice. He was a distinguished botanist in his day, and published at Bath, in the year 1798, an important work on the "Mints of Great Britain," illustrated by twenty-four engravings, many of which are taken from Bath specimens, while he has indicated the exact habitats of all the species he had met with about here. Another valuable work of Mr. Sole's, containing coloured drawings of "The English Grasses," was never published, and is probably confined to the single copy belonging to the Bath and West of England Agricultural Society, in the keeping of the Bath Literary and Scientific Institution.* A large number of these grasses appear to have been collected in the neighbourhood of Bath, and to one I shall have occasion to draw your attention in the course of this lecture; many, however, that he has represented are merely varieties of others.

---

* It has the following title—"William Sole. An account of the principal English Grasses, with descriptions of their respective excellencies and defects in Agriculture." Bath, 1799, Folio.

Warner's list in "The History of Bath," published in 1801, contained fifty-six species; but in the small edition of this work, published the year following, and intended as a guide book to Bath and its environs, a much more extended list is given, comprising 191 species, and including many cryptogams. This second list was supplied by the late Dr. Davis of Bath.

The work, however, of most use to the Bath botanist at the present day is the "Flora Bathoniensis" of Professor Babington, published in 1834, to which a supplement was added in 1839. The number of species given in this work is 756, but many of these are unquestionably mere varieties of others, while a few appear to have become extinct, if they ever grew in the localities assigned to them.* In truth, it is not easy to estimate the exact number of plants growing in a particular district, from the uncertainty that exists about species, and the difficulty of determining in many cases whether certain plants are indigenous or not; or how far, on other grounds, they have claims to be admitted. No two authors are agreed, in all instances, as to what is a species, or what a variety. Between two so-called species, there often exists so many intermediate forms that it is hardly possible to fix the limit that shall separate them. If we do not always meet with these intermediate forms in the country whose Flora we are inquiring into, we often find them when we compare specimens of the species in question from different countries. And this, indeed, shows the importance of examining the plants of other countries besides our own, in order to become acquainted with their true characters. Then again as to indigenousness; we call plants indigenous which are known to have been denizens of the soil as far back as botanical records reach, or which we may reasonably suppose to be such, though only recently observed. But Floras, we must remember, have no fixed limits any more than species. They are constantly under-

* See a list of such species in the Appendix at the end of this paper.

going change, some species becoming extinct, from one cause or another, others getting introduced, and after a time becoming more or less naturalised. On this subject I will say more presently. I pass on, therefore, to remark further that the extent of a Flora of any district will depend upon the extent of country we include within that district. It is not uncommon with the authors of Floras occasionally to strain the assigned limits, in order to bring in some particular rare species found outside them. This has been much done in the instance of the "Flora Bathoniensis;" such localities as Spye Park and Bowden being often given, which are fifteen miles or more from Bath. If we were to go the same distance in the opposite direction we might take in a large portion of the Flora of Bristol. Perhaps as a fair limit to our field we might assign ten miles as a distance not ordinarily to be exceeded; and if a few species of particular interest or rarity occur outside those limits, but not far beyond them, they might be inserted in an appendix.

With these premises we may set the number of species in the Bath Flora (excluding all the cryptogams except ferns), at from 700 to 760, according to the views we hold on the points above mentioned. If to these we add about forty species discovered in the district since the publication of the supplement to the "Flora Bathoniensis,"* it will bring the number up to from 740 to 800 accordingly. Suppose we take a middle term and call the number 770. There will still be very many amongst these, perhaps sixty or more, which we cannot well leave out of our list, but which probably, in some cases undoubtedly, owe their introduction into the neighbourhood to accidental causes.† I will now mention some of the circumstances under which such introduction may take place.

Sometimes these strangers are brought in with the seed sown in cultivated land, and where the conditions of the soil, &c., are

---

* See Appendix. † See ditto.

favourable, they re-appear year after year, occasionally becoming quite naturalised. Several foreign grasses have found their way into this country in this manner, as well as two or three species of clover. It has even been conjectured that certain plants, which are almost entirely confined to cultivated land, seldom appearing elsewhere, such as the corn ranunculus and some of our red poppies, however common and generally distributed they may now be, owe their first origin to this circumstance; or plants which are truly indigenous in some parts of this country may be carried accidentally to others where they were previously unknown.

In the "Intellectual Observer" for May last, a curious case is recorded of "Floral Immigration at Mitcham, in Surrey," in which more than forty species of new plants seem to have quite recently sprung up in that neighbourhood, "through the agency of the foreign grain trade." Some of these are British plants, though not before known in that locality; many, however, are foreign; the *Leguminosæ*, a family containing numerous species grown for agricultural purposes, constituting a large proportion of the whole.*

In the Bath Flora, we have about ten species that may be considered as mere weeds of cultivation, some of them having shown themselves in only a single instance. Of these the most recently observed, so far as I am aware, are *Camelina sativa*, *Asperula arvensis*, and *Erysimum orientale* The first of these was found by myself, last year, on waste ground at Weston. The other two have occurred during the present year, as weeds in a garden at Limpley Stoke, that was till quite lately an arable field, the circumstance being kindly communicated to me by Mrs. Peacock of that place.

But many plants find their way into new localities from other causes than conveyance with seed. A large number are escapes

* Intell. Obs. vol 9, p. 284

from old gardens; others have got about from having been themselves formerly cultivated as crops. Garden species, some now out of date, but others still kept up for their beauty, or scent, or culinary uses, or supposed medical properties, that have run wild are very numerous.

Again some species are known to have been planted in the spots in which they are now met with. Such, I believe, has been the case with the sweet-smelling flag *(Acorus calamus)* growing freely on the banks of the Avon in two or three places.

Several trees and shrubs have in like manner been probably planted by the hand of man originally, though they may have since spread of themselves in some instances. Such are the *Lime, Maple, Box,* and the *Berberry,* this last being often cultivated for its fruit.

To such causes we may add the introduction of new plants by ballast. A considerable number of foreign species have found their way to our shores in this manner, and are now frequent in places, especially about sea-port towns.

It has been thought, and not without reason, that the *Senebiera didyma,* which grows in some plenty under walls by the side of the Avon, between Norfolk Crescent and the Gas Works, was originally brought with ballast into the neighbourhood of Bath.

Occasionally accident brings plants to this country from much further distances even than the Continent. As an instance in point, we may mention the *Elodea canadensis,* imported from Canada, nobody knows how, first observed in the north of England and Scotland in 1847, but now so abundant as to prove one of the greatest pests, choking up our rivers and canals to such a degree as to impede navigation. During the summer months our own canal at Bath is full of it in many places, almost to the exclusion of other weeds.

Thus we see how many causes are at work, chiefly through the agency of man, to swell the number of plants growing in a particular district, as also to leave us in doubt what exact

species ought to be admitted into its Flora, and what species excluded. And as new plants come in, so do old plants from time to time die out. This may arise from the failing of some of those conditions necessary to secure their continuance in a healthy state to which we before alluded. But it is oftener due to causes more constraining than these, such as drainage, enclosure, and the clearing of forests. It would be difficult to estimate what have been the combined effects of these operations in diminishing the number of our old original British plants, since civilisation first made a start in these islands. We may imagine how much richer a field must have been open to the researches of the botanist in our own neighbourhood, if we go back in thought to the days of the Romans, when the slopes of the hills round Bath were all thickly clothed as they probably were, and as they still are in places, with trees and brush-wood; and the valleys still unreclaimed for arable pasture. Nor is there a doubt that not here only but in most parts of the country many species were formerly plentiful, which are now extremely rare, whilst a considerable number have been altogether extirpated. And there is still another cause, we regret to say, tending to bring about this extirpation—the greediness of collectors and cultivators of rare plants, who, not content with one or two specimens for their herbarium or garden, will sometimes well-nigh eradicate all they find.

Perhaps it is not too much to say that few years pass without one or more species, in different localities, succumbing to their fate from some of the above causes. And the straitened circumstances under which others are placed, though they may continue to exist, will go towards explaining why certain plants are found at the present day cooped up within such extremely narrow limits. The areas over which they may have formerly ranged have been more and more contracted until they are at last driven into a corner, where alone they can any longer hold their ground.

In the neighbourhood of Bath we have two species especially deserving of notice in this point of view; that is to say from their localisation in particular spots, without positively asserting what has led to this localisation. I refer to the *Euphorbia pilosa*, found in Prior Park lane, and in a wood on Claverton Down, near the monument, the only known station for it in Great Britain; and the *Lysimachia thyrsiflora* that grows, or did grow, plentifully in a small pond near South Wraxall, a species almost entirely confined to North Britain, and very local everywhere. It may be possible, as some think to be the case, that both these plants have been, accidentally or intentionally, introduced into the places where we now find them. With regard to the first, however, the *Euphorbia*, there is evidence to show that it was growing in the same locality nearly 300 years ago, it having been discovered there by Matthias de Lobel, botanist to King James I., and published by him as a British plant in his "Stirpium Historia," the date of which is 1576. He describes it under the name of *Esula major Germanica*, and speaks of it as plentiful "in a wood belonging to Mr. John Coltes, near Bath." I am sorry to say it is not plentiful there now, and it appears to be getting scarcer every year. I would express a hope, therefore, that if any of our members or other persons go to look for it, they will be sparing in gathering specimens, lest it soon become entirely extinct. It has been suggested that it "may have escaped originally from the neighbouring grounds of the Prior of Bath, or from the physic gardens of the herbarists of this city,"* it being a plant undoubtedly used in medicine in those days, but though this might have been the case with the plants growing in the station in the lane near the town, it seems hardly

---

* See a paper by the late Mr. Edward Forster in the "Linnean Transactions," (vol. xvii., p. 533), in which are given full particulars relating to the discovery of this species of *Euphorbia* as a British plant.

likely with respect to those on the Down which is so much further off.

With regard to the *Lysimachia*, Professor Babington is of opinion that it was originally planted by some cultivator of rare species; but without further evidence of this, the improbability of its having been brought, as it must have been, from a considerable distance, to be set in a pond, not in a private garden, but in an open field remote from the city, is against such a supposition. Whatever may have been its origin, it is perfectly naturalised there now, though, perhaps from the effect of dry seasons, there has been very little of it seen, as I am informed, the last two or three years.

Having mentioned by the way these two very local plants let us pass on to a more general consideration of the Bath Flora, as respects the relative number of species in the principal families, and their rarity or otherwise in England. Estimating the entire number on the Bath List at 770, as proposed above, the Dicotyledonous plants will be found to amount to about 570 out of that number, the remainder, with the exception of the *Equisetaceæ*, and *Filices*, being monocotyledonous. More than half the Dicotyledones belong to the families of *Ranunculaceæ*, *Cruciferæ*, *Caryophyllaceæ*, *Papilionaceæ*, *Rosaceæ*, *Umbelliferæ*, *Compositæ*, *Scrophularineæ*, and *Labiatæ*,* which are all fairly represented in the district, and contain each a large number of species. The remaining families contain, most of them, comparatively but a few species, and many of them only one.

The monocotyledonous plants amount to about 175 species, of which more than 100 belong to the *Juncaceæ*, *Cyperaceæ*, and *Gramineæ*. The next largest families in this division are the *Orchidaceæ* and the *Liliaceæ*, the former embracing nineteen species, and the latter thirteen.

---

* The same is probably true of the British Flora as a whole.

The true aquatic plants, or those growing entirely in the water, dicoteledonous and monocotyledonous together amount to about thirty species, the greater number being found either in the canal or the river.

The *Equisetaceæ* and *Filices* number together about twenty-five species. The latter, the true ferns, are not very numerous about Bath, and include few rare species.

With respect to the comparative rarity or frequency of occurrence of the plants in the Bath Flora, about 480 species may be considered as either for the most part very common, or if not equally plentiful everywhere, at least generally distributed throughout England, and not calling for particular notice except in certain cases to be hereafter specified. About 230 species are more or less uncommon; or, if locally plentiful in some parts of this country, are far from general. It is, however, very difficult to draw an exact line between these two divisions. In both cases the naturalized and other plants not really native, already spoken of, are excluded.

A list of some of the rarer species, including others which, though not very uncommon, are likely to interest botanists visiting the neighbourhood, will be found in an Appendix at the end of this lecture.* I have not given the localities in which they are to be severally met with (except in the case of plants found at Wick, and for the most part peculiar to that station), as they may be seen in the "Flora Bathoniensis," to which the reader is referred. At the same time it may be useful to state, for the guidance of strangers, the best localities around Bath for plants generally. Such are Prior Park woods, Smallcombe woods, Claverton and Brass Knocker woods, Friary wood, near Hinton Abbey; woods near Limpley Stoke, Warleigh woods, St. Catharine's Valley and the woods bordering on Charmy Down,

* At the time of delivering the Lecture many of the most striking of these species were exhibited, and commented on.

Langridge lane and woods, Wick Rocks, Combehay, and the woods at Midford Castle. For aquatic plants, the canal and river, the ponds at Prior Park and Midford Castle, the Horse and Jockey ponds, near South Wraxall; and wet places on Lansdown, Bannerdown, and Solsbury Hill.

By far the two most interesting plants in the Bath Flora are the *Euphorbia pilosa* and the *Lysimachia thyrsiflora* already alluded to. Next to these, perhaps, is the *Ornithogalum pyrenaicum*, which, though very rare in most parts of England and confined to a few counties, is met with in great abundance in the woods about Bath, appearing in some places even as a roadside weed, or coming up in the open lands adjoining. This plant is further worthy of notice, from the circumstance of its being gathered for the table and eaten; for which purpose the immature flowering spikes are largely collected by the poor in spring, and tied up in small bundles, and brought to market, where they are exposed for sale under the name of French asparagus, which they much resemble in appearance, and a little in flavour, though very inferior. How long this custom has prevailed I am not aware but it is probably of long standing, as it is mentioned in Collinson's History of Somerset, published now nearly eighty years since. Collinson says that "it is not very wholesome, and if eaten plentifully, it occasions nausea and oppression of the breath."

Though it is not necessary to dwell generally upon the commoner plants about Bath, yet it will be right to say a few words respecting certain species ordinarily accounted as weeds, from the circumstance of these despised plants being sometimes passed over even by professed botanists. Nor are they entirely without interest. We give the name of weeds to those plants, which, from their numbers and ready growth, are so troublesome in our gardens and fields, and which we mercilessly pull up whenever they come in our way. They are the spontaneous productions of the soil which spring up whether we will or no. But we may

sometimes imagine they are the same weeds met with in other places, or that a particular weed which happens to be abundant in our own neighbourhood is, as a matter of course, equally abundant elsewhere—or what is, perhaps, more likely, we never give the matter a thought. In truth, however, the term, weed, has no meaning, as applied to any particular species of plant, except in connection with some particular district or locality.

Let us for a moment reflect what are the weeds of other countries? Oftentimes the choicest flowers in our conservatories, though not always shewing themselves in their native habitats in that high state of luxuriance and development to which they are brought by the care and skill of the nurseryman. On the other hand, a large number of our weeds are quite unknown out of Europe, except where they have been introduced,* and though they may not be often cultivated for their beauty they sometimes are, or, at least, kept as objects of curiosity. The little daisy,

* I have alluded above to the introduction of our British weeds into other countries, and it is marvellous to what an extent this has taken place in the case of certain species, which seem to accompany man, without at all his desiring their society, almost wherever he goes. Some of our weeds have found their way into America, Australia, and New Zealand, where they are rapidly spreading, and in increasing numbers each year. In New Zealand, our common Knot-grass, the Dock, Sow-thistle, and Watercress, have not merely obtained a footing, but are growing most luxuriantly; while our common white or Dutch clover is said to be "completely displacing the native grasses, forming a close sward."—(Nat. Hist. Rev., No, 13, pp. 124, 125).

Yet it is noticeable that some of our commonest weeds do not shew so great a disposition to travel as others. While Chickweed has been "carried out as a weed to the whole of the temperate and colder regions of the globe," Mr. Bentham observes, in his "Handbook of the British Flora," that Groundsel is "less disposed than many others to migrate with man." Like some of ourselves, it is fond of home, and does not care to leave it.

which so brilliantly adorns our lawns in the early spring, was seen by one of our countrymen in America sedulously cherished in a pot, and greatly admired by its cultivator, who had never seen it growing in its native soil. Indeed many of our common plants would well deserve a place in our gardens were they not so common, and we so accustomed from their very frequency to pass them over.

But to keep to our own country. No doubt there are some weeds, such as Shepherd's Purse, Groundsel, Chickweed, Dandelion, certain Thistles, a few Grasses, &c., which are universally distributed and everywhere plentiful throughout Great Britain. But this is not the case with all. And it is an interesting question for the botanist to consider, as bearing upon the important subject of the geographical distribution of our native plants, why certain species which are so abundant in most parts of the kingdom as to be accounted troublesome weeds, should yet be totally deficient in some particular districts. It is equally interesting to notice, as we journey on in our botanical rambles, where these same weeds become scarce, and where they finally disappear; whilst, it may be, new weeds which we had not seen before, spring up in their places, taking the same possession of the soil as the old ones.

Now these inquiries can never get their right answer, unless, when studying the Flora of any country, we give the same attention to the commonest plants that we naturally give to the rare ones. If we look into the "Flora Bathoniensis" we shall find a few instances in which, clearly, there have been oversights of the kind I am alluding to; that is to say it has been overlooked that certain weeds, common—some extremely common—in most parts of England, seem to be almost or entirely wanting at Bath. The circumstance is worth pointing out, though it detracts little or nothing either from the general usefulness of this book to Bath botanists, or from the reputation of its author, who for so many years has ceased to reside in the

place. There are three species I more particularly allude to—the Blue-bottle *(Centaurea cyanus)*, found in cornfields; the small Stinging Nettle *(Urtica urens)*, in other districts to be seen on almost every dunghill; and the Wall-Barley *(Hordeum murinum)*, so abundant elsewhere under walls and by waysides. All these plants are mentioned in the "Flora Bathoniensis" either as "frequent," or "common," or "not uncommon," though I never myself succeeded in finding any of them. Neither has Mr. Broome, who has botanized over this district so much longer than myself, found two out of the three, nor the third except in a very few instances. With respect to the *Hordeum murinum*, Professor Babington seems to have discovered his mistake afterwards, as in the supplement to his book he has mentioned it as "rare," giving but one locality for it, "the river-side at Twerton Bridge." I find, however, in Mr. Sole's "Illustrations of British Grasses," to which I have already drawn your attention, some notes relating to this species, which, as his book was never published, it is desirable to put on record, and which tend to shew that even in the above locality this grass may possibly not be indigenous. Mr. Sole, under the head of *Holcus mollis*, another rare grass in this neighbourhood, observes—"We are lucky in having neither Darnell, Wall Barley, nor this species of couch about Bath." Underneath, however, he adds—"I am sorry to find, since writing the above, that Wall Barley has found its way hither, and established itself in Brett's timber-yard, Bath; it is to be feared it will flourish too well in the vicinity." Again, under the head of the *Hordeum murinum* itself, he says, "this grass though common in most places is not so about Bath," underwriting as before, "N.B. But is since arrived here."

These remarks by Mr. Sole were made sixty-seven years ago. I have not been able to ascertain whereabout in Bath Brett's timber-yard was, as there is none, I believe, of that name now. But it is clear, by our not finding this grass in the neighbourhood at the present day, that though introduced, probably by accident,

it has never flourished as Mr. Sole expected, shewing how ungenial the place must have been to it, if indeed it still exists in the neighbourhood.

I might pass on to speak of other weeds, common in most parts of England, but apparently rare about Bath, especially the Black Nightshade *(Solanum nigrum)*, met with in only one or two localities, and of uncertain appearance even there. There is likewise the Corn Marygold *(Chrysanthemum segetum)*, stated in the "Flora Bathoniensis," as in the case above alluded to, to be "frequent in cornfields," which I never met with myself, though it has been occasionally seen by other botanists. *Samolus valerandi* is said in like manner to be "frequent in watery places," whereas it seems to be decidedly rare. Mr. Flower informs me he has observed it in one locality below Combe Down, but I know of no one else who has ever found it. The three following species also, *Senebiera coronopus*, *Malva rotundifolia*, *Geranium pusillum*, not generally esteemed rare plants, are much less common about Bath, especially the two last, than in most other places.

On the other hand, to reverse the picture, we have two or three species, usually accounted rare or local, found in this neighbourhood in the greatest profusion. Of the *Ornithogalum pyrenaicum* I have already spoken. But there is likewise the *Geranium rotundifolium*, found on old walls, banks, and other waste ground, almost everywhere; and yet more plentiful the *Mercurialis annua*, one of the greatest pests in our gardens, which it is next to impossible to get rid of. It is singular how the last mentioned plant seems to be confined to the vicinity of a few old towns, such as Bath, Bristol, London, Rochester, and Norwich; shewing that even in the vegetable world we have our regular town, as well as country residents, indifferent as many species may be to either.

But I must not trespass too much upon your time. Whether I have said anything this evening to lead you to take an interest

in our local Flora I know not. I have endeavoured to do so; and it is much to be wished that more of the members of our club would enter upon a field, in which there are so few labourers, but in which there is as much to be done, as much deserving our attention, and as much to afford rational occupation and amusement to those who follow it up, as in the fields so industriously turned over by the Geologists and Antiquarians.

Lord Bacon has pronounced a garden to be "the purest of human pleasures, the greatest refreshment to the spirits of man." If this be true of the gardens which man plants, it is not less true of those gardens which nature has planted, and to which man is indebted, in the first instance, for all the choice flowers he so highly values. There is, indeed, a difference between the two, but not one surely to depreciate the latter in our estimation. Our gardens are set out and arranged according to conventional rules, and often so artificially conceived as to lie open to the faults of stiffness and formality—whereas nature observes no fixed order in the keeping and grouping of her parterres—neither trimming her beds, nor parcelling out her plants according to their particular hues and modes of growth. But is not nature's garden all the more captivating for its wild luxuriance, its rich and varied colours thrown promiscuously together, and the unrestrained freedom with which trees, shrubs, and flowers are allowed to intermingle, giving to the bright field, the tangled bank, and thick wood, each its peculiar charm, and such as is no where to be found or enjoyed except amid rural scenery? Where, too (in reference to Bacon's remark), is to be attained more evenness of mind, or more unalloyed satisfaction, than in the country rambles, not of the botanist alone, but of all who take the smallest interest in the unnumbered productions of the vegetable kingdom—we might add of all true lovers of the picturesque? For myself, I can truly say that some of the happiest hours of my life, when the mind was most free from the distracting cares of the world, and I might add most out of

danger from its corrupt influences, have been spent amid woods and fields in search of our native plants.

> "Rura mihi et rigui placeant in vallibus amnes,
> Flumina amem silvasque inglorius."

Even when a botanist has become well acquainted with the Flora of a district, there is always the pleasurable hope of still finding something new to reward his industry; and if he fail in this, it is yet no small advantage to have an object to give an interest to every walk, and to induce him to take the exercise so conducive to health. But in truth, the field in which he carries on his researches, if he looks closely into it, will never be exhausted. It is surprising how novelties turn up from time to time under the influence of some of those causes to which I have already alluded, even in the best explored districts. This is in a measure true with the higher orders of plants, but in respect of the Cryptogamia, plants of lower organisation, there is hardly any district in Great Britain that has been worked out so as to be able to say what it yields. These obscure tribes offer, no doubt, some difficulty to the beginner, but they deserve to be considered in their turn. If the student or the collector pass them over at first, as in most cases he naturally would, at least let him not think that there is nothing more for him to do, when he has examined or collected all the larger and more showy plants; or that there is nothing left of any interest to arrest his attention, or to be worth looking after.

I leave it to those botanists who, like Mr. Broome, one of our oldest members, have so thoroughly studied the *Fungi*, among the lowest of all vegetable forms, to speak of the several species of this large tribe found in the neighbourhood of Bath. I hope he may one day make us acquainted with them, pointing out their peculiarities of structure, the places and seasons in which they most abound, and the need in which they stand of further investigation. But should you doubt whether Mushrooms, Toadstools, Puffballs, and Moulds, and other similar productions,

luxuriating in damp woods, rotten timber, rotten fruit, dead leaves, and what not, have any real beauty or claims to your regard; let me briefly draw your attention to another large group of cryptogamous plants,—the Mosses—which I trust you will allow are free from anything to render them obnoxious in your eyes. Ferns, which are the highest order of Cryptogams, find, at the present day, admirers everywhere; indeed they are so much sought after by cultivators and collectors, that the mania for them, we fear, is fast leading to the extinction of some of our rarer native kinds. But the Mosses, though small, are quite as graceful and beautiful as the Ferns, more generally to be met with, and with the further advantage—an advantage, however, shared equally with them by the Fungi—of presenting themselves in the greatest abundance and perfection at that season of the year, when the botanist finds little else to do out of doors.

Lord Bacon says that "In the royal ordering of gardens, there ought to be gardens for all the months of the year, in which, severally, things of beauty may be then in season;" and the selecting of such flowers and fruits as are suitable to each month, he describes as the way to have "ver perpetuum." He who steps out from his own to walk in nature's garden, will find that she, too, has so far provided a "ver perpetuum" as to exhibit a constant succession of forms throughout the year to adorn and beautify her beds. There are few more beautiful objects under the microscope than the leaves and fructification of some of our native mosses, which grow on almost every wall, and tree, and bank, and which spring up in their greatest freshness and luxuriance in the fall of the year, when almost all other vegetation is passing into decay. If any of my hearers can be induced to attend to these interesting little plants, they may be of much service in helping us to a better knowledge of the Mosses of this district, of which we have not a complete list even of the commonest species. And the study of them is

not more calculated to entertain the mind than to improve the heart.

Mungo Park, one of the earliest of those enterprising travellers, who have at various times gone forth from this country to explore the wastes and wilds of Africa, and who alas! have too often, like him, laid down their lives in the cause, has recorded in his Journal a little incident, which some may think trifling, but which can hardly fail to arrest the attention of every serious reader. In a season of great danger and distress, when he had just been robbed, and stript, and ill-treated by a banditti, and he found himself in the midst of a vast wilderness, naked and alone, surrounded by savage animals, and men still more savage, with the reflection that he was 500 miles from the nearest European settlement; when his spirits had begun to fail him, and he considered his fate as certain, and that he had no alternative but to lie down and perish—in that moment the extraordinary beauty of a small moss, in fructification, irresistibly caught his eye. "Though the whole plant" (he says) "was not "larger than the top of one of my fingers, I could not contemplate "the delicate conformation of its roots, leaves, and capsules, "without admiration. Can that Being (thought I) who planted, "watered, and brought to perfection, in this obscure part of the "world, a thing which appears of so small importance, look with "unconcern upon the situation and sufferings of creatures formed "after his own image? Surely not!" he replied to himself, and he goes on to say how such reflections roused him from his despair. Starting up, and disregarding both hunger and fatigue, he travelled forward, assured that relief was at hand, and (he adds) he was not disappointed.

This is but one of the many instances in which the contemplation of the marvellous works of nature has called up in the beholder the best thoughts which a devotional mind can entertain. Bacon can commend us to a garden as "a refreshment to the spirits," but a greater than Bacon would suggest something

better and higher than this when He tells us to "consider the lilies of the field." If, with hearts open to instruction, we "consider how they grow," they will read to us the same lesson which the little moss in the desert read to the African traveller, they will irresistibly carry our thoughts up to Him, who not only "clotheth the grass of the field," but "giveth to all—life, and breath, and all things,"—and who, if we commit ourselves to His keeping, will not suffer a "hair of our heads to perish."

APPENDIX.

I.

Selected List of the rarer and more interesting Plants noted in the "Flora Bathoniensis."

Ranunculaceæ.

Ranunculus lingua.
R.——— hirsutus.
R.——— parviflorus.
Helleborus viridis.
H.——— fœtidus.
Aquilegia vulgaris.

Nymphæaceæ.

Nuphar lutea.

Papaveraceæ.

Papaver dubium.
P.——— argemone.

Cruciferæ.

Nasturtium terrestre. *Wick.*
Turritis glabra.
Arabis hirsuta.
Thlaspi arvense.
Lepidium campestre.

Caryophyllaceæ.

Silene anglica.
Stellaria Glauca.

Hypericineæ.

Hypericum androsæmum.
H.——— dubium.

Malvaceæ.

Malva moschata.

Geraniaceæ.

Geranium pratense.
G.——— pyrenaicum.
G.——— lucidum.
G.——— rotundifolium.
G.——— columbinum.

Papilionaceæ.

Ulex nanus, var. *Wick.*
Genista tinctoria.
Trifolium arvense. *Wick.*
T.——— scabrum. *Wick.*
T.——— striatum. *Wick.*
T.——— subterraneum.
T.——— medium.
Astragalus glycyphyllos.
Hippocrepis comosa.
Vicia sylvatica.
V.— bithynica.
Lathyrus sylvestris.
L.——— nissolia. *Wick.*
Orobus tuberosus. *Wick.*

Rosaceæ.

Geum rivale.
Potentilla verna. *Wick.*
Alchemilla vulgaris.
Sanguisorba officinalis.

Crassulaceæ.

Cotyledon umbilicus.
Sedum telephium. } *Wick.*
S.—— album. }

Saxifragaceæ.

Chrysosplenium oppositifolium.
C.———— alternifolium.

Umbelliferæ.

Petroselinum segetum.
Bupleurum rotundifolium.
Caucalis daucoides.

Caprifoliaceæ.

Sambucus ebulus.

Stellatæ.

Galium cruciatum.
G.—— uliginosum.
G.—— parisiense.
G.—— tricorne.

Valerianeæ.

Valerianella dentata.

Dipsaceæ.

Dipsacus pilosus.

Compositæ.

Tussilago petasites.
Erigeron acris.
Solidago virgaurea. *Wick*
Achillea ptarmica.
Artemisia absinthium.
Senecio tenuifolius.
S.—— sarracenicus.
Bidens tripartita.
Serratula tinctoria.
Carduus marianus.
C.—— eriophorus.
Helminthia echioides.
Hieracium umbellatum.
H.——— sabaudum.

Campanulaceæ.

Campanula glomerata.
C.——— trachelium.

Ericaceæ.

Monotropa hypopitys.

Primulaceæ.

Lysimachia vulgaris.
L.———- thyrsiflora.
L.———— nemorum.
Anagallis tenella.
Samolus valerandi.

Gentianaceæ.

Erythræa centaurium.
Gentiana amarella.
Chlora perfoliata.
Menyanthes trifoliata.

Solanaceæ.

Atropa belladonna.

Orobanchaceæ.

Orobanche minor.
Lathræa squamaria.

Scrophularineæ.

Verbascum nigrum.
Digitalis purpurea. *Wick.*
Veronica scutellata.
V.——— montana.
Pedicularis palustris.

Labiatæ.

Mentha sylvestris.
M.—— piperita.
Calamintha officinalis.
Nepeta cataria.
Scutellaria minor.

Polygonaceæ.

Polygonum bistorta.
P.——— hydropiper. *Wick.*

Thymeleaceæ.

Daphne mezereum.
D.—— laureola.

Santalaceæ.

Thesium linophyllum.

Euphorbiaceæ.

Euphorbia platyphylla.
E.——— pilosa.

Alismaceæ.

Butomus umbellatus.
Sagittaria sagittifolia.

Orchidaceæ.

Epipactis latifolia.
E.——— palustris.
Cephalanthera grandiflora.
Neottia nidus-avis.
Orchis ustulata.
O.—— latifolia.
O.—— pyramidalis.
O.—— conopsea.
Habenaria chlorantha.
H.——— viridis.
Herminium monorchis.
Ophrys apifera.
O.—— muscifera.

Irideæ.

Iris fœtidissima.

Amaryllideæ.

Narcissus pseudonarcissus.

Liliaceæ.

Paris quadrifolia.
Polygonatum multiflorum.
P.——— officinale.
Convallaria majalis.
Gagea lutea.
Ornithogalum pyrenaicum.
Colchicum autumnale.

Cyperaceæ.

Blysmus compressus.
Carex axillaris.
C.—— digitata.
C.—— strigosa.
C.—— pseudocyperus.
C.—— pendula.

Gramineæ.

Calamagrostis epigeios.
Avena pratensis.
Holcus mollis.
Brachypodium pinnatum.

Bromus erectus.
B.——- giganteus.
Festuca myurus. *Wick.*
Kæleria cristata.

Filices.

Botrychium lunaria.
Polypodium calcareum.
Aspidium lobatum.
Asplenium filix-fœmina.
Ceterach officinarum.
Blechnum boreale. *Wick.*
Cystopteris fragilis.

II.

List of species in the "Flora Bathoniensis" not (*). or probably not (†), indigenous.

* *Pæonia corallina.*—An accidental escape.
† *Berberis vulgaris.*—In three or four localities.
† *Nymphæa alba.*—In the Canal, but not unlikely to have been planted there.
* *Corydalis lutea.*—Naturalized on walls in one or two places.
* *Cheiranthus cheiri.*—Naturalized on old Walls.
† *Hesperis matronalis.*—Probably an outcast from gardens.
† *Erysimum cheiranthoides.*—Introduced with seed.
* *Cochlearia armoracia.*—Escape from gardens.
* *Koniga maritima.*—Ditto.
† *Senebiera didyma.*—Brought with ballast?
* *Isatis tinctoria.*—Said to have been formerly cultivated at Keynsham.
† *Saponaria officinalis.* — Probably an escape from former cultivation.
† *Silene nutans.*—Said to have been found on a wall at Batheaston: probably an accident.
† *Tilia europæa.*
† *Acer pseudoplatanus.*—Naturalized.
* *Medicago sativa.*—Escape from cultivation.
† *Prunus cerasus.*

* *Epilobium angustifolium.*—Escape from garden.

* *Œnothera biennis.*—Ditto.

† *Sedum reflexum.*—Thoroughly naturalized on old walls in many places, but doubtful if indigenous.

* *Sempervivum tectorum.*—Roofs of houses : introduced.

* *Ribes grossularia.*—Naturalized.

† *Ribes rubrum.*—This species is so abundant in some localities that it may possibly be indigenous. In one afternoon's walk about Swainswick and Woolley, I noticed it in hedges in more than forty different places.

* *Petroselinum sativum.*—Escape from gardens : naturalized in places.

* *Fœniculum vulgare.*—An escape.

† *Caucalis daucoides.*—Introduced with seed ?

* *Lonicera caprifolium.*—Escape from gardens.

* *Centranthus ruber.*—Naturalized on old walls in a few places.

† *Inula helenium.*—Escape from former cultivation ?

* *Achillea serrata.*—Escape from garden.

* *Doronicum pardalianches.*—Ditto.

* *Vinca major.*—Ditto. Naturalized in places.

* *Cuscuta trifolii.*—Introduced with seed.

† *Pulmonaria officinalis.*—Probably an escape from cultivation.

* *Anchusa sempervirens.*—Ditto.

* *Symphytum asperrimum.*—Escape from cultivation.

* *Borago officinalis.*—Ditto.

† *Verbascum virgatum.*—Ditto.

* *Antirrhinum majus.*—Naturalized on old walls.

* *A.———— orontium.*—Introduced with seed.

* *Linaria cymbalaria.*—Old walls ; thoroughly naturalized.

* *Veronica buxbaumii.*—Introduced with seed.

* *Polygonum fagopyrum.*—Escape from cultivation.

† *Euphorbia lathyris.*—This species, formerly much cultivated, is so thoroughly naturalized in the woods at Warleigh that it may possibly be indigenous there.

† *Euphorbia esula.*—Said to have been found near Farley Castle: probably an accident.

† *Buxus sempervirens.*—Probably planted.

* *Acorus calamus.*—In two or three places by the river side, but introduced.

* *Ornithogalum umbellatum.*—In a few places, but probably not indigenous.

† *Bromus arvensis.*—Introduced with seed?

III.

Plants either extinct in the Bath district, or inserted in the Bath Flora by mistake, or probably.

Cardamine bellidifolia.—Bab. Fl. Bath. p. 4. Said to have been found formerly by Merrett. No one has found it since.

Dentaria bulbifera.—"In Prior Park, near the Upper Lodge, abundant." *Rev. B. Richardson Sole M.S.* Mr. Flower informs me that this plant has not been observed of late years, and that possibly the locality may have been destroyed by the building of the Roman Catholic College.

Arenaria tenuifolia.—"Probably a mistake." See Bab. Supp. p. 71.

Mœnchia erecta.—Bab., p. 8. Said to have been found by *Dr. Heneage Gibbs.* No one else seems to have met with it.

Erodium moschatum.—Bab Supp., p. 72. Mr. Flower informs me this species rests on the authority of the late Mr. J. Jelly, in his *M.S. Flora Bathonica,* from whence it was copied by Professor Babington. Possibly it may have been confounded with the *E. cicutarium.*

Vicia lutea.—Bab. p. 13. "Gathered on the road-side beyond Midford, by the Rev. B. Richardson, and reported by him to Dr. Davies. Not observed of late years, and possibly extinct." *T. B. Flower.*

Lathyrus hirsutus.—Bab. Supp. p. 75. Inserted by error in the Flora Bathoniensis, as well as in many of the British Floras, as regards the Pensford locality, the *Vicia bithynica* having apparently been mistaken for it. The true *Lathyrus hirsutus* is not known to grow anywhere in this country except in Essex.

L. —— *latifolius.*—A mistake. See Babb. Supp., p. 75.

L. —— *palustris.*—Bab., p. 14. Said to have been found by Dr. Davies "in moist hedges about Smallcombe Wood." Either a mistake or now lost by drainage.

Cicuta virosa.—Bab., p. 21. "A single plant only observed in the Canal, by Dr. Heneage Gibbs. Has long since disappeared." *T. B. Flower.*

Senecio sylvaticus.—Bab., p. 21. Said in the Fl. Bathon., to be "frequent on dry banks and pastures," but neither Mr. Broome, nor Mr. Flower, nor myself ever met with it. It grows at Hanham, but must be considered a very doubtful native of the Bath district.

Carduus tenuiflorus.—Bab., p. 27. Said to have been found on the "banks of the Canal" by Dr. Davies; but Mr. Flower remarks that Dr. Davies, a few years since, could give him no information about this species, and he considers it as "probably an error."

Gentiana campestris.—Bab. Supp., p. 83. Dr. R. C. Alexander, on whose authority this species rests, informs Mr. Flower, the plant in question should be referred to the *G. amarella.* The *G. campestris* must therefore be erased from the Bath Flora.

Asperugo procumbens.—Bab., p. 33—"The locality for this rare species rests on the authority of Mr. Hill, in Blackst. Sp. Bot. p. 5. It is possible he meant *Lycopsis arvensis*, which was occasionally mistaken for it by the older Botanists." —*T. B. Flower*

Verbascum lychnitis.—Bab. p. 33.—Found by Dr. Davies many years since, and by no one else. Possibly an escape. Mr. Flower informs me that "Mr. Haviland had formerly a botanic garden at Batheaston," which may have given origin to it.

Salvia pratensis.—Bab. 38.—Said in the "Botanist's Guide," to have been found at "Wyck by Mr. Swayne," but surely a mistake for the *S. verbenacea.*

Ophrys aranifera.—Bab. Supp. p. 94.—No one appears to have found this species except the late Mr. Jelly. If not a mistake, probably extinct.

Narcissus biflorus.—A mistake. See Bab. Supp. p. 95.

Carex davalliana.—Bab. p. 54. Not found for many years. Bentham considers it as only a variety of *C. dioica.*

Briza minor.—Bab. p. 59.—An error; a variety of the *B. media* having been mistaken for it. *C. C. Babington.*

Poa bulbosa.—Bab. p. 59.—On the authority of *Mr. Dyer,* in the "Botanist's Guide." Supposed to be an error, some other species having been mistaken for it.

Equisetum hyemale.—"Not found for many years." *Bab. Supp.,* p. 103.—Probably extinct.

Polypodium dryopteris.—"Not now to be found," where Mr. Sole met with it; and Prof. Babington thinks that perhaps the *P. calcareum* had been mistaken for it. See *Supp.* p. 103.

If the above plants be withdrawn from the Bath List, it will reduce the entire number of species to 747.

IV.

Additions to the Bath Flora since the publication of Professor Babington's Supplement to the "Flora Bathoniensis."

* *Camelina sativa.*—Waste ground at Weston.

† *Adonis autumnalis.*—"Occasionally observed among corn on Rush Hill and Odd Down." *T. B. Flower*—Probably introduced with seed.

Ranunculus aquatilis.—Var. *fluviatilis.*—In the river and the canal.

Barbarea præcox.—A weed in gardens at South Stoke. Considered by Bentham as only a form of *B. vulgaris.*

† *Erysimum orientale.*—A weed in fields at Limpley Stoke. *Miss Peacock.*

* *Dianthus cæsius.*—Naturalized on old walls at Swainswick.

† *Linum angustifolium.*—Fields near Winsley. Probably introduced with seed.

† *Impatiens noli-me-tangere.*—"In woods at Prior Park." *Mr. Clark.*—A very doubtful native

* *Trifolium incarnatum.*—"Naturalized in several places about Bath; an escape from cultivation." *T. B. Flower.*

Vicia bithynica.—Slopes of the hills about Pensford.

Fragaria elatior.—In the wood by the side of the Gloucester Road, about four miles from Bath. Considered by Bentham as only a variety of *F. vesca.*

Poterium muricatum.—"Combe Down." *T. B. Flower.* Only a variety of *P. sanguisorba*, according to Bentham.

Rosa micrantha.—Banner Down. Probably only a variety of *R. rubiginosa.*

R. —— *canina*, Var. *sarmentacea.*—"Hedges at Combe Hay." *T. B. Flower.*

† *Pyrus communis.*—Near the Rocks, Batheaston. *C. E. Broome.*

Epilobium roseum.—Wet places, Combe Down, Batheaston, &c. Not uncommon.

Saxifraga granulata.—Stantonbury Camp, North east side.

Œnanthe lachenalii.—"Not uncommon in bogs around Bath." *T. B. Flower.* Not considered by Bentham as distinct from Œ. *pimpinelloides.*

Œ. —— *fluviatilis.*—"In the Canal between Bath and Bradford." *T. B. Flower.* Thought by Bentham to be only a variety of *Œ. phellandrium.*

* *Heracleum giganteum.*—"Naturalized on the banks of the Great Western Railway at Keynsham." *T. B. Flower.*

* *Coriandrum sativum.*—Found by Mr. Broome and myself in a field of mangold near the monument on Lansdown, Sept., 1858. Probably introduced with seed. In Warner's first list of Bath plants, Mr. Sole gives this species as growing on "waste places about Dolemead, Bath." It is not mentioned in the "Flora Bathoniensis."

† *Asperula arvensis.*—Fields, Limpley Stoke. *Miss Peacock.* Perhaps introduced with seed.

Valeriana sambucifolia.—"Damp places in the neighbourhood of Bath." *T. B. Flower.* Only a variety of *V. officinalis* according to Bentham.

* *Dipsacus fullonum,*—"By the side of the river at Keynsham; not wild." *T. B. Flower.*

Anthemis arvensis.—On walls near Winsley; also near South Wraxall.

Gnaphalium sylvaticum.—"Between Box and Marshfield." *T. B. Flower.*

Hieracium murorum, Var. *maculatum.*—In quarries and on walls about Combe Down, as well as in the woods at Prior Park, but not considered by Bentham as distinct from *H. sylvaticum.*

Utricularia vulgaris.—"In the canal between Bathampton and Limpley Stoke." *T. B. Flower.*

* *Cuscuta epilinum.*—"On flax, at South Wraxall and Winsley." *T. B. Flower.*

* *C.* —— *trifolii.*—Clover fields, Batheaston. This and the last species probably introduced with seed.

† *Mentha viridis.*—Sides of a stream in a meadow between South Stoke and Midford

† *Lamium maculatum.*—On a bank by the side of the foot path leading from South Stoke to Combehay. Possibly an outcast from some garden, though not near one.

* *Rumex scutatus.*—"Waste ground by the Saltford railway station: naturalized." *T. B. Flower.*

Polygonum dumetorum.—"Among bushes near the railway, about one mile from Keynsham, towards Bristol." *T. B. Flower.*

* *Euphorbia cyparissias.*—"Waste ground by the railway station, Saltford; possibly planted." *T. B. Flower.*

Callitriche aquatica, Var. *platycarpa.*—"Bogs near South Wraxall." *T. B. Flower.*

Ulmus campestris, Var. *suberosa.*—"Copse leading from Odd Down to Combehay." *T. B. Flower.*

Salix fragilis, Var. *Russelliana.*—"On the banks of the Avon." *T. B. Flower.*

S. —— *triandra.*—"Box brook." *T. B. Flower.*

Lemna trisulca.—In the canal near Combe Hay.

L. —— *polyrrhiza.*—"Canal basins." *T. B. Flower.*

Potamogeton heterophyllus.—"River Avon." *T. B. Flower.*

P. —— *flabellatus*, Bab.—"In the canal, near Sydney Gardens." *T. B. Flower.*

P. —— *decipiens*, Nolte.—Found in the canal by Mrs. Hopkins: not previously observed in Britain. Described and figured in Seeman's "Journal of Botany," No. 51, p. 71, Pl. 61.

* *Elodea canadensis.*—In the canal in great plenty; also in the river.

Fritillaria meleagris.—This plant, which, Mr. Ellacombe informs me is extinct at Bitton, the station marked for it in the "Flora Bathoniensis," has been re-discovered by Mr. Flower in meadows about Philiip's Norton, though seldom flowering. He says it has been also found near Bradford Wood.

Allium oleraceum.—Borders of field, South Stoke.

Scirpus fluitans.—"Bogs near South Wraxall." *T. B. Flower.*

† *Setaria viridis.*—"Waste ground near the church, Combe Down; very sparingly." *T. B. Flower.*

Gastridium lendigerum.—"In very small quantity in the quarry above the Observatory field, near Prior Park. *T. B. Flower.*

* *Lolium perenne*, Var. *Italicum.*—About Swainswick. Escape from cultivation.

† *L.* —— *temulentum*, Var. *arvense.*—"Cornfields, Monkton Farleigh." *T. B. Flower.* Probably introduced with seed.

Bromus commutatus.—"Cornfields on Lansdown." *T. B. Flower.*

B. —— *secalinus.*—Cornfields, South Stoke. This and the last, and *B. arvensis*, are considered by Bentham as one species.

Aspidium rigidum.—"Quarries on Hampton Down, very sparingly. I fear the locality has been destroyed by the numerous Fern collectors." *T. B. Flower.*

Summary of Proceedings of the Bath Natural History and Antiquarian Field Club for the year 1866.

(Read February 23rd, 1867.*)*

Mr. President, Vice-President, and Gentemen,

In preparing a summary of the proceedings of the Club during the past year, your Secretary has been considerably embarrassed with the amount of material before him, rendering it somewhat difficult to form a summary adequately representing the work accomplished. Taking the events of the past year, however, in the order of their importance, he proposes, in the first place, to give an abstract of the papers and communications made at the various Evening Meetings; secondly, to give an account of the four chief Excursions; and lastly, of the Tuesday or home walks, and other business.

The Evening Meetings, notwithstanding a little discouragement at first, owing to causes over which, no doubt, the Members had no control, have been maintained during the past year with varied success, and the programme for 1866 duly carried out. The first Lecture of the series by the President was alluded to last year—the second for February 15th on "Ancient Leaden Stamps found in England and other parts of Europe, by the Reverend Prebendary Scarth," was not given owing to the domestic affliction of the Vice-President. His place, however, was kindly supplied by the Rector of Swainswick, who gave a description of the three marble figures inserted in the wall of the Angel Inn, at Marshfield. The conclusions which Mr. Earle had arrived at after careful observation were that these crowned figures represent the Virgin and Child, S.S. Margaret and Catherine; and were formerly a portion of a series of five figures forming the reredos over an altar; the two others being now lost, or perhaps still to be found concealed in the walls of the town, or somewhere in the neighbourhood. He ventured to give them as early a date as the 13th century, and said that they merited the careful attention of the antiquary. Alluding to the frequent occurrence of the name of St. Catherine in the neighbourhood of Bath, and quoting the ancient oath which the Freemen of Bath took, that they should maintain "St. Katern's chapel, and keep holy St. Katern's day," he impressed the Members with the idea that the day would be a red letter one in his calendar, on which any traces of this said St. Catherine's chapel could be discovered. After tea the President gave a short description of the peculiar habits and structure of the Artemia salina—a small crustacean found in the salt pans at Lymington, and called by the workmen the "Lymington shrimp." Some tree-wasps' nests were exhibited, and the Secretary of the Bath and West of England Agricultural Society laid on the table several volumes of beautiful paintings of Natural History objects, by Mr. Robbins, an artist of some reputation in Bath, of the last century.

On March 15th, Mr. Charles Moore described "the range and structure of the Brachiopoda, with reference to local species." Having alluded to their old name of "lampades" or lamp shells, so called from the peculiar hole through which the pedicle thrusts itself being similar to that in ancient Roman lamps, he enumerated the families of these Mollusca, stated their early appearance in the strata of the earth, and traced their rise, numerical development and final disappearance through the various formations. In illustration, several beautiful specimens of Crania, Lingula, and Terebratulæ from his own collection were shown, ranging from the Lower Silurian formation to the most beautiful and delicate shells found in our present seas. The Rhynconella, so abundant in the rocks of this neighbourhood, first appears in the Lower Silurian, and passing up through the various formations is found at the present time, though reduced to four or five living species only. The internal structure of these shells, the wonderfully developed spiral coils of the spirifer and loops of the Terebratulæ, were described and illustrated by specimens and drawings; and Mr. Moore concluded with an allusion to his own researches, whereby he had been enabled to extend the range of some of these Brachiopoda far higher up in the strata, than hitherto supposed to be possible by other geologists.

The third and last Lecture of the spring Session was given by the President, on the 12th of April, on "Phosphatic Nodules obtained in the Eastern Counties for agricultural purposes." As the Lecture has been printed and published, chiefly at the expense of Mr. Jenyns, and is now in the hands of the Members, or may be obtained by any who wish for a copy; it will be sufficient merely to state that the opinion formerly held that these nodules found in the upper Green sand at the base of the lower Chalk were coprolites, was shown to be erroneous. And the opportunity was taken to pay a graceful tribute to the memory of the late Professor Henslow, to whose patient research and scientific acumen agriculturists were indebted for the discovery of the great value

of these nodules in an economic point of view. The transition from phosphatic to flint nodules was easy, and Mr. Crickitt concluded the evening's transactions by reading a paper on the formation of flints. Differing from Dr. Buckland that flint was formed of the silicious matter held in suspension in the chalk mud of an ancient sea, and precipitated in a gelatinous form around organic nuclei on the ocean bed, the Lecturer advocated the theory that the ancient sea beds were covered with living sponges which had been buried alive by a drift of decomposed coral mud. In process of time this bed was upheaved, and by the effect of alkaline volcanic springs, like those of Tongariro, holding silica in solution, the porous strata were interpenetrated, and the silica lodged in the cavities, thus forming masses of flint.

Three Evening Lectures of the winter and spring Session, of 1866–67, have already been given,—by the President, on the "Bath Flora,"—by Mr. Crickitt on "The Hot Springs of Bath, and elsewhere,"—and by Mr. Scarth on "The Roman Villa lately excavated at Wick, by the Club." When the concluding lecture by Mr. Moore on the 13th March, shall have been delivered, it is to be hoped that means will be provided to ensure the publication of these and similar papers in a more permanent form than that afforded by the columns of the newspaper press.

The four Excursions fixed at the Anniversary Meeting have all taken place. The good attendance of Members and the pleasing recollections which have remained, testify to the interest which has been felt.

The first, in April, to Caerwent, was numerously attended, fourteen or fifteen Members having assembled at the Bath Station for Portskewet and Chepstow. The Vice-President met the Members at the latter place, and under the admirable guidance of the Lady of Dennel Hill, they proceeded in carriages to investigate the antiquities and historical places of the neighbourhood. The Church and Farm House at Mathern, about three miles distant, was the first point; in the north wall of the chancel

a black slab has been inserted recording the first foundation of the Church in A.D. 600, in memory of Thewdrick, king of Maganuck, or Glamorgan. A great battle was fought at Tintern, and the king who was present being slain, was forthwith accounted by the men of Glamorgan a martyr, under the title of St. Thewdrick; hence a church arose to his memory. This record is said to have been by the hand of Bishop Godwin. Adjoining is Mathern House, formerly the Palace of the Bishops of Llandaff; several traces of 15th century and Elizabethan architecture in the old gateway-tower, and windows, attest its former importance. Moiens, or Monks' Court, a bow-shot across the fields, the property of Mr. Lewis, of Dennel Hill, is of later date, traces of a former house are however to be seen in an orchard at the back. A gateway between two tall towers leads to an oblong grass covered court, a sloping garden on the south has traces of a stew or fish pond, and the occupants of the house state that a coffin had been found in the garden, whether Roman or Mediæval was not known. The Bishops of Llandaff appear to have resided here after leaving Mathern. A weather-worn stone, now in a room over the tower gateway, found during repairs in a chimney, has the following Latin inscription :—

HUNC DOMUM CONSTRUXIT * * * LANDAVENSIS.
* * * C.S. * * *

("SC" being probably part of the word Episcopus.)

The arms over the entrance doorway are those of Godwin, according to the reading of one of the Members, so that the missing word is probably "Godwin" in the inscription. A stone with a Roman inscription was found in a wall adjoining, and is now in the Museum at Caerleon. A pleasant walk across the fields led the Members to the modernised mansion of St. Pierre. A glimpse of the oak panelled dining room, with the portrait of Henry Martin the regicide, who spent his latter years under restraint in

Chepstow Castle, was courteously permitted, also the four incised monumental slabs in the Chapel adjoining, inserted in the floor of the chancel, one of which bears an inscription in Norman-French, to the memory of Urian de St. Pere, temp, Edward I., 1239. The other three are of later date. Leaving the house, the Members drove through the park with its numerous deer, fine yew trees, and picturesquely broken limestone ground, on their way to Sudbrooke Camp, inspecting by the way a ruined megalithic structure on the right hand, near Portskewet, situated on rising ground. The stones, of which some are erect, are composed of a sandy Conglomerate, with small pebbles of quartz, and are much weather worn. A quarry at the base of the rising ground gives a section of the Limestone, which assumes a rich red and yellow tint. Caldecot Castle, and the walls of Caerwent and most of the old buildings in the neighbourhood are principally composed of a similar stone. Sudbrooke Camp, a portion of which seems to have been washed away, is said to have been the first station of the Romans after crossing the Severn; it assumes a semi-circular or oval form, and has been likened to a bow, the side next to the Severn forming the string. A small chapel dedicated to the Holy Trinity, the original portions of the edifice being as early as the twelfth century, stands at the north-east angle of the camp outside the vallum.

The gradual encroachment of the Severn at this point threatens soon to undermine the remaining small space of ground between the ruins and the river. Caldecot Castle with its fine gateway and tower was the next point visited. Formerly the residence of the Constables of England, and giving the title of Baron Beaufort to the Dukes of Beaufort, it ranks amongst the finest of the Castles in Wales. Situated in a level plain, its chief protection seems to have been the height and massiveness of its surrounding walls with their encircling deep moat, which are both in a very fair state of preservation. At times, too, the castle might be made difficult of approach, as all the country

could be put under water. A short inspection of the neighbouring church, with its well kept churchyard, was made, and the stream of the Troggy followed to Caerwent, the Venta Silurum of the ancients. Before entering, the Vice-President beneath the shelter of a massive portion of the south or port-wall gave a short description of the city, and the various discoveries which have from time to time been made. A considerable portion of the walls now remain, enclosing a space of forty acres, and are in some places on the south side, twenty-five feet high. The facing has been removed in several places, and the "herringbone" work in sandstone exposed; red sandstone supplying the place of the usual bonding courses of Roman bricks. The remains of the north gateway may still be seen in a cottage garden, and the fosse on the west and south-west is still of great depth. The via Julia runs through the camp, and the church, which has no features of architectural interest about it, appears to have been built of the stones of the Roman station. Only one inscribed stone is said ever to have been found at Caerwent, but a very interesting bath, with all its accompanying chambers, was laid open to the south of the farm-house; a model of this is preserved in the museum at Caerleon, and it has been described by Mr. Octavius Morgan in the Archæologia. The Beaufort Arms gave such accommodation as it could offer to the Members for the night, and the next morning being bright and balmy, induced some of the Members to make an early start for the Windcliff, whilst others, under the guidance of Mr. Irvin, inspected the Castle; and the geologists the limestone quarry across the Wye. The principal feature to be noticed here is the existence of a thick bed of Oolitic limestone, some twelve feet thick, at the base of the quarry nearest the river, similar to that observed by the Secretary, at Skrinkle Bay, near Tenby, just above the Shales and fish bed of the Carboniferous limestone. The capping of the quarry appeared to be New Red, and there was a very thick talus of yellow sand and clay, the accumulation of six or seven years

merely. Where the Gloucester road rises beyond, the limestone strata on the right present a very upheaved and contorted appearance, similar to that on the banks of the Avon, at Clifton. After breakfast, the train was taken to Newport, and a walk of three miles brought the Members to Caerleon, the ancient Isca Silurum, nestling beneath the Welsh hills, on the right bank of the golden Usk. The station of the second Augustan legion under the command of Vespasian, it was a city of no mean importance, as the great amount of antiquities in the museum attests. The walls formerly enclosed about fifty acres, and were one mile in circumference; the mortar in the walls contains but little of the customary pounded Roman brick, except at the angles, where it occurs in the usual quantity. Under the able guidance of J. E. Lee, Esq., all the points of chief interest were shown—the amphitheatre, called King Arthur's round table; the lofty mound the site of the ancient Norman keep, whence is a glorious view of the surrounding country; the church, and the admirable museum, the arrangement and management of which reflect so much credit on its curator. There was but a short time to inspect the great variety of Roman curiosities here collected together, and a cursory glance merely could be given at altars, columns, pavements, bricks, funereal urns, glass vases, Samian ware, fibulæ, ornaments and coins. Memory only retains a few of the more prominent—an altar to Salus Regina, a votive tablet for the health of Severus and his sons, many sepulchral slabs, bricks inscribed "LEG. II. AVG," coins from Claudius Cæsar to Arcadius and Honorius inclusive, electrotype in gold of an engraved stone, representing Hercules strangling the Nemæan lion, the impression in wax of a nicolo set in a ring of debased silver, the subject being Venus Victrix, portions of ornamental ribbed glass, two ivory carvings (one a tragic mask), with holes, showing that they were attached to harness or the like, and numerous other curiosities. The courteous and hospitable proprietor of this mine of Roman antiquities invited the Members to a sumptuous lunch,

and the short time allotted was but too quickly passed in antiquarian talk, and sipping classic wine, of which the ancient Romans appear to have left a goodly cellar full—"sunt etiam Ammeniæ vites, firmissima vina." The juice of the Ammenian grape was most highly appreciated, and helped to strengthen the pedestrians for a rapid walk to the train at Newport.

The Second Excursion, on May 15th, was devoted especially to geology under the guidance of Mr. Charles Moore, the object being to visit the Trap dike lately discovered by Mr. Moore on the Mendips. The route taken was from Bath to Shepton Mallet by railway. Passing through the latter town, and following the main road, the first halt was called at a section on the right hand side of the road, exhibiting a horizontal deposit of Rhætic and Liassic beds on the upturned edges of the Carboniferous limestone. A fault on one side has brought down the Liassic beds on a level with the Carboniferous limestone, against which they rest at a slight angle. These beds which are of the same geological age as those of the Lower Lias near Weston, and contain the same fossils, are very much like the "Sutton stone" beds. Those Members who were present at the Southerndown excursion last year, were struck with the similar appearance, both lithologically and as regards their fossil contents, which they presented. The first few blows of the hammer revealed the usual fossils of the Lower Lias, Lima gigantea, L punctata, and many specimens of Ostrea liassica. The same bed was traced on some rising ground on the opposite side of the road. The chief peculiarity to be noticed in these beds as compared with the "Sutton stone" series, was the absence of corals, of which during this short visit no traces could be found. Even the flinty Conglomerates which form so conspicuous a feature in the beds at Southerndown, are traceable here. The Members then mounted the Old Red axis of the Mendips, passing on their road some ancient Barrows, and followed the Romano-British road, called the "Ridgway," till they arrived at the Beacon (one of the highest points), an upright

Oolitic monolith. Whilst passing along the "Ridgway" several indications of Trap were noticed in heaps of stone by the road side. At Waterlip quarry, on the right, the Mountain limestone has almost a vertical "dip." In a field near the East Cranmore Tower, Mr. Moore standing on an outcrop of Trap running from east to west, pointed out that this "appeared to be the very point of upheaval where the mighty volcanic agencies which had disturbed the whole of the range had burst forth." That this had taken place at a remote period, and after the deposition of the Coal measures, he endeavoured to prove from the fact that in the neighbouring valley to the north, the older rock overlies the more recent strata, the coal being worked beneath the Carboniferous limestone, which Mr. Moore contended could only have occurred from the Carboniferous limestone being upheaved by volcanic agency, and doubled back over the coal, the lava at the same time bursting forth wherever a vent could be found.

The Members were much indebted to the courtesy of Major Paget, M.P., who opened his tower for inspection; to Mr. Green, who provided a most welcome lunch in the shades of Cranmore Wood; and also to the Rev. J. S. Horner, who allowed the Members to walk through his finely timbered and romantic Park, and provided a cold collation for them at the Rectory.

The Third Excursion on the 21st of June, to Avebury (from the notes kindly supplied to the Secretary, who was unable to be present, by one of the Members), appears to have been a pleasant one. There was an early start from the Bath Station, at 8.30, to Calne. The architecture of the well-restored church was explained by the incumbent, and the tablet to the memory of a King of the Gipsies pointed out on the outside of the south porch. Cherhill and Oldbury Camp were visited under the guidance of the Revds. Penderleath and Inman, on the way to Avebury; at the latter place the church was shown by the incumbent, and the font, supposed to be one of the oldest in the kingdom; a short account of the megalithic structure was also given by the same gentleman;

and after a due supply of good Kennet ale, the Members refreshed stormed the hill of Silbury, and walked thence to Marlborough.

The second day seems to have been passed in visiting churches, and wandering through the charming scenery and amid the magnificent trees of Savernake Forest; and in a vain and fruitless attempt to overtake an ever-vanishing member on his pony. After a visit to Martensell Hill and Camp, St. Ann's or "Tann" Hill, and a walk of fourteen miles along the ridge of the Downs overlooking the rich Vale of Pewsey, Devizes was reached in time for the evening train to Bath.

The fourth and last Excursion of the year took place on the 9th of October. Encouraged by a rising barometer and the prospect of fine weather the Members mustered strongly at the Bath Station for an early start to the ancient Caer Segont, hodie Silchester, by way of Reading and Mortimer. After a brief glance at the remains of the Abbey at Reading, a short walk of two-and-half miles from the Mortimer Station brought the Members to the amphitheatre at the north-east angle of the city walls. Though much over-grown with shrubs the form is tolerably perfect. Guided by a gentleman of local influence, the city was entered at the east gate, and the Rev. J. G. Joyce, rector of Strathfieldsaye, was in readiness to conduct the Members to the spot where the excavations had been made. The form of the city, and the walls which surrounded it on seven sides, and in some parts are of considerable height, were pointed out. A great variety of coinage, from the earliest to the latest period of the Roman occupation of Britain, has been found, and some beautiful gold, silver, silver-plated, and bronze specimens were shown most ingeniously mounted in cardboard and covered over with glass. The iron work was in some cases in very good preservation and very abundant. Many curious things were shown—scissor blades, lock plate and key, hinges, strigils, the tools with which the tesseræ were cut and laid, a numerous assortment of bronze styli, fibulæ, a glass tube, studs, hair pins, &c., &c., the bone tickets

both round and oblong, which admitted to the gladiatorial shows, and even child's toys of iron. The visit of the club was made memorable by the discovery in the Forum of a beautifully sculptured bronze eagle, a portion of one of the military standards which accompanied the Roman legions. A vote of thanks was cordially given to Mr. Joyce for his courteous reception, and a hurried exit made from the Forum by Members who were anxious to partake of something more substantial than Roman antiquities.

The prospect of visiting Strathfieldsaye induced some of the party to remain for the night at Reading, and the next day, again under Mr. Joyce's guidance, the plain and homely mansion of the late Duke was inspected, and in the hall was seen the fine tesselated pavement of geometrical pattern with an urn in the centre, which has been so successfully moved from Silchester, and lately placed in its present position. Various reminiscences of the Duke and his campaigns were shown, and a drive through the magnificent avenue of elm trees nearly a mile long, and across the finely timbered park, brought the party to Marochetti's beautifully proportioned column and statue of the old Duke, erected by the tenants and servants to the memory of their good old master. A hospitable reception at the Rectory increased the obligations of the Club to Mr. Joyce, and was duly appreciated by all present.

Some Members of the Cotteswold Field Club, accompanied by their President, Sir William Guise, visited Bath on the 18th July, and were met by our Members at the station. Under the guidance of Mr. Moore the geological features of the Warleigh Valley and heights were pointed out. The gravel beds at Freshford, said to be of the same age as those at Amiens and Abbeville; the inferior oolite along the canal banks, thirty feet of which in the section there exposed would represent beds in the Cotteswold district 200 feet thick, and all the beds in this district with the exception of the basement sands; the section opposite Dundas where the Inferior Oolite rests upon very thin beds of Upper Lias;

the section of Middle Lias at the base; and the coralline nature of the top beds of the Oolite on Hampton Down, were all successively visited and described. The Members of the two Clubs then dined together on their return to Bath, and spent the evening in a discussion on the age of the "Sutton stone" beds at Southerndown.

Under the last head of Tuesday walks, your Secretary congratulates the Club on the energy with which they have been maintained through the year, and the various good results which have flowed from them. In the first place, the excavations going on at the site of the old Abbey of Keynsham, alluded to in the last summary of proceedings, have been as carefully watched as the circumstances of the case admitted, and two incised slabs rescued from destruction, and placed in the portico of the Literary and Scientific Institution. One is of an early date in Norman French, and bears the following inscription round its edges:—

ISABEL DE PENDELESFORD
GIST ICI DEU DEL ALMI EIT MERCI. AMEN.
PATER ET AVE.

Probably to the memory of some benefactress of the Abbey. The second slab which is of later date, with a decorated cross in the centre, bears the following:—

HIC JACET WALTERUS JOCE
CANONICUS NUPER CUSTOS CAPELLE [SANC]TE
ANNE IN THE WODE
CUJUS ANIMA PROPICIETUR ALTISSIMUS
AMEN.

Five other incised slabs composed of oolite, and one of Purbeck marble, were found; one of the oolite slabs was highly calcareous, probably from Portland. Another was broken in several pieces, and had the following elegiac couplet:—

IN MARSHFIELD NATUS GRANT ABBAS ECCE
JOHANNES,

[IPSE JACE]T HIC SUB PULVERE· PRES[BYTERI]. On one portion; and, "OBIIT 18 KALEND MARCII A. DOMINI, M^{8} ⌉ ⌉ " (1499) in Arabic letters, on another portion.

"In Dugdale's Monasticon," John Grant was confirmed Abbot of Keynsham, 1487; and it is an encouraging and interesting fact that it is due to the labours of some of the Members of our Club, that the actual spot in which the Abbot was buried has been discovered, and also the date of his death.

Three other incised slabs, lying side by side, were to the memory of the Deschell family. One was thus inscribed:—

"JESU MISERERE ELEANOR DESCHELL QUONDAM CONSORTIS JOHANNIS DESCHELL CUJUS CORPUS HIC REQUIESCIT, ANNO DOMINI MCCCCC. JESU FILIUS DEI MISERERE MEI, AMEN."

A second to the memory of "Johannis Deschell" himself, the husband of Eleanor. The name only was legible. A third had the name obliterated, and only the words

"HIC REQUIESCIT CORPUS CUJUS ANIMA PROPITIETUR."

Another slab, which had been turned with its face downwards, had the following inscription, and a cross and scroll in the centre:—

"HIC JACET JOHN SPALDYNG—CUSTOS AC FRATRIBUS SEMPER AMABILIS ET GRATUS ET CUSTOS SANCTE ANNE I̅ SILVA CUJUS ANIME PROPITIETUR, MAG. DEUS."

The scroll contained the following:—

"[VOLO.] ME JUDICARI. DOME SECUNDUM [MISERICORDIAM TUAM]."

Other fragmentary inscriptions were scattered about—one was

to the memory of a man and his wife (but the names were unfortunately illegible), and was as follows :—

"HIC JACENT CATERINA UXOR EJUS, * * * CUJUS ANIMIS PROPITIETUR DEUS."

The device was that of an angel, with expanded wings, holding a book with the letters I.H.S. on it ; a double cross ran down the centre of the slab which was of a very hard and close textured Oolite. Several others may be seen cut up and used for coping stones and steps of the new house, which a builder has erected on the site.

The name of a chapel of St. Anne in the Wood constantly occurs—are there any traces of this chapel existing ? Amongst other beautiful and choice remains was a stone book, with four lines on each page, a quotation, probably from the Vulgate, of the 15th century ; and a finely cut draped figure of our Saviour riding on an ass ; and several other delicately sculptured portions of finials, capitals, &c., of Norman, Early English, Decorated, and Perpendicular periods.

Several of the slabs had been used twice over, the under side when removed being seen to have an inscription on it. The capital of an Early English column has been kindly presented to the Institution by Mr. Cox, of Keynsham, and is now in the Portico.

Beneath a large blue Purbeck marble slab, on whose upper surface was the indentation of a fine brass, the skull and bones of an aged man were found four feet beneath the surface in a walled grave, his lower jaw containing two molars much worn, the bones were very brittle and discoloured with time. Report states that some Bladudian had appropriated the skull for his tobacco box.

It is to be much regretted that some competent person does not watch these interesting remains which are from time to time discovered, and which the requirements of a needy speculative builder are turning into practical use for building purposes.

Another short excursion of the Club was to the Radstock Coal-pits. The Members under the guidance of Mr. McMurtrie were shown over the "Ludlow's Pit." A rapid but smooth descent was made in the iron cage to the lowest gallery, a depth of 150 fathoms, and under the charge of "viewers" with lamps and candles, they proceeded down a gallery for about 800 yards to the "head" of the working, where a narrow seam of coal about one foot two inches in thickness was being worked. The whole process was kindly explained by Mr. McMurtrie, and some curious wedge shaped masses of Shale intervening between narrow bands of coal pointed out. Abundance of the usual coal fossils, such as ferns, calamites, lepidodendra, fruits, seeds, &c., have been found, but no shells or mollusca. The shaft is sunk through the New Red, with an intervening band of gritstone. The galleries are in some parts lofty enough to admit of horses working; yet owing to the great pressure it was stated that when disused for some time these galleries have been known to close up entirely; and this arises by the gradual elevation of the floor, not by the subsidence of the roof. In the "heads" the coal seam is worked sometimes by the removal of a thin band of superincumbent Shale, which allows the "seam" to become detached and upheaved from below.

On Tuesday, May 8th, Mr. Godwin, Vice-President of the Bristol Architectural Society, kindly gave a Lecture to the Club, at the Literary and Scientific Institution, on "Mediæval Bristol." After an admirable and clear sketch of the ancient city, its rise, and progress, the Members, under Mr. Godwin's guidance, plunged into the dirty holes and corners of Bristol, and were amply rewarded by the sight of many an architectural gem, ecclesiastical and domestic, which was pointed out and described by their able guide.

The Box Tunnel and the stone quarry of Randall and Saunders at Corsham, were objects for another day's walk. Mr. Amor, the contractor, took charge of the Members in their walk through

Mr. Brunel's great but unnecessary work; the dryness of the tunnel, except where the shafts admitted the rain and spring water, is remarkable. The boring was commenced at both ends, and when the workmen met in the middle, they were only about one inch out of the straight line. The exact length of the Tunnel is 3,195 yards, or $1\frac{3}{4}$ mile: greatest depth 300 feet below the surface: gradient 1 in ·100. W. The strata having an E. dip, a succession of beds from the Inf. Oolite to the Forest Marble (the top bed of the Great Oolite), were cut through. The Members took one hour walking up; ten minutes only shooting down in "trollies."

Another important walk of the season was to Weston, where the Rev. Prebendary Bond received the Members in his garden, and pointed out the coffin lid which had been found in the churchyard, and was placed there for safety: the following inscription runs round a cross in the centre:—

"GALFRIDI TUMULO REQUIESCUNT OSSA SUBISTO, QUI FUIT ANTISTES H' D̃Ũ FUIT IPSE SUPERSTES."

Proceeding to the back of the Vicarage a well-defined bank was traced leading nearly in a straight line to what is now called Fosse Lane, and so joining the via Julia over Lansdown, beneath "Prospect Stile." Whether or not this be the true line of the Roman Road which is supposed to go through the village lower down, is left to conjecture. Through the kindness of Mr. Bond, excavations had been made in a field close to the monument, and many traces of Roman occupation found, confirming conjectures hitherto hazarded, from the uneven conformation of the ground, that this was the site of a Roman Villa. From the blackness of the soil, and the numerous pieces of coarse sun-baked ware, the teeth of sheep, ox and dog, and other indications of human occupation, further and more systematic researches would be well rewarded. A walk to Farley Castle and Limpley Stoke must not be omitted from the list. At the former place the antiquities

preserved n the chapel, even the ancient tomb of the Hungerford family (date, 1398), paled in interest before certain attractions of a more modern date. The curious flat grave stones in the churchyard at Limpley Stoke, of the 13th or 14th century, and the newly restored church at Bradford, all the original features of which have been preserved, and the excrescences removed, were inspected.

During another walk to Compton Dando the Wansdyke was traced near the Turnpike gate between Burnet and Marksbury through a ploughed field, and into a pasture land, where it is as well or better developed than at Englishcombe. The line of the Dyke was followed to Compton Dando, where it disappears at the brook or river Chew. The church being visited discovery was made of an inscription on a plain coffin slab of the 12th century, in the churchyard. This inscription, which runs down the centre of the stone, now broken in two pieces, is considered by Mr. Scarth to read as follows :—

MOT (TRAM) DORMANT GIST ICI DEU DE SA ALME EIT MERCI PT. NOSTER.

One of the last walks of the Club was through Kelston Park, by the kind permission of Colonel Jones, to the Railway cutting immediately beneath his woods, where a section of the cutting gives a band of white lias with black and dark brown clay shales below, succeeded by red and light green marls: the black shales being the representatives of the Rhætic beds.

With reference to the "Ladies' Day" not having been repeated this year, your Secretary wishes to state that notice was posted in the Vestibule of the Literary and Scientific Institution, fixing on Tuesday, 24th June, for an excursion to Stourhead. Only one or two Members however having signified their intention of joining, it was deemed advisable to postpone the repetition of this pleasant little occurrence to some future occasion.

H. H. WINWOOD,
Hon. Sec.

Thermal Springs at Bath and elsewhere. *By* R. E. Crickitt.

(Read January 4th, 1867.*)*

The subject that I wish to bring before your notice—namely, the various hot springs that are scattered over the globe, is one which, in spite of the labours of Von Buch, Bischof, Henry, Daubeny, Hallmann, and others, has not, I think, been sufficiently considered, nor investigated with the patience that should lead to its own reward in the acquisition of a knowledge of the interior changes which are now going on beneath the surface of the earth. I believe that these springs, if properly questioned seriatim, will give us an answer to many of the geological problems which have been a puzzle, and the cause of the oscillation in men's minds, alternately making a Neptunian or Plutonian theory, to have the pre-eminence for the time being.

I would suggest that an effect, such as the natural heating and mineralization of a spring of water, should be considered, if chemically questioned, to contain its own answer, to lead to its own cause.

The theoretic generalization I would oppose is this.

According to the Astronomical theory, our world has probably in its origin been struck off from the sun, or been condensed from a nebulous state, that at any rate it has existed in time past, as a molten mass, that it has gradually cooled down to a state of solidity on the surface ; but that the interior is still in a state of fusion, and that the solid exterior forms a mere crust over the still molten interior. This theory has been supported, and considered proved by the oblate form of the earth's sphere, and for some other reasons, which I shall hereafter more particularly examine. Accordingly, this theory has been assumed to have passed into the region of facts, and has been taken as an efficient cause to explain the heating of springs of water, for you have only to assume their source at a sufficient depth, to arrive at any given degree of heat.

But after all, this is only theory; and to assume it to be true, and thence to explain effects on that assumption as if it were an undoubted law of nature, is jumping at a conclusion, and standing in the way of our arriving at truth, by preventing us taking the trouble to examine in each case whether such an explanation is fairly founded on facts.

Thermal springs are found all over the world, and of all temperatures.

In China, in Japan, in Kamschatka, in Siberia even, where, as at Yakutsh, the soil is permanently frozen to a depth of 630 feet, the hot springs nevertheless arise among the giant mountains of the Himalayas, in the Islands of Java and Sumatra, in the plains of Hindostan, in the sandy deserts of Arabia, in the ancient land of Asia Minor, in the new world of Australia. In the Andes of South America and the Rocky Mountains, and the Alleganies of North America, and Trinidad, which halts between the two, in New Zealand our Antipodes, in Iceland, we have them of every variety.

The most important, at least in a medical point of view, exist in Europe.

Spain is full of them, especially in the provinces of Granada, Seville, and Biscay, the most celebrated being the hot springs of Fuente Caliente, in Valencia. Portugal contains many, amongst which sulphurous thermals predominate.

Sicily contains many, amongst which may be mentioned the sulphurous springs of Segesta, between Palermo and Trapani, which have a temperature of 165°. Naples abounds in hot springs; there is a remarkable one called the Stufa di Nerone, near Tritoli, west of the lake Averno, and where, in the depth of a grotto, water nearly boiling is found; then there are the famous Baths of Bajæ, the fashionable Baths of Nero's time. In the Papal States there are the Acqua Albula, near Tivoli, whose praises have been sung by Virgil; they are sulphurous, and some of the springs hot and some cold; then there are the Bagni di Stigliano, which vary from 100° to 122°.

In Tuscany there are the springs of Monte Catini and Castracaro.

In Savoy there is Aix les Bains, which is a sulphurous thermal.

In the Pyrenees there are above 200 hot springs, the most celebrated being the Bagneres de Bigorre, which vary from 87° to 123°, the Bagneres de Luchon from 77° to 150°, and Bareges from 87° to 113°.

In France they are specially found in the district of Auvergne. Vichy is the most important of them, of about 170°, and it is an acid alkaline spring rising from Limestone over Granite.

In Switzerland, in the Canton of Vaud, there are also several thermals principally sulphurous; in the Valais there are the famous Baths of Leuk, and many others. In Germany and Austria there are the sulphurous thermals of Aix la Chapelle and Borcette, and those of Baden, near Vienna, the alkaline of Carlsbad and Marienbad, the muriated lithia water of Baden Baden, the indifferent thermals of Gastein, of Wildbad, of Tüffer, in Styria of Landeck, in Silesia of Schlangenbad, in Nassau of Warmbrien, and various others.

Now from the evidence given by water taken from various Artesian wells and from deep mines, it has been concluded that there is a regular increase of temperature as you descend into the earth.

The Artesian wells of Grenelle give an increase of 1° for every 37 feet of descent, the Durham mines 1° for 44 feet, the Saxon lead mines 1° for every 65 feet, the mine of Dolbrouth 1° for 75 feet, the Wheal Clifford mine 1° for 22 feet—an average taken upon a large number of mines and wells gives 1° for every 45 feet of descent.

As a result of such a rate of increase, taking the mean temperature of the earth at 80 feet deep (that is beyond the influence of the sun) at 50°, it follows that at 7,290 feet deep the heat will reach 212°, the boiling point of water, at 25,500 it will melt lead, at 21 miles it will melt gold, at 47 miles it will melt

wrought iron, and at 100 miles from the surface all will be fluid; "the rocks will be as water." Hence it would appear that our Globe, of 8,000 miles in diameter, is only a liquid mass contained within a thin shell of 100 miles in thickness. That is to say, a globe of 10 feet in diameter would have a crust of only one-eighth of an inch in thickness. Hence it has been said that the varying pressure of the atmosphere may be sufficient by weighing unequally on this thin shell to cause an oscillation of the crust, and so give rise to earthquakes; and, in proof of this hypothesis, it has been adduced, that an earthquake is always preceded by a fall in the barometer. Calculations have been made, to show that the alteration in the atmospheric pressure indicated by two inches rise or fall in the barometer, represents a pressure sufficient to account for this, viz., 8 tons on the square yard, or 25 million tons on the square mile. But when we think, that an increase of pressure as shown by a rise of three inches, amounts to an increase of weight on the crust of the earth equal to only one two hundred and ninety-five thousandth part of its own weight (supposing it to be only 100 miles thick), this would seem inadequate to produce any effect, on even so frail a bridge as this.

This central heat theory is said to be a question particularly interesting to Bathonians, as, according to tradition, we are to be one day the victims of a want of balance in nature, and to sink down into these subterranean fires. But I think we may re-assure ourselves. In the first place, the increase of heat in proportion to depth has been too hastily assumed, as a law, for it is clear that local circumstances have a great effect in at least modifying this increase; at Wheal Clifford the increase of heat being 1° in 22 feet of descent, whereas at the mine of Dolbrouth 75 feet of descent is requisite to give a similar increase, and in some mines even 90 feet is requisite, while at the Lago di Monte Rotondo at 60 feet depth a temperature of 212° is reached. Theory would say that the difference would depend on the conductibility of heat of the various rocks, and would be in an inverse ratio in propor-

tion to that, if the heat came from the centre of the earth; but experiment proves that it is not so. (See address of President Geological Society for 1858.) Again, theory would say that this heat would increase regularly towards the tropics, as there the earth would lose less heat by radiation. Fact shows a departure from this assumption. Moreover, at the Bagneres de Luchon, in the Pyrenees, it was found that by boring a horizontal shaft into the mountain, they came upon hotter water, and so proving that it is not always an approach to the central parts of the earth that involves increase of heat. If the globe has gradually cooled down and formed a solid crust on its exterior, it follows that it must still be cooling down, and that such cooling has proceeded steadily from the time when it first began to cool, although it may well be that as the crust thickens, it cools more slowly. I only state that the progression must be regular, and not subject to fits of increase of heat. If we examine the geological records of the past, we find that as we mount upward in time, towards the commencement of our earth's history through the Pliocene, the Miocene, the Eocene, the Cretaceous, the Carboniferous, the Devonian, the Silurian eras, we shall find that there are numerous signs that the climate of the globe has in these previous ages been much warmer at least in Northern latitudes than now obtains, and these facts taken isolated have seemed to countenance the idea that the cause was the internal heat of the earth, and hence an additional reason for supposing the central heat theory a fact.

But admitting the fact of the previous warm climate, I do not think that the cause has been rightly interpreted.

Let us suppose, however, that we admit the theory. We find that during these periods, although there were times when the climate of the polar regions was warmer and more uniform than at present, yet there were alternating periods when this state of things was followed by a much greater cold than now exists, and that if it be said that formerly the polar and temperate regions

were warmer, it may be equally said that formerly these regions were much colder, for we find signs of extensive ice action down as low as latitude 40° north, and clear proofs that, at any rate in the Pliocene and upper Miocene strata, an arctic degree of cold once existed. In fact that the surface of the globe, at least between the pole and latitude 40° north, has not gradually and steadily become cooler, but that it has alternately been hot and cold.

Now bearing in mind that cold is a negative quality merely, that it is an absence of heat; what does this prove? Clearly that the heat or the want of it was due to causes, exterior to the earth, and not from within. For if the heat were from within, it follows that, if the earth were gradually cooling down, it would cool most rapidly where the radiation was greatest, and where it was less supplied with fresh heat from without, as at the poles, and if it had once cooled down in those parts to a great degree, although the cooling might be afterwards checked by an increase of solar heat from without, yet that there would exist a great degree of difference between the intrinsic heat of the earth below its surface, in the tropics which have never been subject to the extremes of surface cold, and a latitude of, say 45°, which has been so subject to arctic cold. Now this is just what we do not find to be the case, for at a distance from the surface of the earth to which the sun's rays do not penetrate, we find that the earth's heat is the same in both latitudes, viz., 50°, and the difference of depth to reach that heat is nearly the same in both latitudes or within a depth of about 20 feet—that is to say, that at about 100 feet deep at the equator, or 80 feet in latitude 45° the temperature is constant at 50°.

Again, how is it that at the bottom of the deep seas, where you may approach 7 miles nearer to the earth's centre, we find the temperature is under 40°, and does not show any signs of being heated from below—in fact is exactly the temperature it should be, assuming that it is only heated from without, by the

sun's rays. According to the theory that the centre of the earth is hot, and that you increase your warmth as you approach that centre, this depth of 7 miles should reach a heat more than sufficient to melt lead. No doubt from the mobility of water it would convey away and lose this heat to a great extent; but it is a bad conductor of heat, and therefore it would only convey it away, not allow it to radiate away, and consequently we ought to find that the water was still being heated from below, whereas it never seems to have been so heated—for if in a time past the cause of the higher temperature was central heat, we find a previous era existed when the waters were evidently icy cold, instead of being always as they should have been cooling slower than the earth.

But lastly, if it be granted that the heat increases in the proportion to descent, then, as I before mentioned, the interior of the earth must be in a molten state, and the solid crust must be a mere shell of not more than 100 miles thick or one eightieth of the diameter of the earth. Now it is a well ascertained fact that our globe in its diurnal revolution, spins upon an axis which does not always point to the same spot in the heavens, but like a top slowly works its axis round in a circle. Now the cause of this motion which causes the precession of the equinoxes may be shortly explained thus:—If a ring of satellites be supposed to revolve in the plane of the equator round the earth, at the summer solstice, when the north axis of the earth is inclined towards the sun, this ring of satellites would, on the side nearest to the sun, where its attraction was greatest, be below the plane of the earth's annual orbit, consequently the sun's attraction would tend to alter this, and incline them upward as they came on the side nearest to the sun, and if this ring of satellites be supposed to be a rigid ring in contact with, and adhering to this earth, it would tend to bend the axis of revolution upwards, or at right angles to the path of annual revolution. Of course the reverse motion would be produced at the winter solstice, this

would have a tendency to cause the axis of the earth to describe two small circles in the year amongst the stars.

Now as the earth is an oblate spheroid, having its polar axis 26 miles shorter than its equatorial axis, or as it were a sphere of 8,000 miles diameter, with a belt of 13 miles thick at the equator, sloping off to nothing North and South, the amount of such motion caused by the impulse of a ring of 13 miles thick upon the earth can be accurately calculated, it being proportional to the relative weight of the belt and of the globe. The motion calculated from the data of the average weight of the earth, and its rigidity agrees with the observed amount of this motion.

But if the earth were a liquid mass with only a solid shell, the effect would be that the shell would, as it were, slide over the liquid interior, and would not retard the oscillation caused by the band to the same extent; in other words, if the interior of the earth were liquid, its precession would no longer be the same that it is observed to be. But it may be said that under the great pressure of the superincumbent rock, the interior might be heated to any extent without becoming fluid. Experiments have been made to test this (by, I think, Fairbairn, the Engineer); but so far from confirming this idea, he found that granite, slate, and other rocks which can be only melted at an intense white heat, without pressure; became fluid at a red heat when inclosed in iron tubes and subjected to as much pressure as he could obtain with a screw. Therefore I conclude the earth is not liquid in its interior, with a solid shell, and therefore the heat does not regularly increase as you descend into it.

If we observe the relations in which the thermal springs occur, we shall see at once that they seem to be divided into three classes or varieties.

We find springs that are evidently connected with active existing volcanoes, and these are generally sulphurous, very hot, and contain plenty of silica.

We then have those that are closely connected with the basic

rocks, granite, slate, or basic limestone, these are generally sulphurous and salt, and moderately warm, and these, or many of them, seem to have this curious characteristic, that they show an inconstant temperature of their sources. Those at the Bagneres de Luchon were cold springs until after an earthquake that took place in the year 1755; those at Bigorre were by an earthquake in the previous century, in 1660, temporarily rendered cool, though they soon recovered their heat; those hot springs such as at Aix la Chapelle, and some of the German and other springs that were known and used by the Romans, would appear to have become warmer since their times, for they apparently used them for bathing direct from the source, without any cooling, which could not now be done.

The last class of springs which we will now examine, appear to have a very equable temperature, though not so high as those that rise from near the granite.

The first general characteristic of this class is that they arise from, or close above the Carboniferous limestone, the water appearing to well up through some natural fissure or fault, which follows the joint lines of the rock; hence the water that has penetrated from the surface following the planes of stratification, being the lines of least resistance, again comes to the surface by natural fissures acting like Artesian wells (presuming that the opening of these fissures is below the level of the edges or out-crop of the strata where the water enters), the water consequently may traverse the lines of stratification for a long distance, taking the short cut of the joint opening for its exit.

The usual manner of accounting for hot springs appearing above the surface of the earth has been thus:—It has been supposed that the water from the surface has descended into the lower regions, where it has come into contact with heated rock, the consequence of the internal heat of the globe, and that this has generated steam and gases which have then forced the water thus heated to the surface.

Now it is evident that in the case of water springs that have a moderate heat and are constant, that the usual effect of hydrostatic pressure might cause water first to descend and afterwards come to the surface hot, by the short cut of a fault; but in the case of hot springs that are intermittent, or only the accompaniments of volcanoes, this could not be the case. For if the water descends by its usual laws, it will only ascend again on the principle of finding its own level, which it will do whether it has been heated in its descent or not; the heating will neither retard nor accelerate its ascent; if it were otherwise, it would follow that the force of water descending generates force, or in other words, that a certain height of water can at one time give a pressure greater, at another time less. For if the heat were the cause of the water rising to the surface, it would at the same time prevent the supply (which only descends by its own weight) from coming down, it would be forced back. Therefore if a spring be intermittent, the heat has arisen or accumulated *after* the water has reached a low level, the heat is *also* intermittent. A spring may be intermittent with the heat permanent under such circumstances as exist at the great Geyser of Iceland, where the supply seems to percolate into a deep hole, the sides of which are highly heated. The effect of this is, that as the water flows in, it is heated to boiling point, and the water continues just at the boiling point until this fissure or hole is filled to the surface, and runs over; it then appears that from the want of heat conducting power in water, the lower part of the column is super-heated, and causes those intermittent explosions and the grand fountains of hot water that are there. The same effect may be produced on a small scale, by boiling water in a long narrow tube in a vertical position. This is peculiar and exceptional, depending on the water's loss of air.

Therefore if water only rises to the surface by hydrostatic pressure, which is, I think, proved, and that it rises in a boiling state, and if the source of its heat is central, and only increases

1° for each 45 feet of descent, it follows that boiling springs must come from a depth of 7,290 feet, and at its starting point has been subject to a pressure of 214 atmospheres, or 3,200 lbs. on the square inch—a pressure sufficient, one would think, to force it through the rocks in its ascent, and so drain it away and prevent its arrival at the surface.

Now it would seem that by an analysis of the waters themselves, you might gather from whence they had come, through what strata they had passed.

The principal salts found in the Bath waters are Sulphate of Lime, Chloride of Sodium, Chloride of Magnesium, and Sulphate of Soda.

From whence then come these salts? lime, soda, and magnesia are to be found in the Granite, and in the oldest rocks of the earth; but then they are in the form of silicates; for the solution of those silicates, water charged with carbonic acid gas, or even super-heated water would be sufficient, but in the one case the solution would be carbonates of lime, soda, or magnesia, with silica pure, or in the other, silicate of lime, soda, or magnesia, which, as it cooled, would gradually deposit the silica, and carry off the lime, soda, and magnesia, ultimately to become carbonates. It is even possible, if we can imagine sulphuric acid to be evolved at the same time into the solutions formed by the carbonated water, or the super-heated water, that we might have sulphates of lime, soda, and magnesia, but we should never get the chlorides of sodium and magnesium. And, moreover, it is quite impossible that all these four different salts could be formed at the same time from the same source, the sulphuric acid would decompose the chlorides, even if they could be formed. Hence we must conclude that these salts are not derived from the solution of any igneous rock, in which the bases exist in the form of silicates, that they cannot have been brought from any one common source, and therefore we must conclude that they have been in existence previous to their solution as sulphates and chlorides, or at least some of them.

It may be said that we find all these salts in sea water; true, but the proportion is vastly different; in the solid precipitate from sea water there are 75 parts chloride of sodium, 9 chloride magnesium, 3 chloride potassium, 5 sulphate of magnesia, and only 4 sulphate of lime: while in the Bath waters there are 80 parts sulphate of lime to 12 chloride of sodium, and 14 chloride of magnesium, with the addition of *Sulphate of Soda*, which is absent in sea water.

Whence, then, come these salts? The sulphate of lime is generally found in the New Red Marls, *i.e*, above the Coal measures. It is found in a fibrous form, with sulphate of strontia, at Aust Passage, on the Severn; the chloride of sodium is also found generally in England in the same formation, though not exclusively; the chloride of magnesium does not exist naturally as such in the form of a rock, but carbonate of magnesia is plentiful in the form of Magnesian Limestone and Conglomerates, such as are found on Durdham Downs. It appears that water, such as rain water, impregnated with carbonic acid gas, dissolves carbonate of magnesia, forming bi-carbonate of magnesia, as is shown by a new process for obtaining carbonate of soda from salt. This, brought into contact with chloride of sodium, decomposes it, and chloride of magnesium and bi-carbonate of soda are the result. Thus, the presence of the chloride of magnesium would appear to be a consequent of carbonate of magnesium, which is only found in the rocks of the Poikilitic system.

This view is confirmed by the fact that analysis shows that carbonate of soda exists in these waters, in the proportion to the chloride of magnesium of their respective chemical equivalents, viz., to 7·142 chloride of magnesium, 5·760 carbonate of soda; this is noteworthy.

Thus, then, we find that these four principal salts are derived from rocks that belong to the formation lying above the Carboniferous rocks.

It is evident that as the Bath springs rise above the surface of

the earth, and the land here is about 70 feet above the sea level, that their supply must be obtained from a higher level than that.

We find the New Red Sandstones and Marls, all around Bath, though at some distance from it. We should first look for them westward, seeing that the general dip of the strata in England is towards the east, and we find them there accordingly at Bristol. But as the Coal measures come to the surface between Bristol and Bath, it is clear that some convulsion has destroyed the regularity of the dip, and from the pits at Twerton, it appears that some extraordinary upheavals and subsidences have occurred, which has broken the continuity of the strata, and makes it probable that a fault or dyke exists somewhere between Bath and Twerton, which prevents the water coming from the west. The same Red Sandstones and Marls exist both north and south of Bath, which would show that under Bath there is a geological basin, and that the lowest point of the New Red lies there. Therefore, if rain falls on these points, north and south, it would penetrate the lines of the strata and rise up through any fissure that may exist, by hydrostatic pressure.

I do not think that these waters can come from a lower strata, at any rate, than the Carboniferous limestone, for we have no deeper strata at all within the range of Bath covered by the New Red. It seems probable that the waters coming from the south do not reach Bath, as there appears to have been a disruption of the strata, and that a fault exists nearly following the line of the Avon, running east and west in our valley. Hence we are almost shut up to the conclusion that the water comes from a north westerly direction. A little to the north-east of Bitton we find the New Red, and in the vicinity we have the Carboniferous Limestone, and the Magnesian Conglomerate. As the level of this part is a little higher than Bath, rain falling here might follow the line of strata, which generally, for England is east by south, or south east, and would therefore reach the parallel of Bath, if not intercepted.

Let us look around the country between Wick and Bitton. It is a valley running north-east and south-west by compass, and from Bath, bears from north-west to north-west by north. At Tracy Park, after descending from the Oolite, we come on the Lias, at a height of about 270 feet above the level of Bath springs: (here we find iron pyrites). Turning our steps to the left, we gradually descend until we come to the Druidical stones, and here, or a few yards to the south, we come on the New Red Sandstones at a level of about 207 feet above Bath. Bearing south-west by compass, we traverse the New Red Sandstones at Wick Court, passing the shaft of a forsaken coal mine, just on the banks of the river Boyd opposite Wick (and here the level is 115 feet above Bath). A little to the south and west following the Boyd, we come on the Coal measures, which we retain till near Bitton.

It is the whole of this valley, and also the valley that is a continuation of it to the north and east, following the Boyd, that on the one side branches towards Pucklechurch, passing the Magnesian Conglomerate at Cleve Bridge, and on the other hand leads towards Codrington Court—an area that I should estimate at about eighteen square miles. That, I look on, as the source of the Bath springs. Here we have in close connection the Red Sandstone and Marls, containing chloride of sodium and sulphate of lime: at Wick the Magnesian Conglomerate giving carbonate of magnesia; at Tracy Park evidences of iron in the form of pyrites, and the whole valley giving evidences that the Coal measures exist and extend at least the whole length of the valley, and far to the south, probably under the whole of Lansdown Hill and under the valley of Bath, the dip of the strata being on the whole towards Bath and Batheaston, and therefore the drainage being in that direction.

It may be said that this space is not sufficient to supply the water for the Bath springs; but when we see that this area contains upwards of five hundred million square feet, and that

consequently each inch of water falling here and penetrating the earth, will give an annual supply of upwards of a million tons, we shall conclude differently; for the Bath springs altogether give forth less than nine hundred thousand tons per annum.

It has been adduced as a contradiction to my theory of the source of these waters, that when boring for coal at Batheaston, a warm spring similar to the Bath waters was come upon, above the New Red; but if I am correct in my view of the lie of the strata, this is only what might be expected; for if Bath and Batheaston are nearly on a geological level, and there are fissures through the New Red, which, no doubt there are, the water would be forced up from below, and pass between the New Red and the Lias formation, and would only be stopped in its upward rise by want of fissures in the superincumbent strata, and it cannot be supposed that the source of these waters is above the New Red, for if so, the area drained and forming a source of supply would be still smaller than I suppose it to be, which is one of the objections to my theory.

Some years ago, a well 170 feet deep was dug in Kingsmead Square, east of the springs, and the consequence was that the flow of water was interrupted at the Cross Bath—the well having evidently tapped the course of that spring. There is also a report that a shaft which was sunk at Batheaston, in 1817, by William Smith—Strata Smith—for coal, was the means of lessening the flow of water at the Bath springs.

If this latter circumstance should be a fact, it would, I think, go far to prove that my surmise is correct, and that the water does come from the northern side of Bath.

For a boring so far to the east as the Batheaston, to affect these springs, shows that the strata under Bath are very level, that the water flows freely through them, and that they are dammed up by some natural impediments, east, south, and south-west.

The next question is, whence comes their heat?

It has been supposed that the iron pyrites scattered through the New Red, or rather between the New Red and the Lias, might by oxidation be the cause. But in the first place this oxidation giving rise to heat only occurs when the sulphuret of iron is more or less pulverised and heaped together in masses. When it occurs as it does near Bath, it has been deposited by water, and is the result of the decomposition of carbonate of iron by a sulphate, probably of lime, by which a sulphuret of iron is deposited, and carbonate of lime formed and carried away. A similar result has been proved to have occurred at the thermal springs of Aix la Chapelle, where, in cleaning the spring basin, fragments of Transition Limestone (between which and Grauwacke the spring issues), were found covered with a thin coating of iron pyrites.

Bischof mentions another case where, at the enclosure of a mineral spring, on taking away an old wooden tube that had been previously used at the issue of the spring, and removing the earth around it, dark yellow iron pyrites were found in it.

We find also that the coal is in various places coated with iron pyrites, therefore we conclude that the pyrites, when found detached and scattered, are a result of the long continued action of carbonated water dissolving the oxide of iron through the soil or rocks, and then decomposed and deposited as a sulphuret by the action of a sulphate, probably of lime, and that they cannot therefore be looked on as a source of heat.

The mineral constitution of the waters has thrown some light on their source of supply, but not on their source of heat. Let us see if the gaseous contents will lead us further.

The King's spring yields about two and a half hogsheads of water per minute, and evolves about 267 cubic inches of gas in that time, of which nitrogen forms 97 per cent. to 3 per cent. of oxygen, with a small and varying quantity of carbonic acid gas. We are first struck with the differing proportion of the nitrogen gas found in this water 97 to 3, whereas in rain water the pro-

portions are nitrogen 67, oxygen 33, or about 2 to 1. Atmospheric air containing these gases in the proportions, nitrogen 80, oxygen 20, or 4 to 1.

The explanation you will usually find is, that the atmospheric air which is naturally contained in spring water, as derived from rain water, has been deprived of its oxygen by various substances in the earth, but as you cannot take out of a basket more than is put in, and as these waters naturally evolve rather more than the fourth of a cubic inch of nitrogen per pint, and still retain in solution a certain amount of this gas, and originally rain or spring water does not contain more than the fourth of a cubic inch of the mixed gases, I do not see how this can account for the observed result; if it be so, the part is greater than the whole.

The water supplied by rain to the earth contains not only oxygen and nitrogen, with carbonic acid, but also ammonia, that is, nitrogen plus hydrogen 3, and the earth gives more. Assuming that the water comes from about Bitton, and flows through the Carboniferous strata, we know that coal is constantly giving off both carbonic acid gas, sulphuretted and carburetted hydrogen, therefore we should find these gases besides ammonia.

Let us first account for the ammonia. I find by experiment that if chloride of sodium, with ammonia, be exposed to the action of carbonate of magnesia dissolved in water, with carbonic acid gas, a transformation takes place, and as a result we get chloride of sodium, carbonate of soda, chloride of magnesium, and the ammonia disappears, leaving only nitrogen gas.

The rationale I take to be this—

The carbonic acid gas in the water dissolves the carbonate of magnesia, and then appears in the water in the form of bi-carbonate of magnesia, an unstable salt; this being brought into contact with chloride of sodium, from the great affinity of chlorine for magnesia, and of soda for carbonic acid, gives rise to a double decomposition, and chloride of magnesia and bi-carbonate of soda are formed, but at the moment when the decomposition takes

place, and the chlorine is nascent, the hydrogen of the ammonia, from its very strong affinity for chlorine, seizes on a part of it, and hence the ammonia is decomposed, and we have chlorhydric acid and nitrogen set free.

The large quantity of carbonic acid gas contained in these waters I look upon as derived from the decomposition of vegetable matter within the earth, with the addition perhaps of a small quantity derived from the decomposition of the bi-carbonate of soda, as before mentioned, but no doubt the source is mainly from above, not from below, for there is a remarkable instance of this in the waters of Spa, in Belgium, which evidently derive their source from a peaty moor at a considerable altitude above the village. These waters are highly carbonated, and the greater the heat of the weather, and consequent increase of vegetable decomposition going on, the more are the waters supplied with carbonic acid gas; to so great an amount does this vary that the gas is seen bubbling up quite rapidly in warm weather, and forms a sort of weather glass to the natives. Sulphuretted hydrogen is given off both by the coal itself, and is formed also where there is a supply of sulphate of lime in meteoric water in the presence of organic matter decaying; in this latter case the organic matter depriving the sulphate of lime of a portion of its oxygen, the sulphuretted hydrogen thus formed, will, if the water containing it be of a considerable heat, be given off in the state of gas, and we thus find it in springs of high temperature like Aix la Chapelle; but if the heat is not considerable, the sulphuretted hydrogen absorbs oxygen and passes on into the state of sulphuric acid and this action is specially favoured by the presence of porous bodies, and this formation of free sulphuric acid I take to account for the presence of sulphate of soda in our waters, there being bi-carbonate of soda left from the decomposition just mentioned. When vegetable matter—wood—(which may be looked on chemically as coal plus hydrogen and oxygen), decays, it may lose part of its carbon oxygen and hydrogen as carbonic acid and car-

buretted hydrogen. It may evolve carbonic acid and form water by union of its hydrogen with external oxygen or from its elements: at any rate it appears coal is wood, that is, carbon with but a small portion of hydrogen and oxygen left: and as we find that the various qualities of coal have more hydrogen and oxygen in proportion as they are less completely carbonised, and that anthracite and graphite, have respectively less and less of a gaseous admixture, we may assume that ordinary coal is still undergoing the carbonising process, and thus evolving carbonic acid and carburretted hydrogen or water.

But when carbon has arrived at the state in which it exists in coal, that is nearly pure, it may act as pure carbon, that is as a carrier of oxygen, in the same way that spongy platinum does; thus the platinum absorbs into its pores oxygen, and if a stream of hydrogen is poured on it, they unite and form water with the evolution of such an amount of heat that the platinum becomes shortly red hot and the hydrogen inflamed. If then the coal is, as we have reason to believe giving forth carburretted hydrogen, and that it is supplied with oxygen from the meteoric water, a union might take place, water be formed and carbon deposited with the evolution of considerable heat.

I find, by enquiry of mining bailiffs, that deep down in coal mines they say the coal is warm, the intervening rock comparatively cold and damp, and that this warmth in the coal is more noticeable as you go deeper, where the pressure is greater.

The deeper the coal the more bituminous it is, and the richer the Shales in its vicinity in bitumen and photogen oils, and as the best opinions say that these oils are due to the action of heat on vegetable matter or coal, or by the decay of those substances, at considerable depths, it would seem that there is evidence that coal has decayed, and its present warmth would indicate that it still is decaying, and undergoing the bituminising process.

Thus then the mineral salts indicate that the waters of Bath come from some point, probably near Bitton; that charged with

salts and the gases found in the air they penetrate between the New Red Marls and the Carboniferous Limestone; that there being no reason to suppose the Coal measures absent, that they permeate them, and hence become charged with various other gases which however they do not bring with them to the surface, but combine with the oxygen of the air, and not only by their union give rise to heat, but also give rise to a degree of low combustion in the coal with evolution of heat, which is retained and conveyed away by the water. I think, therefore, that the heat of these waters is an evidence of internal *motion*, changes now going on under the surface of the earth,—in this particular case in the Coal measures.

For what is heat? Is heat a thing, an entity in itself, or is it not rather an evidence of motion? I put my finger in the candle and burn it, what has occurred? The flame has so far destroyed the conservative vitality of the part that chemical decomposition is induced or commenced, that is, a new mode of motion in the parts is set up.

We have heard it said that the centre of our earth is one molten mass, existing in a passive motionless state. I cannot believe it! all evidence is against the notion of motionless heat: look at the sun, the great centre of our heat, and what do we find on his surface but the signs of intense activity, the celebrated willow leaves or granules on his body appearing to be bodies some hundreds of miles long, darting about with inconceivable rapidity. In fact, is not heat the life of physical creation? Is it not the evidence to us of the universal presence of the Great Architect of the Universe himself, the grand source of life? Nature's law itself is motion,—change; there is no such thing as permanent rest, and heat we now know is only a mode, an evidence of motion: that it is intermittent we have reason to believe, for as we cannot have heat without motion, and we find that the earth has undergone periods of alternate rest and movement, so no doubt it has been subject to periods of heat and cold.

As we now find that in parts, the earth is still in a state of movement, so have we reason to believe that it is there locally being acted on. An instance of this has been lately brought to my knowledge by Mr. Hippesley, the owner of Stoneaston Park. Above the coal district of Somersetshire, in his neighbourhood, during the late Government survey, there was a station on one of the hills, and for some reason they had to repeat certain observations after a lapse of some months, when it was found that the hill on which the station was placed had diminished sensibly in altitude since their first visit, and as this is exceptional and limited to one hill over the Coal measures, it seems an evidence of changes going on in the coal, therefore of evolution of heat.

I think that we shall find that all similar springs, that is, those not having their source in or near granite, or flowing over hot lava, have their heat originated in the same manner, that the cause is local, and due to changes going on in the coal, and not to any central source. I find the thermal springs on the Ganges, at Buxton, and in Australia, and also in Virginia, occur under similar circumstances, and may be accounted for in the same way.

The subject is very difficult, for we have not yet even a sufficient analysis of the waters, and we have much to learn of the correlation of motion and heat. I cannot, therefore, hope that I have persuaded you to my views, but if I have made you suspect that there may be a new solution to the mystery, if I have made you feel that the central heat theory is doubtful, if not altogether untenable; if I have made you think that at least the subject may be looked on as an open question, I shall be satisfied. As the darkest part of the twenty-four hours is that which precedes the light of day, so do I feel sure that the consciousness of the darkness of ignorance, must precede and herald the dawn of the light of knowledge: at any rate the dawn will come.

TABLE OF CONTENTS.

VOL. I. No. 1.

PROCEEDINGS

OF THE

BATH NATURAL HISTORY

AND

ANTIQUARIAN FIELD CLUB.

No. 2.

1868.

PRICE TWO SHILLINGS.

RULES

OF THE

Bath Natural History & Antiquarian Field Club.

1.—The Club shall be called "THE BATH NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB," and shall consist (for the present) of not more than Seventy-five Members.

2.—The object of the Club shall be to make Excursions around Bath, with the view of investigating the Natural History, Geology, and Antiquities of the neighbourhood.

3.—The Founder of the Club, the Rev. LEONARD JENYNS, shall be considered the permanent *President;* and a *Vice-President* and *Secretary*, the latter acting also as *Treasurer*, shall be chosen each year from among the Members at the Anniversary Meeting on the 18th February.

4.—Quarterly Meetings for the election of Members, and for other business, shall take place on the *First Tuesdays* in April, July, October, and January.

5.—There shall be a Committee of Management consisting of the officers and two other Members of the Club (the latter to be elected annually), whose business it shall be to consider and determine all matters connected with finance, and printing the proceedings of the Club, or papers read at any of its meetings; or any business requiring consideration previous to the Quarterly Meetings.

6.—There shall be Four Excursions during the year, to be fixed at the Anniversary Meetings, *subject to alteration* at any previous Quarterly Meeting, if agreed to by all the Members present—Six to form a quorum. A list of such Excursions, with the respective Places of Meeting, shall be suspended in the Vestibule of the Bath Literary and Scientific Institution. Such Members as feel disposed shall also meet every *Tuesday*, at the Institution, at 10 a.m.

7.—The hour of Meeting shall not be changed, except for the convenience of taking particular trains, when it is arranged to go by rail to any place; in which case the altered time shall be posted at the Institution not later than Twelve o'Clock on the Tuesday previous.

8.—In arranging the Excursions, due regard shall be paid to Natural History and Antiquities, so as to secure an equal share of attention to each subject; with this view, when the same Excursion does not include them both, they shall, so far as practicable, be taken alternately.

9.—Special Meetings shall be appointed for the reading of Papers or Exhibition of Specimens, notice being given to the Secretary, at, or previons to, any one of the Quarterly Meetings, by Members having such communications to make to the Club.

10.—Persons wishing to join the Club may be proposed by any Member at one of the Quarterly or Special Meetings, and elected (by ballot) at the next Meeting afterwards. Three black balls to exclude.

11.—Any Member of the Club may invite friends to accompany them on the proposed Excursions.

12.—It shall be the business of the Secretary to take Notes of the Day's Excursion, and to draw up a summary of the Year's proceedings, previously to the next Anniversary; he shall also see that the proper Notices of Excursions are suspended at the Institution, and communicate with the Members by letter, when occasion shall require. His accounts, as Treasurer, to be passed at the Anniversary.

13.—A Subscription of Seven Shillings and Sixpence shall be paid yearly by each Member, to defray any expenses the Club may incur otherwise than by journeys and refreshments. This Subscription to be considered due on the Anniversary.

14.—Members whose Subscriptions are in arrear for One Year shall be considered as having withdrawn from the Club, if, after application, the same be not paid up.

15.—There shall be a Supernumerary List for Members whose absence from Bath is only temporary. Such Members, on their return, and on payment of their Subscription for the then current year, may be admitted to the Club at once, or so soon as a vacancy occurs.

H. H. WINWOOD,

Hon. Sec.

LIST OF MEMBERS

OF THE

BATH NATURAL HISTORY & ANTIQUARIAN FIELD CLUB,

INSTITUTED FEB. 18th, 1855.

President.

*REV. LEONARD JENYNS, M.A., F.L.S., F.G.S.

Vice-President.

*REV. H. M. SCARTH, M.A.

Secretary and Treasurer.

REV. H. H. WINWOOD, M.A., F.G.S.

Rev. THOS. STEELE, LL.D. & D.C.L., 2, Bathwick Terrace
*C. E. BROOME, Esq., Elmhurst, Batheaston
*Captain W. V. HEWITT, 3, Church Street, Widcombe
*CHARLES MOORE, Esq., F.G.S., 6, Cambridge Place
W. DOBSON, Esq., Oakwood, Bathwick Hill
Rev. H. N. ELLACOMBE, Vicarage, Bitton
H. WILLIAMS, Esq., 31, Henrietta Street
Colonel E. P. ST. AUBYN, 7, Great Bedford Street
JOHN BARRETT, Esq., F.R.C.S., 13, Pierrepont Street
Rev. THOS. JACKSON, 32, Sydney Buildings
Rev. GEORGE BUCKLE, Vicarage, Twerton
Rev. JOHN EARLE, Rectory, Swainswick
JOHN JOHNSTON, Esq., 8, Sion Place
Mr. J. P. TYLEE, 7, Bridge Street
Mr. CHARLES EKIN, F.C.S., 8, Argyle Street
A. B. BRABAZON, Esq., M.D., 12, Darlington Street
C. J. FOX, Esq., M.D., Brislington, near Bristol
Captain HARDY, R.N., Kilkenny House, Sion Hill
W. LONG, Esq., 16, Lansdown Place East
Major NICKLE, 5, Lambridge Place
Colonel WYNDHAM BAKER, 12, Green Park
C. J. PHIPPS, Esq., F.S.A., The Paragon
Mr. S. HAYWARD, Hanover House
Rev. D'COURCY MEADE, M.A., 1, South-west Buildings
J. LE MARCHANT, Esq., 17, Sion Hill
W. S. MITCHELL, Esq., F.L.S., F.G.S., &c., St. George's Lodge
EDMUND SMITH, Esq., 1, Spencer's Belle Vue

** Original Members.*

Lieut.-Colonel WICKHAM FREEMAN, 3, Johnstone Street
Captain F. R. FRAMPTON, R.N., 46, Pulteney Street
Rev. H. HODGES MOGG, Newbridge Hill, Bath
W. RODWELL, Esq., 9, Catherine Place
J. F. GOODRIDGE, Esq., 5, Henrietta Street
Lieut.-Colonel S. W. HENNAH, 2, Perrymead, Widcombe
Rev. W. S. SHAW, Beechen Cliff Villa
Rev. Prebendary BOND, Vicarage, Weston
Captain LYSAGHT, R.N., 3, Sion Row
Rev. C. BAKER, Tellisford Rectory, near Bath
Lieut.-Colonel W. H. BAYNES, 18, Russell Street
Major J. H. BEAN, 8, Sydney Place
EMANUEL GREEN, Esq., Holcombe, near Bath
Mr. J. T. IRVINE, Combe Down
H. D. SKRINE, Esq., Warleigh Manor
Rev. T. P. ROGERS, Vicarage, Batheaston
ALFRED BANKART, Esq., Weston Manor House
Rev. C. B. BARROW, 15, Marlborough Buildings
JOSIAH GOODWIN, Esq., F.S.A., George Street, Bathwick Hill
W. ALLEN, Esq., The Cloisters, Perrymead
Colonel W. COCKELL, 18A, Queen Square
CHAS. E. DAVIS, Esq., F.S.A., 55, Pulteney Street
A. F. JANVRIN, Esq., 7, Royal Crescent
J. McMURTRIE, Esq., Radstock
S. KEMP, Esq., Oriel House, Widcombe
J. WEDGEWOOD YEELES, Esq., Bathford
H. BONHAM ACTON, Esq., 4, Great Bedford Street
Lieut.-Col. ENGLAND, 7, Norfolk Crescent
H. B. INMAN, Esq., Batheaston
Capt. J. T. CHANDLER, 33, Marlborough Buildings
Rev. ROBT. DRUMMOND, St. Catherine's Court, Batheaston
T. F. INMAN, Esq., Batheaston
Captain P. SAUMAREZ, R.N., 21, Paragon
C. J. MATHEWS, Esq., Upland Villa, Bathwick Hill
C. R. WELD, Esq., Belle Vue House, Newbridge Hill
HENRY BIRD, Esq., M.D., 5, Henrietta Street
WALTER ELLIS, Esq., 2, Royal Crescent
T. F. WALKER, Esq., F.R.G.S., 6, Brock Street
CHAS. TIMINS, Esq., 3, Cavendish Place
Rev. T. H. TOOKE, Rectory, Monkton Farley
T. FELTON FALKNER, Esq., 8, Southgate Street

Hon. Member.

W. BOYD DAWKINS, Esq., F.R.S., F.G.S., &c.

Supernumerary List.

Colonel TUDOR
H. J. HUNTER, Esq., M.D., Privy Council Office, Whitehall
ROBERT E. CRICKITT, Esq., Ceylon
Sir GEORGE J. R. HEWETT, Bart., Albury, Guildford, Surrey
Captain G. W. V. VILLIERS

LECTURE

ON THE

REMAINS of a ROMAN VILLA Uncovered in Cold Harbour Farm, near Tracy Park, October, 1865,

BY THE

REV. H. M. SCARTH, M.A.

NOTICE.—*Any opinions expressed in the Proceedings of the Club must rest on the authority of their respective Authors.*

adjoining the pasture field in which the Villa stood. In the next arable field are the remains of an ancient Cromlech, two upright stones of which now only remain, although formerly there existed a third, and the whole was capped by another large stone. The hedge which then divided these fields is now removed, and the whole turned into arable land. This Cromlech, which is marked in the Ordnance map, and described as "Druidical Stones," has often been the object of a walk to the Bath Natural History and Antiquarian Field Club, and their visits to it called attention to the peculiar traces in the field adjoining, and led to the suspicion that the

Lieut.-Colonel WICKHAM FREEMAN, 3, Johnstone Street
Captain F. R. FRAMPTON, R.N., 46, Pulteney Street
Rev. H. HODGES MOGG, Newbridge Hill, Bath
W. RODWELL, Esq., 9, Catherine Place
J. F. GOODRIDGE, Esq., 5, Henrietta Street
Lieut.-Colonel S. W. HENNAH, 2, Perrymead, Widcombe
Rev. W. S. SHAW, Beechen Cliff Villa
Rev. Prebendary BOND, Vicarage, Weston
Captain LYSAGHT, R.N., 3, Sion Row
Rev. C. BAKER, Tellisford Rectory, near Bath
Lieut.-Colonel W. H. BAYNES, 18, Russell Street
Major J. H. BEAN, 8, Sydney Place
EMANUEL GREEN, Esq., Holcombe, near Bath
Mr. J. T. IRVINE, Combe Down
H. D. SKRINE, Esq., Warleigh Manor
Rev. T. P. ROGERS, Vicarage, Batheaston
ALFRED BANKART, Esq., Weston Manor House
Rev. C. B. BARROW, 15, Marlborough Buildings
JOSIAH GOODWIN, Esq., F.S.A., George Street, Bathwick Hill
W. ALLEN, Esq., The Cloisters, Perrymead

HENRY BIRD, Esq., M.D., 6, Henrietta Street
WALTER ELLIS, Esq., 2, Royal Crescent
T. F. WALKER, Esq., F.R.G.S., 6, Brock Street
CHAS. TIMINS, Esq., 3, Cavendish Place
Rev. T. H. TOOKE, Rectory, Monkton Farley
T. FELTON FALKNER, Esq., 8, Southgate Street

Hon. Member.

W. BOYD DAWKINS, Esq., F.R.S., F.G.S., &c.

Supernumerary List.

Colonel TUDOR
H. J. HUNTER, Esq., M.D., Privy Council Office, Whitehall
ROBERT E. CRICKITT, Esq., Ceylon
Sir GEORGE J. R. HEWETT, Bart., Albury, Guildford, Surrey
Captain G. W. V. VILLIERS

LECTURE

ON THE

REMAINS of a ROMAN VILLA Uncovered in Cold Harbour Farm, near Tracy Park, October, 1865,

BY THE

REV. H. M. SCARTH, M.A.

TRACES of Roman work had long been known to exist in fields lying underneath the northern declivity of Lansdown, and situated nearly opposite to Tracy Park, the residence of the Rev. C. R. Davy, who owns the property on which are the remains that have lately been uncovered. About seven years since I visited the spot with the Rev. H. T. Ellacombe, F.S.A.; there were then numerous fragments of Roman pottery, tile, and pieces of cut stone, lying in an arable field adjoining the pasture field in which the Villa stood. In the next arable field are the remains of an ancient Cromlech, two upright stones of which now only remain, although formerly there existed a third, and the whole was capped by another large stone. The hedge which then divided these fields is now removed, and the whole turned into arable land. This Cromlech, which is marked in the Ordnance map, and described as "Druidical Stones," has often been the object of a walk to the Bath Natural History and Antiquarian Field Club, and their visits to it called attention to the peculiar traces in the field adjoining, and led to the suspicion that the

regular earthen enclosure, rectangular in form, and comprising within it about two acres, contained remains which would be worth investigation. At the suggestion of the Secretary of the Club, the Rev. H. H. Winwood, and through the kind co-operation of the Rev. Mr. Ellacombe, vicar of Bitton, permission to excavate was obtained both from Mr. Davy, the owner of the property, and from the occupier of the farm, Mr. Mathews, both of whom contributed every assistance to render the work complete. Accordingly, on the 12th October, 1865, excavations were begun, and foundation walls were immediately come upon within the rectangular earthen boundary. The walls were found to run at right angles, and as the excavations proceeded, disclosed no fewer than 13 or 14 rooms upon the same level, two of the floors of which had been provided with hypocausts, a larger and a smaller one, with the heating apparatus adjoining. The floors, which were once supported by the pilæ of these hypocausts, were found to have been broken up, but fragments of the suspensura were found, and a few tesseræ; but the plough, and former depredations for the sake of material or supposed concealed wealth, were found to have destroyed both floors. The pilæ were of brick, of the usual height and form, but older materials had also been worked up, and the portion of a pilaster or small column was found used as one of the supports.

This leads to the inference that the Villa had been rebuilt or enlarged, and as one side of the pilaster was weather-worn, it is evident that the first building must have been of an earlier date. The pilaster had been turned in a stone lathe, which is the case with all the Roman pilasters found in this and other neighbourhoods. At the south-east angle of the Villa, where the walls had been traced to their limit, a stone water-course was laid bare, and followed until its outlet was ascertained. At the south-western end, the paved court was

uncovered, which had contained within it a small garden, probably a flower or ornamental garden. On the north side of the larger hypocaust was found a solid block of masonry, which seemed to have been the basement of an elevated part of the building, as we find represented in the wall paintings of Villas preserved at Pompeii. They seem to have had a square turret, from which the whole of the farm buildings could be overlooked. This arrangement is followed to the present day in Italian Villas, and we find the same in mediæval buildings, as in the Abbot's House at Wenlock, Salop, and the Deanery at Wells. Many tiles were dug up in the course of excavating, some of which were flanged, and one or more were found pierced with square apertures; portions also of wall-plaster were dug up with the pattern still fresh upon it, and stone roofing tiles quite perfect, of the usual elongated hexagonal shape, with the hole at one extremity, in which sometimes the iron nail was found which fastened the shingle to the woodwork of the roof. Many of these roofing nails were found perfect, as well as remains of iron clamps and fastenings for timbers, one very perfect, six or eight inches long, with a head to it.

A portion of the leg of a marble statue of small size was dug up, about three inches in length, which appears to have been mended by a rivet. This marble statue was probably one of the Lares or Penates, which presided over the welfare of the family, and were supposed to take charge of the house. The Penates were regarded as divinities, the Lares as guardian spirits, whose altar was the domestic hearth in the atrium or hall of the house, upon which each individual made offerings of incense to them in his own home. (See "Plaut. Aul. Prol.," 2, and Rich's "Com. to the Latin Dictionary and Greek Lexicon.") I am inclined to think that this fragment of marble was a portion of the *Lar*. Similar fragments of statuary were found in excavating the Roman Villa at Wood-

chester. (See Wright's "Celt, Rom. and Saxon," ch. vi., p. 195.) Many bones of animals were found, as is usually the case in the course of excavating Roman Villas. These are, for the most part, tips of the antlers of the fallow and the red deer. Some have the marks of the cutting tool upon them, and seem to have been prepared as handles for knives and other implements. Bone hair-pins also were found, and many oyster shells, in different parts of the Villa. Specimens of different kinds of pottery were found, from the coarse black to the finer red and Samian; also some good specimens of glass, some of which had undergone the action of great heat.

All these were brought from the Villa, carefully ticketed, and have been placed in a case in the Museum of the Literary and Scientific Institution, by the care of Mr. Winwood.

The following is a list of the chief articles found in excavating:—

Iron.—An iron celt, exactly like the head of a modern spud, into which has been fixed a wooden handle; two large clamps; three large flat-headed nails; many roofing nails; clamps and fastenings of various kinds; part of a singular horse shoe, twisted at the sides (a similar piece of iron was found at Silchester, and is said to be an implement connected with farriery); also fused metal.

Bronze.—Small portions of fine plates, probably pieces of mirrors; and small bronze vessels.

Stone.—Six different parts of columns of various sizes; a hand-stone for grinding or pounding, and top stone of a quern; curious quern, or hand-mill; large quartz crystal; Roman weight of stone, pierced, and probably used as a spindle; part of a stone water-course, 3ft. long, 10½in. wide, and 6in. deep; stone pinnacle, or the terminal ornament of the roof, similar in form and ornament to that found at

Wellow and at North Wraxall (see "Wiltshire Archæological and Natural History Mag.," vol. vii. plate 4); part of a hone, or whetstone; fragments of flint; tesseræ.

Jet and Kimmeridge Clay.—Ornament of jet, polished and pierced; fragment of a bracelet, formed of Kimmeridge clay; fragment of coal shale.

Wall Plaster.—Fragments of wall plaster, with pattern fresh upon them.

Mortaria.—Fragments of mortaria, for grinding or triturating.

Glass.—Pure glass of a fine quality, some having formed parts of vessels, and others being for window glass; a portion of ribbed glass, apparently cast.

Tiles.—One large flat tile, 18½in. by 15in.; several smaller ones; and portions of flanged tiles.

Pottery.—Fragments of Samian ware; Upchurch ware; coarse brown red and black ware; black ware ornamented.

Bone.—Bone hair-pins, one very fine with a circular head; portions of antlers of the red and of the fallow deer; boar's tusks.

It must be noticed that among the cut stone, all of which appears to have been obtained from the Down above, some was so worked as to render it evident that it had been used in forming the circular apse of one end of a room, which is a common feature in Roman Villas. Such remains as could not be brought away by hand or in a carriage, were deposited at Tracy Park, where they remain at present.* Among these remains is a cut stone, which seems to have formed part of a sun-dial, having a circular opening in the centre, from which radiate straight lines to the extremity; the outer angles of the stone being rounded off. Another curious cut stone was found in the course of excavation, being

* Now placed in the Literary and Scientific Institution, Bath.

of fine white lias, and polished so as to form a slightly conical surface, with a rim or margin round it. The appearance is that of the under stone of a fine quern, or hand grinding mill; but the material is finer, and the stone more polished than any I have yet seen. The portions of this stone that were found have been put together, and are now in the Museum of the Bath Literary and Scientific Institution. There are marks of this stone having been mended by means of a rivet in former times, which indicates that it was an implement of some importance and value. A variety of coins were found, but all small bronze, and of little value, except one silver one, not rare or of any particular interest.

By the kindness of John Bettington, Esq., who has paid some attention to the subject of Roman coinage, I am enabled to give the following list of coins found in excavating the Villa :—

The earliest coin found was one of Claudius Gothicus, which could not be later than A.D. 270, the date of that Emperor. The latest coin is of the date of Valentinian, which could not be struck later than A.D. 455. The numismatic record, therefore, extends over a period of 185 years, but as coins have been found in this locality more than a century ago, as we learn from Rudder's "History of Gloucestershire," we are not to take the results of the late excavations as a perfect chronicle. The late diggings have yielded—

1 Claudius Gothicus	A.D. 270	Date of Emperor's death.
2 Victorinus	A.D. 267	Date of death.
4 Tetricus Senior	A.D. 337	„
5 Constantine the Great		
2 Arcadius	A.D. 395	Date of death A.D. 408.
4 Constans	A.D. 350	„
1 Delmatius (doubtful)	A.D. 335	„
5 Valens	A.D. 378	„
6 Valentinianus	A.D. 455	„

At Boxmoor, Herts, in excavating a Roman Villa, window glass was found (see "Archæol.," vol. xxxv., p. 63), also the bottom of a vessel of brown glass, with a spiral of bluish white running over it. It exhibits marks of the glass blower's rod. The coins there found range from Nero to Arcadius. Window glass is found at Uriconium (Wroxeter). This is to be seen in the Museum at Shrewsbury, and to some fragments the mortar is still adhering. (For account of glass manufactories, see Pliny, "Natural History," lxxxv., c. 66.) In an "Account of the Roman Villa and Discoveries made on the Borough Hill, the ancient Benna Venna, by Beriah Botfield, Esq, F.R.S." ("Archæol.," vol. xxxv., p. 383), various specimens of window glass are mentioned, and fragments of a beautiful specimen of fine glass belonging to a Thuribulum. These articles were found near the Baths. The objects found at this Villa were deposited in the British Museum, and the drawings have been placed in the Library of the Society of Antiquaries.

In Sir Robt. Atkins's "History of Gloucestershire," mention is made of the discovery of a Roman Villa in the locality of Tracy Park, and a fuller detail given by Rudder ("History of Gloucestershire," p. 211). The latter describes certain Roman antiquities found in a field called Beach, and then goes on to give some account of the Cromlech, and offers conjectures respecting it. The farmhouse, on the other side of the deep hollow, a quarter of a mile to the south-east of the field in which the Roman Villa now described was situated, is noted on the Ordnance map as Beach Farm, and the fields adjoining seem to have the name of Beach, but the name of the farm where the Villa lately uncovered once actually stood is called Cold Harbour Farm. This is a name commonly given to places where Roman remains are found. The spot described by Rudder, and known by him under the name of Beach, is now called

Villa Field, and a Roman Villa may also have existed there. "Since the publication of Sir R. Atkins's History (says Rudder), other antiquities have been found in a field called *Beach*, in the hundred of Wick, by people at plough, in the year 1743, who turned up with the soil a quantity of brick, very hard and ponderous, and much superior in fineness to what we make. Mr Haynes, the proprietor of the ground, caused the surface to be opened, and presently found that these were parts of a brick pillar. There were three foundations of such pillars standing in a line, each 21 inches square; the intervals were 13 inches. The three pillars stood against the middle of an abutment in the foundation of rough stonework, measuring 5½ feet in front, which being carried on in the same direction with the pillars about 22 inches, then spread itself outwards on each side in a circular sweep."

It seems plain from this description that they had come upon the hypocaust, the floor of which had been torn up, and that it had, like many other Roman rooms, a circular apse as a termination. The account goes on to state that, "between the pillars, in beds of mortar, were parts of several urns of fine red pottery, but of different shapes and dimensions, some pieces of wood burnt to a coal, a crooked sacrificing knife, about 6 inches long, and the jaw-bone of a sheep or a goat. And some time afterwards the capital of a pillar of freestone, about 2 foot square in the cornice, was turned up by the plough in the same field. From these remains, and from a great number of Roman coins found there, which are in Mr. Haynes's possession, there can be no doubt of this having been a Roman work." Mr. Ellacombe, the rector of Clyst St. George, writes me word through his son, that he has always considered Mr. Haynes's Villa, here described, to be the one near the Cromlech, viz, that which this Club has uncovered.

It is clear that, as the plough had torn up the floor supported by the hypocaust, red pottery and utensils which had lain upon it, broken and buried by the fall of the roof, had fallen in between the pilæ, and mingled with the wood ashes which remained in the hypocaust. A century ago, and even less, these suspended floors were a great puzzle to the antiquary. We are only too thankful where any account, however imperfect, remains to us of what was discovered in a past age. After giving this description of the remains of the Villa, he goes on to describe the upright stones in the field adjoining, and says, "There is a field in this parish called the Chestles, or Castles, where are three large stones, about 5 feet high from the ground, drawn thither from the cliff below, and placed upright, pretty near together, in a triangular form. They are without inscriptions, but one of them being taken down, at the foot of it were found some old coins, a circumstance more especially denoting them to be monumental, but to what age or people they are to be attributed, is not easy to determine." Mr. Ellacombe informs me that these coins "were sold at Mr. Haynes's sale, and may probably be in the Bristol Musuem." He says that he himself was present at the sale. In a plan and drawing sent me of these stones, some years ago, by Dr. Thurnam, the position of three stones is marked upon the plan, and a fourth represented as broken into two parts, and a fifth lying a little distance out of the circle. The sketch was made by the Rev. T. Webb, October 13th, 1845, and indicates that the three upright stones were most probably covered by a fourth; and the finding of the coins shows that it evidently was a place of sepulture, and not improbably that of some tenant of the adjoining Villa, who perhaps had been a person of note in his day. The Cromlech might, however, be antecedent to the Villa, and probably was so, and afterwards used as a burying place

in Roman times, as it was common for old Celtic burial places —as, for instance, barrows—to be used for later interments. Instances of this are very common. (See Mr. Greenwell's "Researches," published in the "Archæol. Journal," 1865.) Mr. Rudder, however, is of a different opinion, and puts forth an explanation of the number three which is rather ingenious, whatever we may think of its correctness. He says, "It is supposed they were placed there after the time of the Romans, as a memorial of some chief who fell in battle in this part of the county; and their number and nearness to Dyrham, an adjoining village, lead me to conjecture that they stand for the three British Princes whom Ceaulin the Saxon slew in a bloody battle in the year A.D. 577." If we could bring any evidence to substantiate this conjecture, it would indeed render this Villa and its locality a place of no common historical interest; but I fear the upright stones which are found in other places south-west of Dyrham might put in their claims also for this honour.

If the coins found at the base of the stone were known to be ancient British, it might favour the idea; but it is to be feared they are now irrecoverably lost, and probably when first found could not be accurately deciphered. It is not, however, improbable that the battle of Dyrham decided the fate of this and other Villas, as well as of the three cities of Cirencester, Bath, and Gloucester, as all the country adjoining these three cities fell with them into the hands of the victorious Saxons. The latest coin which has been found on the site of the Villa brings it down to the year A.D. 455, the very latest period of Roman occupation of this island. But the coins may have been in circulation among the Romanized Britons to a much later period, and probably were so; and as no Saxon coins have been found in the Villa, we may conclude that it was occupied by a Romano-British master till the Saxon conquest, when it shared the fate of the many

Roman Villas which once stood around Bath, and have perished by fire. The traces of burnt matter, and the stones reddened by fire, attest this fact; and a population like the Saxon, inured to living in the woods, and constructing their own simple habitations of timber, saw little use in the preservation of these Villas, which seem to have been given up to plunder, and the cattle driven off the farm. Mr. Kemble, in his "Saxons in England," vol. ii., page 296, speaking of the Saxon conquest of Britain, observes, "They had not the motive, the means, or perhaps the patience, to unbuild what was solidly constructed. Where it suited their purpose to save the old Roman work, they used it to their own advantage; where it did not suit their views of convenience or policy to establish themselves on or near old sites, they quickly left them to decay. There is not even a probability that they in general took the trouble to dismantle walls or houses to assist in the construction of their own rude dwellings. Boards and rafters, much more easily accessible, and to them much more serviceable, much more easy of transport than stones and hard tiles, they very likely removed." There are certain features of this Villa which remain yet to be noticed.

1.—The *Rectangular Inclosure.* The portion of this boundary directly opposite to the part where excavations were made, consisted of a broad wall of masonry, about 5 feet wide, for several yards, which then ceased, and was continued in a straight line at nearly the same width by an earthen mound. The mound forming the inclosure was cut through at different points, but did not indicate any masonry except opposite to the Villa itself.

2.—The remains of walls of the Villa appear to have been of a uniform height. The surface, when uncovered, did not present a jagged or broken appearance, but as if remaining in their original condition; and this is found to be the case

in most, if not in all, the Roman Villas uncovered in this country, and leads to the supposition that the stonework remains much at its original height, and that upon it was erected a wooden framework; and the remainder of the wall was constructed of clay and straw-bands, as barns and cottages are still constructed in counties where stone is scarce. An antiquary (the Rev. W. C. Lukis) who has given some attention to the construction of Roman Villas, having excavated two in different counties, writes me word to the following effect:—"I have been fortunate in discovering the remains of Roman Villas in two parts of England where they were not known to exist previously: one was at Great Bedwyn, Wilts, and the other was in Yorkshire. In both these cases I am sure that the only masonry of the houses consisted of foundations, which originally were raised to the height of one or two feet above the level of the soil." In the account given of the excavation of a Roman Villa at Keston, near Bromley, in Kent, by George R. Comer, Esq., F.S.A. ("Archæol.," vol. xxxvi., p. 120), a drawing is given of the general plan of that Villa as it appeared when uncovered; here also, it is observable that the walls appear perfectly level on the upper surface, and though the fact is not noticed, yet had the walls been jagged or broken, the artist would no doubt have so represented them in his effective drawings. The superstructure was of wood, and the interstices were filled with straw and rubble.

"I observed in Yorkshire (says Mr. Lukis) what I did not so distinctly trace in Wilts, that the wooden walls had been internally covered with straw reeds, bound together at intervals with straw-bands, in long lengths, nailed to the wood frame, and the plaster was thickly laid on; some fragments which I have collected are from three to four inches thick, and show the fresco colouring on the face, and the reed impressions on the back."

Probably, if the pieces of plaster found at the present Villa had been more carefully examined, some such traces would have appeared, although the fragments were so small that it was difficult to infer much except the colouring and indications of patterns. It is not improbable that the Romans introduced into Britain the style of building which we find preserved in barns, out-houses, and cottages in Devonshire, Cambridgeshire and Huntingdonshire, and other counties. If the walls of the Villas were thus constructed, it will fully account for the mass of earth and burnt matter which has been found to cover the floors, and which has tended to preserve the pavements below, though in a broken condition. In most instances where the pavements have been found entire, they are indented and crushed by the fall of the timbers, and are strewed with roofing tiles. Thus, the same correspondent tells me, that "in Wilts he uncovered a considerable extent of ground, but met with no hypocausts, and the mosaic pavements were fairly entire;" but in Yorkshire the *falling in of the roofs* had destroyed the pavements, which he "found in fragments at the feet of the pillars, and among the *débris* were found also two human skulls." Here was an evidence of the house being burnt, the heavy roof falling in after the rafters had given way, and the whole remaining a smouldering mass, till it burnt itself out, and then became the ground-work for further accumulations of vegetable matter, until the whole was coated with greensward and brushwood. The quantities of burnt matter found within the walls upon the floors of the rooms at Cold Harbour, seem to have indicated a sudden destruction. With respect to the formation of earth walls, or cob walls, as they are called in Devonshire, I am fully aware that they appear to have been derived from the East, and are found among many different people; not only are they common in India, but in Africa, as well as in Europe. Mixing the earth with lime and pounding

it together, and adding chopped straw, makes a very tenacious concrete. Among the Moors, large boxes are used for making masses of this concrete. The ancient walls of Tangier appear to have been thus built. (See "Urquhart's Pillars of Hercules," vol. ii., ch. 6.)

3.—The *form* of the Cold Harbour Villa seems to have been similar to that of other Villas found around Bath, and was probably oblong, like that at North Wraxall. Not many, however, of these Villas have been completely excavated, some portions, as at Newton, having been previously destroyed. The most perfect lately uncovered is that at North Wraxall, described by Mr. Poulet Scrope, in the "Wilts Magazine," vol. vii., p. 59, where plans and drawings are given. This appeared never to have been disturbed since the day of its destruction. The Villa was an oblong building, containing an ambulatory and 13 or 14 chambers, with the hypocausts and bath entire. A stone wall inclosed the garden or compound within which the Villa stood, and the well was found within it. Beyond this were out-buildings, probably for farm purposes; these also were encompassed by a wall, and the burying place of the family was found a little further removed from the dwelling. Much gratitude is due to Mr. Scrope for the care he took in the excavation, and for the careful record he has left of its results. During the time the excavations were in progress, during the year 1859, this Club paid several visits to the spot, and noted the particulars, in which they were much assisted by the kindness of the rector of the parish, the Rev. Mr. Christie.

A great many Roman Villas have been excavated in this country, and careful plans made of their arrangement. They are very varied in plan, but, I think, may be reduced to three typical forms:—

1.—The three sides of a square, and built round a central court; of this the one uncovered at Wellow is an example.

This is the finest yet uncovered in this neighbourhood. Sometimes there were two or three of these courts, as at Woodchester.

2.—In the form of the letter L, of which the one uncovered at Colerne is an example.

3.—A plain oblong, like that found at North Wraxall, and which I am inclined to believe was the form of the Villa at Cold Harbour.

Further excavations would probably have brought to light the ambulatories, which would be in the south side of the building, and probably near to the edge of the field where the Villa stood.

5.—The position of this Villa must not be overlooked. Roman Villas were generally placed not far from great Roman roads. The present one stood midway between two —the Foss, which passes over Bannerdown, and the Via Julia, which runs through Bitton. But there was probably some nearer road than these, as the one is about two miles, and the other is full five miles from the Villa. Some vicinal road, which traversed the north skirts of Lansdown, probably united the two, though I have as yet been unable to hear of any distinct trace of one. It is not improbable that a Roman road passed straight over Lansdown, diverging from the Via Julia near the village of Weston, and making for a Camp a little west of the Grand Stand on the Race Course, and thence over the Down direct for this Villa, from whence it continued on in the direction of the Aust passage.

The foundations of this Villa have now been dug up, and the only traces of it are the inequalities of the ground from whence the materials have been taken, which is strewed with pieces of brick and pottery, and the crumbling remains of the concrete floors, which serve to enrich the land. The field is now tilled, and the plough will soon eradicate every vestige of the Villa. Already the earthen inclosure is

sinking into the level of the surrounding land, and the whole will become as though no building had ever existed.

A wall, 128 paces long, has been built out of the stone foundations dug up, and this wall runs in the direction of the old earthen boundary of the Villa, though not upon it It is calculated that the wall contains about 2,400 cubic feet of masonry, mostly obtained from the Villa. The spring of water which had supplied the Villa is just beyond this wall, and outside the Villa boundary, at the N.W. angle of the inclose, some vestiges of a road appear. The compound in which the Villa stood runs W. by South, and E by North, so that the aspect of the building was South West.

6.—Traces of another Villa appear in Lansdown, within a quarter of a mile of the Roman Camp, through which the Turnpike Road passes, and on a point of the Down looking towards Swainswick and Woolley. The very slight excavations which the Field Club, under the guidance of the Rev. John Bond, caused to be made in that spot, indicated that underneath remains would be found which would amply repay further investigation. We may hope that the success which has attended the excavations on Cold Harbour Farm will encourage the Club to proceed, as each successive disinterment produces fresh information, and by careful comparison of results we arrive at just conclusions. No doubt permission would be obtained to excavate, and by a good system of supervision being organised, very interesting discoveries might be made. But it is important in all these diggings that some one be on the spot to note each object found, as well as to watch and direct the labourers.

7 —The number of Villas, amounting to 20, which have been found around Bath, is a very instructive and suggestive fact; and from it we may infer the security of the country, as well as the state of civilisation and comfort under the Roman rule. These Villas appear to have been comfortable country

residences, and the owners engaged in agricultural pursuits, as well as the pleasures of hunting, and united with their avocations the elegancies and luxuries of refined society.

As we go northward, Roman Villas gradually become more rare, and after quitting Yorkshire and Lancashire, we lose them altogether.

They are not found in Durham, Westmoreland, or Northumberland, or in the still more northern parts. In these regions you have the fortified camp alone. The great northern barrier has no Roman Villas in its vicinity.

It might here be not irrelevant to mention some of the larger and more interesting Roman Villas that have been found in this country. Mr. Wright (in his "Celt, Roman and Saxon," p. 186) observes that modern discoveries have shown us how marvellously the country was covered, especially in some of the southern and midland districts, with these great rural residences. The largest and most magnificent Roman Villa yet discovered in England (he considers to be) at Woodchester, in Gloucestershire. It is situated in the Vale of Gloucester, or rather on the high grounds bordering on the Vale, and about four miles from the Roman road from Cirencester to the Aust passage across the Severn, and is 12 miles from Cirencester and the same distance from Gloucester. It is, I believe, only opened for exhibition at certain times, when a charge is made to visitors, and the money so received, devoted to the parish school. It would afford to this Club an object of interest for a visit, if the time of the next uncovering could be ascertained. Several other Villas have been found in the same neighbourhood, and crossing the Severn at Lydney we come upon a very striking and extensive one, which has yielded some good pavements and many objects of interest. I am enabled, through the kindness of the late owner, to place before this Club a ground plan of the Villa. The extent of it will be seen at once, and

the situation in Lydney Park is very beautiful and commanding. The inclosure which surrounds the Villa and its appendages had also contained a temple dedicated to the god "Nodon," as is known from an inscription in brass dug up there. Somersetshire, as well as Gloucestershire, was noted for its Villas, and rich in pavements as well. I have mentioned that the remains of 20 villas have been found within a radius of eight or nine miles around Bath. In the neighbourhood of Somerton very extensive Villas have been found—two in the parish of Kingsdon, one near the Roman Road to Ilchester, the other on the Bank of the Carey ; and a third at Lytes Carey. These three Villas are, according to Mr. Wright, included in a distance of about a mile. In the parish of Hurcot, adjoining Somerton, two Villas have been found, another at Charlton Mackarel, and another at Copley, and in the parish of Littleton several Villas have been found. Others could be mentioned, all in the neighbourhood of Somerton, as at Pitney, which Villa covered an acre and a-half of ground, and contained a very remarkable pavement, of which this Institution possesses engravings.*

Roman Villas appear to have been equally abundant in Hampshire and Oxfordshire. Sussex boasts the handsome Roman Villa at Bignor, situated near the Roman road from Chichester (Regnum) to London, and others also in that neighbourhood. The pavements at Bignor, which are protected, and exhibited to visitors, are well worth a visit. In Cambridgeshire and Essex, Roman Villas have been uncovered by the Hon. Richard Neville, who has collected an interesting Museum at Audley End, and has recorded the results of his excavations in the pages of the "Archæological

* A Roman Villa has lately been uncovered at Chedworth, near Foss Bridge, north of Cirencester, on Lord Eldon's estate, which is described, though briefly, in the proceedings of the "Society of Antiquaries of Scotland," vol. vi., pt. ii., p. 278, by James Farrer, Esq., M.P. This was visited by the Field Club in May, 1867.

Journal." (See vols. vi., viii., x., xi.) Wilts and Dorset have also been fruitful in their remains, but for an account of them I must refer to Mr. Lyson's published collection, which is beautifully illustrated. It is to be regretted that the Bath Literary and Scientific Institution does not possess a copy of Mr. Lyson's great work. In Kent, the Roman Villas are thickly scattered on the line of Roman road from Canterbury to London, and on the banks of the Medway towards Maidstone. Many have been found in Northamptonshire, Lincolnshire, and Nottinghamshire, but Yorkshire and the Midland Counties have been but little explored. Shropshire, Herefordshire, and Montgomeryshire have produced some, and more may probably be found. It is to be regretted that no one has yet been found to bring together the scattered notices of Roman Villas laid open in Britain, and to note their position in the several counties where they occur. Mr. Wright has briefly mentioned some of the leading discoveries, but a very interesting work might be compiled on this subject, and a very instructive map published, if some one would bring together these different discoveries, and classify and arrange the objects which have been collected in the course of excavation. Might not Government publish a large map, reduced from the Ordnance survey, containing entries of the sites of all the Roman camps, cities, roads, villas, bridges, and whatever pertains to the Roman period, noting also the extent of the forests at that day, which can pretty clearly be ascertained? Such a map ought to accompany the "Monumenta Historica Britannica." What the Emperor of the French has lately done ought to incite us not to be *outdone!* Private museums in this country contain many curiosities of Roman art, which have been obtained from the sites of Roman Camps and Villas; and if these could be brought together under one view, in an illustrated catalogue, it would

greatly aid our conceptions as to Roman art and domestic manners.

Even if the objects that have been found in the Villas around Bath had been brought together in the Literary and Scientific Institution, it would have possessed a Museum of Roman domestic art and refinement not inferior to any on the Continent, if we except the cities of Italy.

It will not be out of place here to say a word about the mode of agriculture, as well as of horticulture, in Roman times. Both were carefully attended to, and when we find a Roman Villa, we infer very naturally both these accompaniments. In fact, traces of Roman agriculture are still existing, and probably the terraces on the sides of many of our hills are the result of Roman handiwork. Plants still flourish which were introduced by the Romans, and the vine is found growing wild in the neighbourhood of their Villas. How far the Saxons, as well as the ancient Britons, were indebted to Roman example for their agricultural improvements, and for some knowledge of the principles of rural economy, is a question on which I cannot now enter; but the works on agriculture left behind by the Romans, not to mention those beautiful poems of Virgil, the "Georgics," evince the value set upon it by that people. I think there is little doubt that the Ecclesiastics of the middle ages greatly profited by the traces left of Roman agriculture, as well as by their books upon it. As the remains of Roman buildings gave hints to mediæval architects, so no doubt they profited by the remains of agriculture as well. The elegant "Lectures on Roman Agriculture," by Prof. Daubeney, published in 1857, have made this subject accessible to all, while the matter is so handled as to impart to it the highest interest, combined with practical utility.

Cato and Varro both wrote upon Roman agriculture, but from Columella we derive the fullest information on Roman

farming and gardening. He appears to have lived about the same time as Seneca and Celsus, and to have resided at Rome, though by birth a Spaniard. He treats upon every subject connected with rural economy, and is the first to recognise the importance of science to agriculture. I could wish that some of our modern agriculturists knew more of what had been done, and thought, and said in ancient times on agriculture. We, who now profit by the experience of near 2,000 years, have no cause to boast, if we excel in certain modern inventions. The Romans seem to have derived their first knowledge of scientific agriculture from the Carthaginians, having caused the writings of Mago, a Carthaginian, to be translated into Latin, and abridged. This treatise, even in the abridgement, filled six volumes, and seems to have been the text book for Roman study. It was saved at the sack of Carthage, and translated in Rome at the public expense.

The Carthaginians laid down a maxim which we hear reiterated continually at the present day, viz., that capital must be a primary consideration in letting or taking a farm, and your farm must not be larger than you have capital to stock and cultivate,—"imbecilliorem agrum, quam agricolam esse debere." Virgil also well describes the attention that must be paid to soil and climate in the mode of cultivation:—

> "Ventos et proprium cœli prædicere morem
> Cura sit, ac patrios cultusque habitusque locorum,
> Et quid quæque ferat regio, et quid quæque recuset."

Also, "great importance was attached to the position of the country house, as well as to its size, with reference to the extent of the property—not too large, so as to involve useless expense; nor yet too small, so as to be deficient in room for storing away the produce of the farm." It was to be built also with an eye to *elegance* and *comfort*, as well as utility,

in order to hold out inducements, not only to the owner himself, but to his wife also, for passing her time there. The younger Pliny (Lib ii., Ep. xvii.), in describing his Laurentine Villa, which he praises as being well adapted for all purposes of use and convenience—but (as Professor Daubeney observes, "Roman Husbandry," p. 47) "according to the ideas of that period, neither sumptuous nor extravagant—details a suite of apartments of such extent as impresses us with an exalted notion of Roman luxury. Those who would follow out this subject will find ample information in Mr. Castle's beautiful work, "The Villas of the Ancients," or by referring to Pliny's Epistle. But it is rather with the Villa as described by Columella that we have to do, because his description will better suit the class of Villas discovered in this country; only in his pages we have a description of a complete and well-appointed Villa, or, as we should say, a first class country house, whereas many of the Villas in this island, and the one in particular now under consideration, were small.

The Villa was divided into three parts—

I. The *Urbana*, which contained the apartments of the proprietor.

II. The *Rustica*, for the farm labourers.

III. The *Fructuaria*, for the farm produce.

The probable ground plan may be seen in Mr. Castle's work, and in Dr. Daubeney's. The Villas in this neighbourhood which come nearest to this description are those at Wellow, at Woodchester, and at Lydney, where we trace what we should now call farm premises, as well as the owner's residence.

The *Urbana* was divided into winter and summer apartments, which accords with our finding a certain portion warmed by the hypocaust, and another part without it.

The *pars Rustica* consisted, first of kitchen, which being the general resort of the slaves, was to be lofty and spacious, and it is supposed that the smoke ascended through openings

either in the roof or in the sides, as no traces of chimneys have been found in the Roman houses; but instructions are given that the smoke should be carried into the *Woodhouse*, for the purpose of drying the fuel for use, and this could only be done by means of flues. The cells of the farm slaves were to look toward the south, and the *Villicus*, or bailiff, was to have his dwelling near the gate leading to the house, that he might thus overlook the labourers. The cells of the ploughmen and shepherds were to be near their respective cattle. The *pars Fructuaria* contained the granary for corn, the wine-press, oil-press, and wine cellar. I cannot but think that in the arrangement of the Grange of the Monastery of the middle ages, and even in the Monastery itself, you have preserved much of the arrangement of the Roman Villa. The Monastery was the dwelling of a community, and therefore larger; but the disposition of the buildings probably had for their model the ancient Roman Villa.

The Romans are well known to have been great gardeners. It is interesting to have found the traces of an ornamental garden in the Villa at Cold Harbour Farm. In the earliest period of Roman history, observes Dr. Daubeney, every family had its garden. In the Laws of the Twelve Tables, the term *Hortus* is synonymous to *heredium*, or inheritance. Pliny remarks that men of the highest rank were willing to borrow their names from its contents, as in the Valerian family, where the *Lactuarii* did not think themselves disgraced by taking their names from the *Lettuce*. The variety of plants cultivated appears to have been small, compared with our own system of gardening, although the kitchen garden was so important. From Marshall, we know that flower pots were common in the windows of the houses (Epis. xi., 19), and the central court of the Villa contained a small garden, as we see from paintings on the walls of the houses at Pompeii, and find traces still existing in the courts.

The fashion of cutting trees into the figures of animals appears to have been much in favour, and the cypress and the box had to undergo tortures of this kind—as we sometimes see in cottage and farmhouse gardens at the present day; a fashion which is happily dying out, but which was very prevalent at one time. Flowers and vegetables appear to have been planted side by side in Roman gardens. Plutarch speaks of the practice of planting roses and violets side by side with leeks and onions, which seems to imply, as Dr. Daubeney observes, "that in his time the ornamental part of the garden was not kept distinct from the useful." We still see in the farmhouse gardens of this county the same tendency to mingle flowers with pot-herbs and kitchen plants. The pot-herbs which Columella directed to be cultivated in his garden comprehended the greater part of those in use at present, except the potatoe, and a few others, which we owe to the discovery of America. It is rather remarkable that the exploration of a new continent, and the continued demand for fresh luxuries and conveniences, should have added so little to the articles of human sustenance obtained from the vegetable kingdom; so that while the Eastern world has furnished us chiefly with tea and coffee, to the Western Hemisphere we should be indebted for little more than the potatoe and tobacco." ("Lectures on Roman Husbandry," p. 256). (See Columella, Book 10; Virgil "Geor.," iv., 116.) Having now briefly touched upon what may have been the accompaniments of this Villa, we may draw our observations to a close by expressing a hope that the labours of this Club in disinterring these ancient remains, may not have been altogether without profit, and that some knowledge has been derived of the nature and extent of Roman industry, and interest imparted to a subject, which, if followed out, might also lead to not unimportant results.

LECTURE

ON

TRACES of the EARLY HISTORY of BATH and its NEIGHBOURHOOD,

BY THE

REV. J. EARLE, M.A.

THERE is no town in the country that has been the subject of so much writing as Bath. With the single exception of London, there is no place, I imagine, that has produced, through centuries, such a succession of writers on its local history. Some of them were mere scribblers; but others were serious and able writers. I have heard that observation made by others, and, as far as my experience goes, I really believe it to be true, and not only so, but would say, having given pretty considerable study to the history of Bath, that it is remarkable in this way, that there is no great period in the history of the country which is not represented in this locality. A person who reads through the history of Bath does, in effect, read a history of England in small, because there is no important epoch that is unrepresented in the history of our immediate locality, and that from the very earliest times. There is a great number of towns which for the last 400 or 500 years have been more distinguished than Bath, with the exception of the singular position of Bath in the last century; but I know of no town which from the

British period—from the earliest dawn of history down to the present day—represents at each stage something, and something worth telling, like the history of Bath.

But I am now going to confine myself to one particular set of observations, and their leading idea may be found in a page of Mr. Scarth's *Aquæ Solis.* That gentleman observes that the Roman pavements found outside were better than those which have been found inside the city walls; and he accounted for this by the greater demolition and reconstruction which took place within the inclosed area, than on the outside. This seems a very simple observation, but it is one of very extensive application, and I propose to apply it to other ages besides the Roman.

But before quitting the Roman period one observation must be made about Roman coins The instruction got from such coins is not from contemplating them as objects, but from the circumstances and associations of their excavation. It is desirable to know in each case in what spot they were found, at what depth from the surface: and to have a complete catalogue of all coins found from first to last within a definite circuit. It is only by these data that any useful results can be summed up from coins discovered. I fear that the coins found in past years in this locality have been very imperfectly recorded, and the consequence is we do not know the total of each reign found. This is one of the most important difficulties in reconstructing the Roman history of Bath; but the fact that these records were badly kept in past times, is one reason why those who have the opportunity should see that they are better kept in future. Excavations, as you know, are going on at the White Hart, and several things have been found there. It is of the greatest importance that these should be kept together and catalogued, that we might know in each case at what depth and in what *stratum* they are found. Mr. Irvine, who is

taking great interest in the excavations, has established the fact, I believe, that the old Roman temple crossed the street, and was situate largely on the area of the White Hart. At all events he has found there the basement of a large building of ancient date, and also a continuation of the frieze of the temple, a portion of which is in the vestibule of the Institution; and that is an additional argument in favour of this supposition. It is a question whether, previous to the Roman period, there was any city of Bath at all, or any town or place of any name. Some of the earlier writers on Bath produce some British names in connection with it, such as *Caer Palladur* and the like; but I have never been able to find any authority for those names, nor have I ever seen a single scrap of evidence to lead me to the conclusion that there was a city at all about the Waters before the Romans came. I do not say it is unlikely, but that I desire evidence to prove it. In the excavations lately made on the site of the White Hart, and which are carried down to the geological bottom—to the lias—they passed through about 18 inches of a fine red greasy clay, which Mr. Irvine thought was the old sediment of the Bath waters; in which case one must suppose that there was once a considerable pool existing there, or a morass of the water, which was very probable, for Mr. Irvine's view is based not simply on what he saw at the White Hart, but at the west end of the Abbey, where a considerable sinking was was made, when he found the same kind of mud. It appeared full of iron, and was of a rusty red colour. That suggests, as I have remarked, an extensive morass or pool, formed by these waters, and almost immediately above that fine clay we begin to have tokens of the Roman period. One of the things observed on the site of the White Hart, was about six inches of a sort of gravelling with concrete, as if there had been a large area, esplanade, or parade ground there, which is exceedingly likely.

The English towns differ from continental towns in this, that every continental town has its square or open area. In England, we scarcely ever see such a thing; but there is reason to suppose that in the Roman period all the towns must have had them. Therefore, in reconstructing in your minds Roman Bath, you must look somewhere for an open area; and I imagine that nowhere could there be a better place than just where the White Hart stood. The temple, certainly, was there somewhere.

Having said thus much respecting the Roman period, I wish to touch on some traces of antiquity outside Bath, belonging to the time immediately following the Roman period, which is remarkable as the herioc age of Arthur, under whom the Britons struggled against the Saxons. We have not of that time anything which can be called recognised or established history. The records of the time are somewhat mythical, and we hardly know what is true, and what is legendary story; but I have a growing conviction in my own mind, that we have in these stories a piece of real history that belongs to this neighbourhood. Lately walking over the ground with Mr. Long, and surveying it, the geographical exactness of the story gives me a strong opinion that we have in these British legends a real history of the battle that was fought between Arthur and the Saxons upon the ground of Solsbury and Hampton Down. The legend runs thus:—

Arthur had defeated Childric the Saxon on the field of Lincoln, and pursued him to the wood and besieged him there. Then said Colgrim to Childric, "Lord Childric, either we must go out into the plain and fight Arthur again, or else we must sue to him for peace. Here we cannot stay: it is better to lie honorably on the land than to perish with hunger."

Childric heard this where he lay within the dyke, and answered with sorrowful voice, "If Baldulf thy brother wills it, and our comrades will it so, we will pray Arthur for peace. For Arthur

is noble in the land, and dear to all his men, and of royal lineage: he was the son of Uther. Happen it will, in divers lands, where good warriors fight, that they win at first and lose at last. Such is our luck this year: better may chance another season, if we may but live."

So twelve knights were forthwith sent to Arthur to ask for peace. Then Arthur laughed with voice aloud: "Thanked now be the Lord, the Disposer of all events, that Childric the strong is weary of my land! He who had divided my land among his free knights is now like the hunted fox, which, from the proudest on the wold, is become the most craven of beasts. Childric the strong, the rich, the boastful, have I driven to bay; and now I have him at my will, either to hang or slay. Yet I will neither slay nor hang, but will grant him peace, and take his hostages and all their horses and weapons; and shiftless they shall go to their ships, and sail over sea to their land and tell of Arthur the king, how I, of my generosity, had compassion on the unfortunate."

This was the ruin of Arthur the king. There was no man so bold as to dare to advise him; but he sorely rued it a short time after.

Childric delivered hostages, all chosen men and noble born; they delivered their horses, their breastplates, spears and shields, and long swords; they relinquished all they had. Then they marched to sea and shoved their ships from land, and were lost to sight. But soon they reappeared at Dartmouth, and landed at Totnes, and ravaged the country. They lived in plenty, made songs of Arthur the king, and said they would make his land their home both winter and summer. This was their game, but it fell to their shame!

Childric won all that his eyes looked upon: he ravaged Devonshire, he took Somerset and Dorset, and invaded Wiltshire. Then, at last, with sound of horns and trumpets, he set forth to besiege Bath and blockade Bristol. To Bath came the Kaiser, and beleaguered the castle, and the men within mounted the walls and defended the place against Childric the strong.

Meanwhile, Arthur was far away in the north, conquering Scotland and making himself master in Orkney, and Galloway, and Man, and Moray. Arthur thought for certain that Childric was gone to return no more. But when tidings came how Childric had landed, and what harm and sorrow he wrought in the South

—then said Arthur, boldest of kings: "Alas, and walawa! that I spared my foe! that I quelled him not with hunger or with the sword! Thus he rewards my goodness! But so help me the Lord, the shaper of daylight, as he shall bitterly abye it, and I will be his bane. I will kill Colgrim and Baldulf, and all their bravest shall suffer death. If life last in my breast, and if the Power that shaped sun and moon will favour me, Childric shall jeer at me no more." Then shouted Arthur, boldest of kings: "Where be ye, my knights, brave men and good?—we must to horse, and speedily wend so far as to Bath in the country's end." So he ordered the Saxon hostages to be hanged, and leaving his kinsman Howel lying sick in Clud, he pushed on till he drew nigh to Bath. In the open field he alighted, and all his knights did on their burnies like stern warriors. When he had ordered his battalions, he threw about him his breastplate of steel, the craftswork of an elfin smith, he incased his shanks with hosen of steel, Caliburn his sword he swung at his side, wrought in Avalon of more than human craft. His helm on his head was like a gable of steel, whereon was many a gemstone, and all circled with gold. That helm had been Uther's, and was called Goswhit by name; no other was like it for virtue or fame. Over his shoulder he hung the shield that in British was called Pridwen; in his hand he seized Ron, the trusty spear, and so equipped he leaped on to his steed.

They that were at hand now beheld the fairest knight that ever led an army to action.

"Lo! where before us here are those heathen hounds that have slain our kinsfolk. Let us fall upon them and stoutly lay about us, and wreak a vengeance for kin and for kingdom. Wreak we the shame wherewith they have shent us, when over the billows they came in to Dartmouth. They *are* forsworn, and they shall be forlorn."

Over the weald the mighty Arthur rode—he made for Bath.

Tidings came to Childric, the strong and the mighty, that Arthur was come and was ready to fight. Childric and his brave men leaped to their horses, and snatched at their weapons; they knew their doom was nigh.

Arthur saw Borel advancing to meet him at the head of seven hundred knights; he couched his spear Ron, and rode his horse so that the earth shook under him. At Borel he rode, and smote

him thro' the breast. Then shouted Arthur: "Now at them; it is well begun!" The Britons smote as the wicked ought to be smitten; and there fell of Childric's men two thousand; while Arthur lost not one! The king was enraged as is the wild boar, when in the beechwood he meeteth many swine. This Childric saw, and began to move over Avon, to hide him in the Bury. Arthur sped at them, as it were a lion, and hurried them to the flood. Many perished there—there sank to the bottom five-and-twenty hundred; insomuch, that the stream of Avon was all a bridge of steel. Childric fled over the water with one thousand five hundred knights; he thought to get away and sail o'er the sea. Arthur saw Colgrim climbing the mount, retreating to the hill that standeth over Bath. After him hied Baldulf with seven thousand knights. They thought on that hill to find a secure standing ground, where they might defend themselves and damage Arthur. Then Arthur, the princeliest of kings, beheld Colgrim halting, and beginning to work at a camping place. Then he shouted loud and keen: "Oh, my bold fellows, march on that hill: for yesterday Colgrim was keenest of men, but now he is like the goat on the hill butting with his horns, when the wolf cometh wildly wending towards him. So will I to-day be Colgrim's doom; I am the wolf and he is the goat—the man shall die."

Again exclaimed Arthur, the most regal of kings, "Yesterday was Baldulf the boldest of knights, but now he standeth on the hill and beholdeth the Avon, how there lie in the stream fishes of steel—sword-begirdled fishes, with red water to swim in; their scales they look pretty like gold-spangled war shields! Their fins how they flutter, just as if it were spears. Now this is uncommon; such cattle above and such fishes below."

"Yesterday Kaiser Childric was the most warlike of kings, but now he's gone a hunting and horns go with him; and away he scampers over the broad weald to the barking of hounds. But he hath left his hunting-party behind—left it beside Bath; and the deer that he flies from shall be a dinner for us."

The king's deed was even with his words. Gripping his spear he put spurs to his horse, and like a bird he flew up the hill with twenty-five thousand men mad for action. Colgrim received them and felled Britons to ground; in the first rush five hundred fell. In high wrath exclaimed Arthur, "Where be ye Britons, my barons bold? Here be our foes, handy to reach: goodmen

mine, lay them with the ground !" Arthur gripped his sword and smote down two Saxon knights quickly, one after the other, and this emboldened his Britons that they laid on the Saxons mightily till they fell, the Saxons, by hundreds and by thousands. Colgrim fought beside his brother Baldulf, and when he saw Arthur make towards him he would have fled, but the heaps of dead encumbered him. Arthur spake loud: "Here I come, Colgrim, to reckon with thee ! We shall divide this land betwixt us two, and thou shalt loathe thy portion." The act was even with the word ; the king hove his broadsword on high and clove Colgrim through the helm, that the sword stayed at his breast. Then with a swing of his hand towards Baldulf he swept off his head, helmet and all. Then laughed king Arthur, and in game began, "Lie now there, Colgrim, having clomb so high ; Baldulf thy brother lieth by thy side. Take my land for your own—dales, and downs, and subject folk. Ye climbed too high to this hill top ; ye would mount up to heaven, ye must go down to hell. There ye will know many of your kin. And greet me now Hengest, that was fairest of knights, and Ebba and Octa, and more of thy kin, and say they may stay there winter and summer, while we here in land shall pleasantly live ; and here your bones shall lie beside Bath."

Then Arthur called to Cador the keen, who was earl of Cornwall, and bade him follow with 5,000 men after Childric, who had fled, "Get to the sea before him, kill the Kaiser, and I will give thee all Dorset." Cador sprang to horse like a spark out of the fire. Over woods and wolds and wildernesses ; over dales and downs and deep waters, Cador, who knew the way, made right for Totoneis. Cador was there before Childric, and raised the landfolk and armed the churls with clubs and staves, and ensconced them in Childric's ships. Cador, with his men, lay in wait in an inland wood. Childric appeared, coming over the downs, making for the ships. Cador cried aloud, "Look alive, boys, brave men and brisk ! Think what Arthur, our princely king, besought us at Bath, before we left him. Lo, where Childric speedeth, to flee to his land and raise a new force to come back again. He thinketh to avenge Colgrim, and Baldulf his brother, who rest at Bath." So Childric and his men were cut off and destroyed between the army on the one side and the churls on the other. Then Cador took possession of the west country and established a

peace that lasted a long time ; insomuch that a man might travel with rings of gold and fear no evil greeting.

But Arthur was gone back to Scotland to the aid of his kinsman Howel.

This legend has, with all its wild, romantic air, and poetically coloured beauty, two important marks which indicate that we have history here. In the first place, the description of Arthur's armour was given before this battle, which shows that a traditional importance was attached to the battle of Bath. For the narrative is taken from a book of three volumes of British story, a large part being occupied by Arthur, and there were plenty of opportunities of giving the particulars of his armour ; but it was given before the battle of Bath, which shows that considerable importance was attached to that very engagement. In the next place is the very striking way in which the geography of the locality corresponds to the description given in the legend. The two hills—Solsbury on one side and Hampton Down on the other—with their several fortifications facing each other, and the river Avon flowing between—agree in a remarkable manner with the description there given.

One of the most important periods in the history of Bath is the Norman period of John de Villula, who built the cathedral and re-edified the town. Of all the buildings which he raised in Bath, there seems to be nothing *in situ ;* with the exception of the basement of two pillars or piers, which are to be seen in the Orange Grove, at the east end of the present Cathedral. These pillars indicate, it is supposed, the crossing point between the chancel and the nave of the Norman edifice, which must, in that case, have run out into the Orange Grove. This is Mr. Irvine's interpretation of these remains, and it appears a natural and correct hypothesis. There have been discovered in the late demolition of the White Hart a corbel and some other carved fragments of the

Norman time, which are probably fragments of the church of John de Villula, but nothing *in situ* with the exception of the two basements referred to. This, in fact, is one of those instances in which an ancient town has really disappeared, because with such a building as the Abbey then was, there must have been other edifices of a superior kind of architecture belonging to persons of distinction residing in the city; and if we look in the immediate neighbourhood of Bath, we shall find it singularly rich in remains of the Norman period. Taking a circle of seven or eight miles, there are a great number. There is Charlcombe church, where there is a very good Norman arch; Langridge church, again, has the most splendid Norman church in this locality. Remains of the same period are likewise to be found at North Wraxall, Swanswick, and Twerton. At Queen Charlton, near Keynsham, there is the Abbey gate, which is a fine old Norman gateway; and so on round the country, not omitting Englishcombe, where there is some remarkable work, not merely a south porch with a Norman arch in it, but also in the church a fine Norman arcade. Of work earlier than Norman times I know of only one single scrap, and that is the font at St. Catherine's church, which is of very high antiquity, probably of the very earliest Saxon period. It represents a first rude attempt at stone cutting, and is, perhaps, the oldest piece of barbaric art in the neighbourhood. There was another church, now lost sight of, and of which we have no traces, and that was old St. Michael's—or St. Michael's *intra muros*, as it was called, from being within the walls—which stood very near the present St. Michael's, which, by way of distinction from the old church within, was called (and is called, when its full designation is used) St. Michael Outwich. St. Michael's *intra muros* appears to have been an old Norman church. Mr. Long has a drawing of it by Lansdown, but where the latter got the copy of it I do not

know; because Mr. Lansdown could never have seen the original. It bore the date 1180, and if that is correct it must have been the oldest Norman building which stood in Bath.

Now when we pass from the Norman period to the next great architectural revival in Bath, we find a very long interval indeed. There really was not any work done in Bath of which we have either any trace or any record earlier than the beginning of the sixteenth century.* This, at first sight, appears very unaccountable; but it can be explained on looking into history. In the twelfth century the Bishop of Bath changed his residence from Bath to Wells. The first who removed was Joscelyn Trotman, a name of particular significance; wherein the fortunes of the two cities may well be bracketed together, the loss of Bath being the gain of Wells. When we are asked for the glories of Bath between the Norman times and the days of the Reformation, the answer is that they are transferred to Wells, where the great architectural development of the building centuries was displayed so conspicuously. It was not merely that the Bishop—I am speaking of the result of years, and use the word Bishop as an abstraction—changed his residence from one episcopal seat to the other, which he had a perfect right to do, and which, although it might have been a loss, could hardly have been called an injury; but there was a positive injury attached to it. When the Bishop moved away from Bath to Wells he divested it of the glory of its abbacy. He incorporated the dignity of the abbot in his own person of bishop, and he left nothing but a poor subordinate prior in his place. He also took away a pretty good share of the estates of the Abbey,

* This is a little too sweeping, though true in the main. Mr. Irvine tells us that some early English pilasters have been found in the masonry of a well on the site of the White Hart; and then there is the East Gate, which ought not to have been forgotten.

which he had changed into a priory, and under these circumstances Bath sank into comparative obscurity and insignificance. The prior left behind, took no pride in his position; he did nothing but let the buildings go down. Perhaps he had not much more than enough to support his house with the necessaries of life, and so he confined himself to promoting the cloth business here, in which he was successful. The Cathedral he let fall into a state of dilapidation, though had there been sufficient revenue probably the old Norman church would have been preserved. Probably it would have been, because we cannot look upon the great spread of Norman architecture in the country places around, except as a reflection of what was doing in Bath—as a consequence and imitation of what was doing here.

In the sixteenth century we come down to times when the Abbey Church was partially restored. In the following—that is, the seventeenth century—there was in Bath and its neighbourhood a great architectural era. It does not seem to have spread very widely in church architecture. I am not aware of much of the latter being done in that century, with the exception of the Abbey Church; and also Swanswick Church, where some windows were put in; but in country houses, farmhouses, and gentlemen's houses in the neighbourhood, it was a very prolific period of architecture. In fact, the prevalence of sixteenth and seventeenth century manor houses is the most distinguishing feature of the domestic architecture of this district. They are to be found in Batheaston, St. Catherine, Swanswick, and Englishcombe. We cannot drive in any direction round the country, without coming across these old Elizabethan and Jacobean manor houses. In Bath, at the same date, there was the Guildhall, built by Inigo Jones; and without doubt there was also here a class of houses equal to any that we now see in the country, if not superior to them. There is now only one remaining, and that is Hetling

House, a fine old building of the 17th century, and one of the class of which I have been speaking. In this house the Earl of Lexington is said to have lived some time last century. Inigo Jones's Guildhall, with all the rest, is gone; and if we want to re-construct in our minds the Bath of that day, we must look to the old manor houses. How different the thoroughfares must have looked then! The houses were not then built to front the streets; that was a habit only introduced in the last century. Previously the gable ends were presented to the street; and an alley had to be walked down to get at the front, which was at right angles with the thoroughfare. Each house stood alone, and was a castle of itself. All this points back to a very different state of society to that which now prevails, when there was much less security than that which is now enjoyed. In like manner, if we turn to the country, the old manorial houses tell us of a different class of society—a class which has vanished. These were the independent houses of the lesser gentry, or yeomen, who have become all but extinct in this country, with whose glory they, more than any other class of the community, are so greatly linked. It was that class that won the historic battles of the country, and which, still existing in America, has carried the North successfully through its great conflict with the South.

We have thus seen how great have been the changes in the architectural features of the city in the past; but we can hardly anticipate, looking at its present arrangements, any such changes in the proximate future. Still we do see, even now, very considerable buildings disappearing in a comparatively short time after they have been built. Among these are the old Blue Coat School, which was not older than 1712, and was built by a highly respectable architect, Killigrew; and the fine mansion (known as Dr. Bave's house) lately demolished for the New Wing of the Hospital; and

when we find, in addition to these, that a house in Westgate Street, where the Duke of Northumberland lived, and drove his four-in-hand, is now a beerhouse, what confidence can we have that anything erected in the midst of a great city will now be permanent any more than in past generations?

LIST

OF

MOLLUSCA FOUND in the NEIGHBOURHOOD of BATH,

BY

HENRY BIRD, ESQ., M.D.

(Read January 15th, 1868.)

THE species of Mollusca included in this paper were all found within a district extending ten miles around the city of Bath during the year 1867. The names and arrangement are those of Jeffreys, as given in his "British Conchology."

LAMELLIBRANCHIATA.

SPHŒRIIDÆ.

Sphœrium corneum.—River Avon and Canal.

S.——— rivicola.—With the last.

Pisidium amnicum.—River and Canal.

UNIONIDÆ.

Unio tumidus.—River and Canal.

U.— pictorum.—With the last.

Anodonta cygnea.—With the last two.

DREISSENIDÆ.

Dreissena polymorpha.—Common in the River and Canal.

PECTINIBRANCHIATA.

NERITIDÆ.

Neritina fluviatilis.—On stones below Bathampton Weir, river Avon.

PALUDINIDÆ.

Paludina vivipara.—River and Canal.

Bythinia tentaculata.—River Avon, Bathampton.

VALVATIDÆ.

Valvata piscinalis.—Wick Water.

PULMONOBRANCHIATA.

LIMNÆIDÆ.

Planorbis vortex.—In the Canal, where fresh water enters below Claverton.

Limnæa peregra.—Stagnant ponds, Lansdown.

Ancylus fluviatilis.—River at Bathampton.

LIMACIDÆ.

Arion ater.—Common in woods, &c.

A.— hortensis.—In gardens and yards, Bath.

Limax marginatus.—In gardens, Bath; under stones at Compton Dando, &c.

L.—— flavus.—Cellars in Bath.

L.—— agrestis.—Common in gardens and fields.

L.—— arborum.—On beech trees in most of the woods; also on trees in a garden at Batheaston.

L.——maximus.—Common in gardens and woods.

TESTACELLIDÆ.

Testacella haliotidea.—Said to be found in Tiley's Nursery Garden, but I have not seen it myself.—Bitton, *Rev. H. N. Ellacombe.*

HELICIDÆ.

Succinea putris.—Banks of the Canal and River.

S.——— elegans.—Springs, Langridge and other places.

Vitrina pellucida.—Moist banks, Claverton, Bathampton, &c.

Zonites cellarius.—Common everywhere in damp places in woods and gardens.

Zonites alliarius.—Bathampton Down, Claverton, and Swainswick.

Z.—— *nitidulus.*—Found in the same places as *Z. cellarius.*

Z.—— *purus.*—Wick Rocks, beneath stones and moss.

Z.—— *radiatulus.*—Under stones and in moss, Lansdown Woods, Swainswick, Warley Common, Combe-hay, &c.

Z.—— *crystallinus.*—Under stones and in moss; woods and other damp places.

Z.—— *fulvus.*—Woods round Lansdown; wet moss, and under decayed wood.

Helix aculeata.—Combwell, near Monkton Farleigh; Bathampton, under stones.

H.— *pomatia.*—This species has not hitherto been found nearer Bath than Cirencester, where it is common in the long grass and woods near old Roman Villas and Camps upon the Cotswold Hills. I have never seen it in the valley, but only in old quarries in the oolite and woods growing on that formation. It is often found nestled in the *Brachypodium pinnatum*, a common grass on the hills round Cheltenham, though it is said never to attack this grass, or to bite the leaves. As old Roman works are common about Bath, and the geological formation is of the same character as near Cheltenham, there seems no reason why the *Helix pomatia* should not be present here. When properly cooked, and the stomach removed from the body of the snail, they have much the flavour of veal.

H.— *aspersa.*—Common everywhere in gardens, &c.

H.— *nemoralis.*—Very common, varying much in colour, as also in the number and breadth of the bands; sometimes plain yellow, brown, pink, or white, without any bands.

Helix arbustorum.—Common on hedges in damp and shaded lanes; Lansdown, &c.

H.— cantiana.—Corston, Compton Dando, and Englishcombe.

H.— rufescens.—Walls, hedges, sides of paths, gardens, &c.; very common; both varieties.

H.— concinna.—Common under stones; Lansdown and other places.

H.— hispida.—Very common in moist woods, banks, &c.

H.— sericea.—Combehay woods; damp places, north side of Lansdown.

H.— virgata.—Common on the downs and higher lands. A pure white variety occurs at Swainswick.

H.— caperata.—Common on sheep pastures, and oolitic hills.

H.— ericetorum.—Lansdown, and higher grounds round Bath.

H.—rotundata.—Common under stones and decayed wood.

H.— rupestris.—Common in the crevices of old walls, on the higher grounds about Bath, as well as in Gloucestershire.

H.— pulchella.—Common under stones, &c.; both varieties.

H.— pygmæa.—Under stones, south side of Lansdown Hill above Weston.

H.— lapicida.—On walls and trees; Claverton and Lansdown.

Bulimus montanus.—Beech trees, Conkerwell; woods at Combehay and near Batheaston.

B.——— obscurus.—On trees, old wood, and walls. Lansdown and other places.

Pupa secale.—Old quarries and long grass; west end of Lansdown.

P.— umbilicata.—Old ivy walls; Lansdown, Claverton, Bathford, Beechen Cliff, &c.

Pupa marginata.—Old quarries; Shockerwick Hill and Lansdown.

Vertigo antevertigo.—Wet moss in swampy places; Lansdown.—*Rev. L. Jenyns.*

V.—— *pygmœa.*—Under stones, logs of wood, in moss, and at the roots of grass.

V.—— *edentula.*—Old quarries, West end of Lansdown and South side of Charmy Down; rare.

Balia perversa.—On elm and beech trees, woods about Lansdown.

Clausilia rugosa.—Old walls and trees, under decayed wood, Lansdown, &c.

C.——— *laminata.*—On trees and under decayed wood, Lansdown, Claverton, and Combehay.

Cochlicopa lubrica.—Bathampton, Lansdown, &c. Common in a variety of situations.

Achatina acicula.—Old quarries, west end of Lansdown, and crop of oolite rock on the north side of the same place.

CARYCHIIDÆ.

Carychium minimum.—Old leaves, decayed wood, and wet moss, damp places, Lansdown, &c.

CYCLOSTOMATIDÆ.

Cyclostoma elegans.—Woods round Bath, where the oolite rests upon the lias.

LECTURE

ON THE

CARBONIFEROUS STRATA of SOMERSETSHIRE,

BY

J. McMURTRIE, RADSTOCK.

(Read January 15th, 1868.)

In the present paper it is not my intention to define *generally* the geographical limits of the carboniferous system of Somersetshire, but rather to describe a section of strata I recently had occasion to construct for the purposes of the Royal Coal Commission, which may be regarded as a *typical* section of the southern portion of the Somersetshire and Gloucestershire Coal Basin.

The line of the section I have shown by a dotted line on the accompanying map.

It commences near the Priory at Chewton Mendip, passes through Farringdon, Paulton, Camerton, and Dunkerton, and terminates at Combe Down Church, near Bath.

It begins with the mountain limestone of the Mendip range, showing the eastern side of that anticlinal, crosses nearly at right angles the best proved and least disturbed portion of the coal basin, and it attempts to define the probable point at which the limestone will again emerge from beneath the coal measures on the eastern side of the basin.

The surface line is from an accurate levelling and survey

of the surface made by myself, the position of the veins has been ascertained by pits, borings, or by underground levellings; and as the section embodies the results of every exploration up to the present time, it is probably as near an approximation to the truth as can be made until the district has been more fully developed.

I purpose taking the strata in their descending order, and I would call your attention first of all to the

OVERLYING FORMATIONS.

These, strictly speaking, form no part of the subject of this paper, but it has been necessary for completeness to show them in the section, and I will, in passing, briefly notice them. The scale being too small to admit of more minute sub-division, I have adopted as nearly as possible the arrangement of Mr. Saunders's geological map.

Commencing at the eastern end of the section and proceeding westward, we find the leading divisions of secondary strata appearing at the surface in steadily descending order—at the top the Bath oolite, then the fuller's earth rock and fuller's earth, the inferior oolite, the lias, and lastly the new red sandstone, with its associated conglomerate. With regard to the upper four of these divisions there is nothing which, in a paper of this kind, need call for special remark; but in working out the thickness of the liassic strata for the purpose of this section, I was struck with the great increase in their thickness in proceeding eastward.

While at Paulton the total thickness of liassic strata is only 160 feet, at Dunkerton, where a boring was formerly put down, their thickness was proved to be 198 feet; and in the trial pit sunk at Batheaston many years ago (for particulars of which I am indebted to Mr. Moore), their thickness is said to have been 277 feet. Mr. Moore informs me that this increase in thickness is owing to the presence in the

eastern end of the section of the upper part of the lias, which is wanting at Paulton; but whether the increase is altogether due to this, or in part to the thickening of the other parts of the lias, I must leave to those who have paid more attention to the subject to decide. With respect to the new red sandstone and its conglomerate, there would also appear to be considerable variation in thickness. At Chewton the total thickness appears to be about 200 feet, all or nearly all of this being conglomerate. At Paulton the thickness has decreased to 138 feet, and the conglomerate is represented by a thin bed of 6 feet; but proceeding eastward to Dunkerton we find the thickness has again increased, the total being 291 feet, of which 63 feet is conglomerate. At Batheaston the division is only thinly represented, the total thickness being only 54 feet, and this is probably due to the same cause which led to so thin a deposit of new red sandstone on the Mendips, viz., the existence of the Batheaston limestones as a land area during a great part of the period. If we might judge of past conditions from the conglomerate, we would undoubtedly be led to the conclusion that Paulton and Camerton were comparatively deep under water during its deposition, and that the increased thickness westward towards Chewton, and eastwards towards Combe Down, is due to the limestone ranges of Chewton and Batheaston, which, if they did not exist as land, must have been low reefs of rock.

In reflecting on the variety of strata by which the Somersetshire coal-field is overlaid, we are inclined to look more hopefully on other districts, where the existence of coal is at present altogether unknown.

Had the Northern, Central, and Southern parts of the basin (which form only a small portion of the whole) been as completely covered up by secondary strata as are those of the East and West, we might now have been labouring under the delusion that no coal-field existed in the county, or that, if it

existed at all, it lay at enormous depth ; and this reflection induces the hope that under many parts of the country now believed to be barren, or in which coal is supposed to be hopelessly buried beneath more recent strata, it may yet be found at moderate depth.

THE COAL MEASURES.

Between the secondary formations, which we have hitherto been considering, and the carboniferous strata, to which I would now direct your attention, there are many points of striking contrast.

The former bear little evidence of disturbance, they occupy a nearly horizontal position, and they are all approximately conformable to each other. The latter, on the contrary, exhibit every possible mark of disturbance ; they generally lie at a high angle, and they are consequently not in conformity with the overlying rocks. A period of great denudation would appear to have succeeded the disturbances to which I have referred, for the irregularities have been washed off, and the new red sandstone has been deposited on a comparatively level surface.

In treating of a formation so extensive within the limits of so short a paper, it is obviously impossible to put before you detail sections ; and I shall therefore confine myself to those broader features which are likely to be of general interest.

The coal measures have been separated vertically into two great divisions, by the intervention of an immense mass of coal measure sandstone, well known in this and other districts as the Pennant rock. The upper division includes all the coal-bearing strata above the Pennant, the lower division takes in all the strata intervening between the Pennant rock and the Millstone grit.

The Upper Division embraces what are locally known as the first, or Radstock, and the second, or Farringdon, series.

These are separated from each other by from 550 to 750 feet of unproductive strata, near the middle of which there occur certain well-defined beds of red shale, from 130 to 250 feet in thickness, which form a well-marked line of separation between the two series. *The Radstock Series* consists in all of 8 veins, viz. :—

	ft.	in.
The Withy Mills Seam	1	4
Great Vein...	2	2
Top Little ditto	1	4
Middle ditto	2	2
Slyving ditto	2	4
Under Little ditto	1	2
Bull ditto	2	2
Nine inch ditto 9 inches to	1	0
Total ...	13	8

The total thickness is considerable, but in no case is the whole of this available in any one place.

The Withy Mills vein and the 9-inch vein are seldom found in a workable state, and the former is absent over the greater part of the district. The Great vein and Slyving vein maintain a tolerably uniform thickness, but they are (the former at Clutton, the latter at Tyning pit, Radstock) divided into two parts, several fathoms of strata occurring between. The Top Little vein and Under Little vein vary very little in any respect. The Middle vein and Bull vein are of good workable thickness in the Radstock neighbourhood, but northward, as at Camerton and Timsbury, they both thin out to a few inches, and become unworkable. The coal obtained from the series is exclusively used for household purposes.

The strata in which the veins of the upper series are contained consist of shales alternating with a kind of sandstone

locally termed "grays," the shales, however, predominating. The only exception to this is in the case of the strata separating the Top Little vein from the Middle vein, which is entirely made up of a hard gritty sandstone, strongly resembling the coarser descriptions of pennant.

The *Red Ground*, to which I have already referred, is a remarkable feature in the upper division. I am not aware whether these beds are known in the upper end of the basin, but they have been met with in every sinking from the first to the second series in the Radstock district, and they have become a universally recognised landmark. In texture they differ in no degree from ordinary shale, but they are distinguished by their colour from the strata both above and beneath them. They are as highly coloured as Hematite, which in some respects they rather resemble. They are strongly impregnated with iron, from which they no doubt derive their colouring matter; but they do not contain a sufficiently high per centage to be of any commercial value.

The Second Series, as proved at Farringdon pit, consists of six veins, omitting one or two of a few inches, which need not be taken into account. The following are their names and thicknesses:—

	ft.	in.
Cathead Vein, in 3 pieces ...	2	4
Top Seam, in 2 ditto	1	9
Peaw, or Peacock, in 3 ditto ...	1	2
Middle Seam, in 2 ditto	2	4
Church Close Seam, in 2 ditto ...	1	8
Seventeen inch Seam	1	5
Total	10	8

Of these only three or four are workable to profit. The veins of the second series do not appear to maintain their distinctive character over the district with the same persistency as those of the first series; indeed, so different are the sections at different parts of the basin, that it is extremely difficult, if not impossible, to co-relate the veins. Generally speaking, however, it consists of six veins, one or more of which are unworkable. The coal produced from it is best adapted for household use, but it is inferior in quality to that produced from the first series.

The strata of the second series consist, as in the upper one, of alternations of sandstone and shale, in which the latter, however, more decidedly predominates. Next in descending order comes the

PENNANT ROCK.

There are few points at which the pennant can be examined in the southern part of the coal-field, and until recently I had an impression that it occupied only a portion of the distance between the upper and lower divisions. But in Gloucestershire, where there are better opportunities of investigating the subject, it clearly forms the entire mass of the rock which separates the two divisions, and the few facts we do know of it in the southern part of the field seem to point to the same conclusion. At Grayfield Colliery, in the parish of Clutton, the Farringdon series rests directly upon the pennant, if its under vein may not be said to be in it; and in the parish of Downside the New Rock pit, before reaching the first vein of the lower division, passed through some 400 or 500 feet of a hard, gritty sandstone, which I believe can have been no other than the under part of the pennant. In the section exhibited I have shown the pennant immediately under the lowest of the Farringdon veins,

because, although not so proved, any intervening strata which exist must be of trifling thickness.

I have had some difficulty in arriving at the thickness of the pennant in constructing the present section. Buckland has estimated it at from 400 to 500 feet, and another writer puts it at 600 feet; but both seem to be far short of the truth. Even in the Gloucestershire end of the basin its thickness has been clearly ascertained to be not less than 1,840 feet, and every circumstance which has come to my knowledge seems to go to prove that in the southern or Somersetshire end of the field its thickness is much greater. In the vicinity of Pensford 2,000 yards of its outcrop may be seen, exhibiting an average inclination of 18 degrees, which is equal to a vertical depth of 1,880 feet; and even there the under part of it is covered by the overlying strata. At Temple Cloud its outcrop may be traced from Highbury Hill to a point nearly a mile to the west, the dip varying from 10 to 25 degrees, equal to a vertical depth of 1,700 feet; but here again we do not see the under part of it, as it is covered by the new red sandstone. At Holcombe church its outcrop is traceable for upwards of 1,000 yards, at an angle of 50 degrees, equal to a vertical thickness of 2,500 feet; but there also we only see part of it.

In deciding the depth for the purpose of this section, I have chiefly been guided by another section, which I have had occasion to construct across the parishes of Stratton and Midsomer Norton; which, by taking the lowest vein of the upper division and its inclination in connection with the upper vein of the under division and its inclination, has led me to the conclusion that the thickness cannot be less than 3,000 feet. This you must bear in mind is only an estimate, and a margin of 500 feet must be allowed either way for error; but it is the nearest approach I have been enabled to make to the truth.

Although the whole of this belongs to the pennant formation, there are, no doubt, occasional beds of shale, as well as thin veins of coal intermixed with the sandstones. Dr. Buckland mentions four veins as occurring above the Globe vein (which is the highest of the lower division), and these must have been in the pennant; but they have not been worked within the memory of man, and I apprehend they were of no great value. At Temple Cloud a shaft was sunk many years ago in the pennant, and a vein was met with, but it was not sufficiently profitable to induce the owners to continue working it; and this, I fear, is the general character of the veins contained in the formation.

The character and economic uses of the pennant sandstones being so well known in Bath and the neighbourhood, nothing need be said respecting them here, and we now pass on to the

LOWER DIVISION.

In treating of this I have been greatly assisted by a paper by "Buckland and Conybeare," published in the "Transactions of the Geological Society" for 1824. At the time Dr. Buckland visited the district, the coal mines of the lower division were more generally and extensively worked than they are now, and he was thus enabled to procure and place on record a great deal of valuable information, which would otherwise have been for ever lost. In compiling his paper, he seems to have consulted the best local authorities, and to this he has evidently added a great deal of personal research, so that in matters of fact his statements are generally correct.

He enumerates in all 37 veins as belonging to the lower part of the coal measures, but from this number must be deducted the four upper veins, which evidently belong to the pennant, leaving 33 as the number contained in the lower division.

This is a greater number than is now known in the district, and it is just possible that Dr. Buckland may have been led into the error of multiplying the number, from the same veins receiving different names at different collieries; but on the whole we may take his list as substantially correct.

He treats the division as a whole, but, like the upper division, it has been sub-divided into two distinct series of veins, known as the (third or) New Rock, and the (fourth or) Vobster series.

There is not so distinct a line of demarkation between the third and fourth series as between the two parts of the upper division, but there is quite sufficient distinction to justify the local classification.

The distinction lies rather in the character of the veins and in the nature of the strata between them than in the intervention of any unproductive stratum of rock. The veins of the New Rock series chiefly produce house coal, they are (like the veins of the upper division) free from fire-damp, and the strata intervening between them is a hard compact sandstone little removed from pennant. Those of the Vobster series, on the contrary, produce an iron-making coal of great purity; they are probably as fiery as any in England, and they are separated from each other for the most part by an exceedingly tender shale.

On the section I have dotted the probable line of separation between the two series, but as they merge gradually into each other, it is difficult to say precisely where the one begins and the other ends.

Of the 33 lower division veins enumerated by Dr. Buckland, about seven are either thin, bad, or irregular; so that the division may be said to consist of about 26 workable veins, of which 18 belong to the New Rock, and eight to the Vobster series.

The following is a list of those of the

NEW ROCK SERIES:—

	ft.	in.
Globe Vein	3	0
Small Coal ditto	3	0
Two Coal ditto	2	0
Warkey Course	5	0
Garden ditto	3	6
Strap Vein	2	6
Great Course	4	0
Fire Stone Vein	3	0
Little Course	1	6
Dungy Drift (2 feet to 5 feet) ...	2	0
Hard Coal	3	0
Perkin's Course	2	0
Foot Coal	2	0
Branch Vein	4	0
Golden Candlestick	2	6
North Shoots Vein	4	0
South Shoots Vein	3	0
Standing Coal	4	0
Total ...	54	0

From the hardness of the strata in which they have been deposited, they appear to have borne the disturbance to which they have been subjected better than the

VOBSTER SERIES,

Which exhibits every conceivable irregularity and distortion. The following is a list of its veins:—

	ft.	in.
Fern Rag	2	0
Stone Rag, 2ft. 6in. to 6ft.,—say ...	4	0

Main Coal with Shaley Coal, do.	8	0
Strap	3	0
Perrink	3	6
White Axen	3	0
Red ditto	3	0
Wilmot's Vein	1	6
Total ...	28	0

The next formation to which I would call your attention (and that very briefly) is the

MILLSTONE GRIT.

In the northern end of the basin its thickness has been estimated at 950 feet; but I am disposed to think that in the southern end of the coal-field it is much less. Mr. Saunders appears to have mapped its outcrop very carefully between Coleford and Nettlebridge, and taking the average of that outcrop in connection with the average of inclination, I arrive at the conclusion that it cannot exceed 500 feet. It would appear to be wanting altogether at one point in the neighbourhood of Ashwick, but that is exceptional; and in the absence of direct evidence, I have shown it in its legitimate position in the section from Chewton to Combe Down, taking the outcrop between Coleford and Nettlebridge as the safest guide to its thickness.

We now come to the lowest member of the carboniferous strata, viz.,

THE MOUNTAIN LIMESTONE,

With its accompanying shales. Much remains to be done in working out the individual beds of this formation in the southern part of the district, but I will at present only attempt to define its total thickness. I have been rather at a loss to account for the low estimates which at different

times have been put upon it. Phillips and Conybeare state it to be 600 feet, Buckland and Conybeare estimate it at from 1,500 to 2,100 feet, and in the "Memoirs of the Geological Survey" its thickness on the Avon near Bristol has been estimated at 2,340 feet; but as far as I am able to judge, its thickness on the Mendips opposite Mells and Vobster cannot be far short of 3,600 feet.

Briefly to *recapitulate*, we arrive at the following results :—

	ft.	ft.
Depth from New Red Sandstone to Great Vein of Upper Series under Clandown	1000	
Thickness of Strata containing the Upper Series	250	
Depth from Bottom Vein of Upper Series to Red Shale Beds	250	
Total thickness of Upper Series ...	——	1500
Thickness of Red Ground		150
Depth from Red Ground to First Vein of Farringdon Series	240	
Thickness of Strata containing the Farringdon Series	310	
Total thickness of Second Series ...	——	550
Total thickness of Upper Division		2200
Pennant Rock		3000
Thickness of Strata containing Third Series ...		1600
Thickness of Strata containing Fourth Series ...		1200
Total of True Coal Measures		8000
Add—Millstone Grit		500
Mountain Limestone and Shales		3600
Total Thickness of Carboniferous Strata of Somersetshire		12100

This estimate differs only in the thickness of the pennant from the estimate made at the Shepton Mallet meeting of the Somersetshire Society, recent explorations having proved it to be thinner than then stated.

So far we have considered the carboniferous system as it probably exists in the centre of the basin, where it attains its greatest vertical depth. I would now, in conclusion, say a few words as to the construction of the *section laterally*. With regard to the central portion of the section between Farringdon and the old Dunkerton Collieries, there is little room for doubt. It has been proved by pits sunk at regular distances between those two points; and that part of the section, therefore, embracing as it does nearly the whole of the upper division, may be taken as substantially correct. The eastern and western parts, however, being more uncertain, I have shown the strata in dotted lines, and it is necessary that I should explain the evidence on which that part of the section is founded. To begin with the western end, the only exploration to the west of Farringdon is a trial pit, which was sunk many years ago, in the village of Chewton. In this shaft, after passing through some 35 fathoms of conglomerate, a boring was put down for 180 feet in a hard stone, said to have been the mountain limestone. We have no further data until we reach the outcrop of the mountain limestone and old red sandstone, on the Mendip Hills.

In the absence of better information, I have taken the outcrop of the under part of the limestone, and extended that formation downwards at its estimated thickness and at the proper dip. I have then shown the millstone grit at its estimated thickness, and in this way I have arrived at the conclusion that the borehole cannot have been in the limestone, as asserted, but more probably in the millstone grit. In the section, the borehole is shown in the upper part of the grit, and this agrees with the statement of one of the sinkers,

who died a year ago, viz., that after passing through the conglomerate, and before getting to the hard stone already referred to, there were traces of true coal measure shale. So much with reference to the western end, about which there is a degree of uncertainty, but in the general features of which there is little room for error.

The eastern end is more problematical; but even here there are data from which fair inferences may be deduced. The points which have enabled me to fix the outcrop in the position shown on the section are the position of the limestone at Wick, the outcrop of the pennant at Newton St. Loe, the position of the veins of the lower division at Twerton Colliery, and, finally, the position of the mountain limestone between Buckland and Frome. Taking the line of strike at each of the points indicated, in connection with the outcrop line of the upper division, I have been enabled to determine the eastern part of the section with a fair amount of probability, if not of certainty.

Only one exploration has been made on the line of section to the eastward of the Dunkerton Collieries, viz., the boring on the Combehay estate, to which I have already referred; and this evidence, so far as it goes, tends to confirm the view I had arrived at from other data. The boring, after passing through the overlying strata, entered a hard coal measure sandstone, in which it was continued for 260 feet, proving nothing except the sandstone and two thin imperfect seams of coal. As the second series, at the nearest point at which it has been proved, contains no such body of sandstone, the natural inference is that the boring went down on the pennant rock, as represented in the section.

Although the coal measures here take the form of a basin, their present shape must not be mistaken for that of the basin in which they were originally deposited. The central part may possibly represent the original shape of the strata,

but with regard to its two extremities, every circumstance induces the belief that their steep inclination is the result of subsequent upheaval.

The question then arises, if the present boundaries of the basin are not the natural boundaries, what are the prospects west of the one and east of the other? In anticlinals it may generally be assumed that any veins or strata proved on one side of the ridge will be found repeated on the other; and the Mendip ridge being a true anticlinal—or series of anticlinals—it may naturally be expected that the under division of veins proved on its eastern side will ultimately be found on the west.

With regard to the eastern or Bath end of the section, however, the question arises, does the limestone there take the form of an anticlinal? I am inclined to think that it may, for between the point at Twerton beneath which the limestone must outcrop against the new red sandstone, and the trial shaft at Batheaston already referred to, where the mountain limestone was met with, a distance of three miles intervenes; and from the angle of inclination at Twerton the mountain limestone could not have been proved at Batheaston unless either a dip in the contrary direction had set in, or some enormous faults had intervened. If, then, an anticlinal does exist there, the inference is that coal may one day be found eastward of Batheaston.

Of the enormous quantity of coal existing in Somersetshire, it may be said that the greater part is beyond our reach; but against this I would urge that so useful a mineral as coal cannot have been placed at a depth *never* to be reached. Mining science may possibly in the end penetrate to the greatest depths at which coal exists, and it may ultimately be found that the gradually increasing depth of our coal-fields is one of the arrangements of Providence to prevent a valuable mineral from being wasted.

SUMMARY OF PROCEEDINGS

OF THE

BATH NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB

FOR THE YEAR 1867—68.

MR. PRESIDENT AND GENTLEMEN,

The printing and publishing during the past year of the first number of the Club's Proceedings is an event which calls for special remark. The preliminary difficulties which usually attend all efforts of this kind have been happily overcome, and it is hoped that the Members have been generally satisfied with the result. Were an additional proof needed of the continued vitality and prosperity of the Club, the Secretary calls attention to the fact that the limit of seventy-five Members has already been reached, and new candidates are waiting until vacancies occur for their admission.

Taking the events of the past year in the order of their importance, it is proposed to divide them under the headings of Evening Meetings, Excursions, and Weekly Walks.

EVENING MEETINGS.

On March 23rd, Mr. Charles Moore concluded the Evening Meetings of the last Session by some remarks on "The Geology of Bath and its Neighbourhood." The severity of the weather—the snow falling continuously, and the drifts being deep—prevented a large attendance of Members.

Owing to his time having been much occupied in preparing a paper for the Geological Society in London, Mr. Moore apologised for his inability on the present occasion to give a detailed description of the geology of the immediate neighbourhood (this he promised to give at some future time); his present remarks would be restricted to the physical geology of the Mendip Hills, and their former continuation into South Wales. These hills formed a very important feature in, and had influenced the geology of, a very wide tract of country. The whole of Somerset, even a large portion of the district across the Channel, to say nothing of the physical features of the district around Bath, had been more or less affected by the great disturbing force which had caused their present form and elevation. Proceeding to describe their structure, Mr. Moore said that the "backbone" of the Mendips, corresponding to what is now called the "Ridgeway," consisted of old red sandstone, and extended from Shepton Mallet on the east to Whatley on the west. Against this "saddle back" rested the Carboniferous Limestone at a great angle, in some places almost vertical, and to this latter formation succeeded the Coal Measures, at the same angle, with numerous "faults" running through them; the New Red Sandstone, the Rhœtic and Liassic beds, having been successively deposited horizontally upon the upturned edges of the Limestone. The mighty agent which had been the cause of this disturbance, uplifting these formations some 20,000 feet, and in one place upheaving and doubling back the Coal Measures upon themselves, so that the coal is worked beneath the Carboniferous Limestone, Mr. Moore had the pleasure of discovering and pointing out to the Members of the Club during one of their late Excursions. In a field near Stoke Lane, a volcanic dyke crops up, and can be traced immediately beneath the turf in several localities; to this he attributed the disturbances and dis-

locations in the neighbouring strata. The period at which it occurred was approximately given as between the deposit of the Coal Measures and that of the succeeding New Red Sandstone and other rocks which show no signs of such disturbance. The great diminution in thickness of the Secondary Deposits to the north of the Mendip range, compared with the same Deposits to the south, may be accounted for by the Mendips having formed a Carboniferous Island in the midst of the ancient seas, thus making a barrier to the irruption of the secondary seas, so that the formation of a deep sea deposit within this barrier to the north was prevented. Various sections in ascending order from the Keuper to the Lias were described, and the wonderful dykes and fissures running generally east and west in the Carboniferous Limestone in the Hotwell and Vallis quarries were dwelt upon. The peculiar features of these dykes having puzzled even the *savans* of the British Association during their visit in 1864, allowance may be justly made for the surprise with which the Members present this evening heard that the painstaking researches of the speaker had revealed to him at the bottom of one of these Limestone fissures (270 feet below the surface) not only a Liassic sea fauna of 95 species, but also three genera* of terrestrial shells of the same age. The conclusion naturally arrived at from this extraordinary discovery was that the portion of the Mendips in which this fissure existed was a land area during the Liassic period. In conclusion, Mr. Moore paid a fitting compliment to the President of the Club, a fellow-labourer in the field of science, by asking permission to name after him a new species of gasteropod (*Fusus Jenynsii*) which he had found in the Southerndown and Brocastle beds, a short description of which was given in the course of the evening, and specimens in illustration of the remarks were exhibited.

* *i.e.*, "Vertigo, Proserpina, and Helix."

The first Evening Meeting of the present season was held on December 18th, when Mr Earle, the Rector of Swainswick, gave the result of his researches on "The Early History of Bath and its Neighbourhood." There was a good attendance, and Mr. Earle's original remarks elicited an animated discussion amongst the Members. Mr. Irvine exhibited, in illustration, some valuable pencil sketches of objects of antiquarian interest in the city and neighbourhood; amongst these, the houses of the old yeomen, which had nearly all passed away, and in examples of which the Batheaston valley was so rich, were especially worthy of notice. Mr. Earle's Lecture, together with a translation of one of the British legends, describing the battle between Arthur and Childric, which, in his opinion, took place on Solsbury Hill and Hampton Downs, will be published in the forthcoming number of the Proceedings.

The Second Evening was divided between Dr. Bird and Mr. McMurtrie. The former presented the Members with a list of shells collected by himself in the Bath district during the year 1867, specimens of which were exhibited. The enumeration of the various shells found within a range of ten miles round Bath was enlivened by a description of their construction, habits, and haunts, and the important place which they filled in the economy of nature. The *Helix cantiana*, originally supposed to be restricted to Kent, was abundant in this neighbourhood. The *Helix virgata*, too, played a more important part than was generally supposed, the flavour of the Lansdown mutton being attributed to the sheep feeding on this small shell, which abounded in the short grass of the Downs. Dr. Bird thought that all the *Helices* were edible. After the Lecture the President made remarks on some of the species. The *Helix pomatia*, often supposed to have been introduced into this country--either by the Romans or at some later period—he stated was now

considered by the best English conchologists as a true native, being found in many different localities where the chalk or oolite prevailed, though not hitherto met with in the immediate neighbourhood of Bath. The πωμα, or lid, which gives this species its name, was said not to be an *opercle*, properly so called, having no organic connection with the animal, but being merely a calcareous covering, secreted by the mantle at the approach of winter, in order to close the aperture of the shell against cold and wet, and cast off on the return of spring : beneath this calcareous lid might be found two or more other membranous coverings, easily separable, occupying lower and lower positions in the cavity of the mouth as the animal retreated further into the interior. This snail, like some other *helices*, retains its vitality for a long time if kept shut up in a dry place, and may often be revived after lying dormant for a whole year or more.

The *Dreissena polymorpha*, said to have been imported with timber from the Baltic in 1824, but like the *Helix pomatia*, probably indigenous, was mentioned as occurring in great quantities in the locks of the canal at Bath, where it had been seen on one occasion, when the water had been drawn off for the purpose of repairs, so thickly coating the sides of the lock as scarcely to leave any unoccupied space.

The President, after making remarks on some species of mollusca which, though outwardly very similar in the form of the shell, differ much in the structure and habits of the animal—as also on other species, in which the shell itself varies greatly, according to age and the peculiar conditions of the locality in which it is found—cautioned geologists as to how they established new species in their palæontological researches, in which they had nothing but the shell to guide them, and the characters of the same often ill-defined from the ages elapsed since being tenanted by its inhabitant.

Mr. McMurtrie concluded the Evening Meeting with a paper on the "Carboniferous Strata of Somersetshire," accompanied with the exhibition of an elaborate plan of the coal-pits in the neighbourhood. The chief feature of this paper—which together with Dr. Bird's list of shells will be published in the forthcoming number of the Proceedings—was the probability of coal extending under Bath, though at a great depth, and the possibility of its being found some day to the eastward of Batheaston. Mr. McMurtrie suggested also that the gradually increasing depth of our coal-fields might be one of the arrangements of Providence, whereby the waste of so valuable a mineral was prevented; and that science may eventually overcome the difficulty at present experienced in working the coal-beds at a great depth, as it had triumphed already over so many other obstacles which formerly were considered insuperable.

EXCURSIONS.

The 2nd of May shone brightly upon the Members for their First Excursion, and there was a large muster at the Railway Station in the morning for Uffington and the "Seven Barrows." It will be remembered that during the Excursion in 1865 to the same neighbourhood, Mr. Wasbrough, of Wantage,—who on that occasion so kindly conducted the Club to Uffington Camp, the White Horse, &c.,—suggested that a visit should be paid another year to the "Seven Barrows;" it was, therefore, owing to this gentleman's courteously renewed invitation, that one of the Excursions was fixed in that direction for this year. Breaks were in readiness at the Uffington Station, and conveyed the party across the Berkshire Downs by the most primitive British trackways a distance of six miles to the farmhouse of Mr. Dawson, the Duke of Newcastle's trainer. Here, most unexpectedly, our kind host Mr. Wasbrough had provided a very

hospitable luncheon, which, owing to the exhilarating air of the Downs, was most thoroughly appreciated. After luncheon, under the guidance of a neighbouring farmer, the numerous Barrows in the vicinity were inspected. Twelve or fifteen at least of various shapes and sizes were counted; some were double, others merely distinguished by a slight elevation above the surface. One or two appeared to have been opened; and according to an account given by Mr. Atkins, of Kingston Lisle, excavations were made some 27 years since, and several skeletons in a sitting or doubled up position with the usual accompaniments of flint arrow-heads found. The leather or bronze boss of a shield found in one is now deposited in the British Museum. A careful and scientific exploration of these Barrows would well repay the antiquary, as but little appears hitherto to be known of their history or contents. A cross country traverse was made to Wayland Smith's Cave, and a short halt called to hear the Vice-President's (Mr. Scarth's) account of Barrows in general and this chambered tumulus in particular, which he compared with those he had seen in Brittany and also with that at Stoney Littleton, near Wellow. The story of Wayland Smith and his forge—made so memorable by our great novelist and historian, Sir Walter Scott—was, in Mr. Scarth's opinion, founded upon the old legend of Vulcan, the God of Blacksmiths; Sir Walter Scott's blacksmith being none other than the Vulcan of northern mythology. A hurried glance at the "White Horse," in passing to the Uffington Station, revealed the fact that a rescouring was sadly needed. It may be satisfactory to learn that the Vicar of Uffington, who accompanied the Members in the latter part of the Excursion, memorialised Lord Craven on the subject. An appeal has been drawn up, signed by the Vicar, the President, Vice-President, and Secretary of the Club, representing the present condition of the "White Horse" and the propriety of keeping it scoured, recommend-

ing also that the operation should be made conducive to the improvement as well as the pleasure of the villagers; and thus this visit of the Club will not be without a beneficial effect.

The Second Excursion, which had been fixed for May 21st to Wroxeter, was, owing to the Vice-President's suggestion, at a Special Meeting called for that purpose, unanimously postponed and a joint Excursion with the Members of the Cotteswold Club on 22nd, to Chedworth, in the neighbourhood of Cirencester, agreed upon. On the arrival by train at the latter town, three breaks full of learned—or at any rate inquiring—brethren, with a supplementary one-horse carriage, started from the King's Head for "Foss Bridge," a pleasant hostelry in a pretty combe about two miles distant from the object of the day's Excursion. Nothing to call for any remark occurred on the road. One halt was made at a wayside quarry, where hammers and eyes were busily at work to ascertain the character of the beds exposed. "Great Oolite with a capping of Forest Marble" was the dictum of the chief. The carriages were once more filled, and proceeded along the ancient Foss Road, which once extended from Devonshire to Lincolnshire, over a rolling country of hill and combe. The cutting north-east wind that blew across the elevated table-land suggested anything but the genial month of May, and the party were not sorry to find themselves at last beneath the friendly shelter of the Chedworth woods—last haunt in these parts of the badger and the raven—the delight also in the present day of the naturalist, for here grow many rare plants, and over their 1,200 acres roams freely the *Helix pomatia*, fat and fleshy as ever, though the noble Roman whose table it graced has left only his ruins behind him. These remains, however, are such as rarely greet the eye of the antiquary in England. Lately, in one of the most picturesque of spots, has been uncovered, through the liberality of Lord Eldon,

a Roman Villa and parts of a Temple. A considerable portion of the Villa remains, the side walls being some eight or ten feet high, and good taste has in every case protected the remains when uncovered. The peculiar feature in this Villa may be said to arise from the very perfect state of the system of baths, the tesselated pavements, of most graceful patterns, being nearly perfect.*

In one of the principal rooms, which had the greatest portion of the pavement perfect, the Rev. S. Lysons, F.S.A., read a paper on the "Antiquities of the District;" from which it appearedthat the first intimation of the existence of any antiquities here was due to a keeper pulling out some tesseræ, whilst in search of an "earthed" rabbit. To this trivial occurrence is to be attributed the recovery of a missing link in early history. Tradition, the learned antiquary stated, had asserted that Arviragus, an ancient British King of the Dobuni, had embraced Christianity; if Corinium (hodie Cirencester) was, as is supposed, his capital, what more natural than that royalty should leave its mark behind? This, as recorded, has been done in a neighbouring combe, for bricks have been there found with the legend "Arveri" upon them, and on the foundation stone of the principal entrance to this Villa, the X. R., the ancient Christian monogram, was incised. May not the word "Arveri" (said Mr. Lysons) be the name of Arvira(gus); may not the Christian emblem corroborate the legend of his conversion? With such happy suggestions and inferences, the learned gentleman carried away the thoughts of his hearers, until a summons to lunch provided by the hospitality of Lord Eldon, suggested more practical views. During the few minutes allowed, the attention of most was diverted to the tesselated pavement beneath their feet, which

* For particulars of this Villa, see an account given of the excavation of it, by James Farrer, Esq., in the "Proceedings of the Soc. of Antiq. of Scotland," Vol. vi., part ii., p. 278.

consisted of very graceful patterns, surrounding figures of the four seasons—Spring, Summer, Autumn, and Winter—with a couple represented in the various phases of the dance most gracefully and artistically delineated. This room contained the various objects which had been found during the excavations, consisting amongst other things of a pair of iron shears, various articles in iron, horns of the red deer of very large proportion, &c., &c. The hearty thanks of the Members having been returned to Lord Eldon for his courteous hospitality, Mr. Lysons then conducted them through the rooms and baths; one room with an apsidal termination was of peculiar interest. A cistern of octagonal shape, containing water, is situated in the centre, in the right hand corner was found an altar, and over it three niches; could this then be an ancient Baptistry? The missing link would indeed be found. But could it not also be the tank with its perennial spring whence flowed the waters which supplied the baths below? It might be. The place for drying corn, the nether millstone, and the bakery were all pointed out. A tumulus with a stone cist lately opened and the remains of two Temples were visited, and a rapid march back from this most interesting place was made to the Inn at Foss Bridge. Here antiquary, geologist, and botanist met together for dinner and papers afterwards, under the presidency of Sir W. Guise, Bart, and record must be made that a dish of cooked Roman snails gathered in the woods were served and tasted by more than one. The conclusion, however, arrived at was that the art of cooking them had been lost. A paper by Edwin Witchell, Esq., F.G.S., on "The Denudation of the Cotteswolds," was most appropriate in the midst of a heavy snowstorm which was then actually setting to work those very agencies to which this gentleman attributed the hollowing out of the ravines and combes. The Members after this dispersed, highly gratified with their Excursion.

A few of the Members slept at the King's Head, Cirencester, and spent the following day in visiting the fine old parish church, now under restoration by Mr. G. G. Scott, the Roman pavement in Lord Bathurst's park, and the museum so rich in remains of the Roman period, especially in objects of iron, *e.g.*, sacrificial knives, a steelyard, &c. ; the so called "Bull ring," an ancient Roman amphitheatre,* and the remains of the old walls were inspected before leaving the ancient Corinium.

The Third Excursion was made on 25th of June, to the Salisbury Museum, Old Sarum, and Stonehenge. Twenty Members with their friends availed themselves of the facilities offered by the Great Western Railway for excursion parties, and left Bath by an early train. The principal point of attraction in Salisbury, to those already acquainted with the elegant architectural proportions of its Cathedral with its almost unrivalled spire, is the museum founded by Mr. William Blackmore, in 1864, and already containing a collection of remains of the stone age, one of the best and most extensive in England. Many thousand specimens of stone implements of all kinds, and from all quarters, are here admirably arranged in historical sequence, and the inquirer—who visits the series, not for the purpose of scoffing, but with the higher aim of learning how many things there are in the world of which he little dreams, and of confessing his ignorance touching the ancient inhabitants of the earth—is gradually led on from case to case, from the archæolithic to the neolithic periods, from the remains of the early dwellers in the caves, the flint implements from the drifts of England and France, to the objects from Pfalbauten of Switzerland, the more recent flint flakes and chips, down to the very similar obsidian weapons of the Mexicans, in use at the present day. Nay, more—for the purpose of illustration—the forgeries of "Flint Jack" are well represented,

* For a drawing of this and description, see Prof. Buckman's "Remains of Roman Art at Corinium," p. 12.

chiefly discernible from the genuine article by the clumsiness of the imitation. The Members were not permitted to wander through the museum without guidance. Dr. Blackmore and Mr. Edward F. Stevens, the curators, very kindly gave all the information that was required, the latter especially being indefatigable in his exertions to describe the contents of the cases. Two hours were most profitably spent here, and all left with a certain sense of oppression at the immense mass of information which was most mercilessly hurled at their heads by their courteous and enthusiastic cicerone, and more than one came away with the suspicion that civilisation has been hitherto attributed to the wrong end of the human chain. Were these the weapons and tools of barbarians, or of a race as civilised, according to their opportunities, as we are, if not more so?

It only remains to be added that the Blackmore Museum was opened to the Members by special permission, the public not being as yet admitted until the whole collection is entirely finished. Constant additions are still being made, and in a few months an opportunity will be afforded of seeing one of the most perfect collections of this kind in Europe. Carriages were taken from the museum for Old Sarum, Lake House, and Stonehenge; the former is familiar to most. The immense size of its earthworks appears to grow with every visit rather than diminish. The mind, however, seems satisfied with the feeling that it knows all about this structure. History speaks plainly here, and facts, not traditional myths, give a certain sound; and so the Members pass on, over, and through the works. Lake House, which was courteously opened for the occasion, caused a short delay. The proprietor, the Rev. E. Duke, displayed in his hall the various curiosities which had been collected from the adjacent tumuli, amongst which as the most interesting may be mentioned an ornament for the neck, or more probably the waist,

of very fine elongated diamond-shaped amber plates, considered unique; and a rare example of an ancient British mould for casting bronze celts, made of syenite. A short ride over the Normanton down, in and out amongst the tumuli, brought the party within sight of Stonehenge; dwarfed, as it appeared, in size by the vast expanse of downland which stretches far away on either hand, some little time was required to appreciate the grandeur of its dimensions. Theory upon theory of its age, form, and the object of its erection was propounded by various Members; but perhaps the most original was that brought forward by the so-called custodian, a Mr. Brown, viz., that it was erected by the Antediluvians, and that its partial overthrow was effected by the "flood" which came from the south-west. The principal and most important fact was that communicated by Mr. Stevens, who accompanied the Members from Salisbury, viz., that the letters "L. V." enclosed in a kind of double sickle, which caused such a learned discussion at the recent visit of the British Association, as to their Roman or Phœnician character, are now *known* to have been cut by a mason, and are of a recent date.

After sufficient time had been allowed, the Members separated, some with their friends remaining for the sunrise on the morrow, the rest returning to Wiley and Salisbury. A lunch had been provided both at the Blackmore Museum and Lake House by the hospitality of Dr. Blackmore and Mr. Duke, which mark of attention was duly appreciated. Those who remained for the sunrise, slept at the George Inn at Amesbury, and the quiet little village must have been somewhat disturbed in its first sleep as four enthusiastic antiquaries passed through it between two and three a.m., bent on the important errand of ascertaining whether the sun did actually rise over the "Friar's Heel" at the summer solstice. With admirable patience, as the long looked for moment arrived,

one stationed himself at the outer circle, the others at the "altar stone," and with note-book and compass in hand awaited with an ardour, perhaps a little chilled by the heavy dew, the first indication of its rising; just as hopes were beginning to fail and the minutes dragged wearily along, an exclamation of surprise burst forth from all as the sun gradually rose, a globe of fire, immediately behind the "Friar's Heel," and no sooner had its first beams touched the top of the gnomon than they fell right athwart the "altar stone,"—a glorious and long to be remembered sight! The inclination of the sun slightly to the south of the stone, was just what might have been expected after the lapse of the few days since the summer solstice. The modern sun-worshippers left gratified but awed at the grandeur of the surrounding scene, which words fail to describe, and having ascertained an undoubted fact, leave it to others to build thereon their theories.

The Fourth and last Excursion, fixed for October 15th, to Camel and Cadbury Camp, was, with the sanction of the Members who intended to join, postponed owing to the extremely unfavourable and wet weather which then prevailed.

The Tuesday Walks have been carried on with more or less vigour throughout the year, and many pleasant associations are connected with them. Amongst the most important places visited the following may be enumerated :—Shockerwick House and Ditteridge Church; the former, lately the residence of Mr. Wiltshire, contains some good pictures by Gainsborough, his friend. Many of the scenes of his best pictures are principally taken from the immediate neighbourhood, *e.g.*, the celebrated picture of the "Harvest Waggon," into which he introduced his friend's daughter and a grey pony, the latter a present from Mr. Wiltshire, and the frequent

companion of his sketching rambles. Corsham and Castle Combe; the Almshouse in the former village, built by the Hungerfords, contains many things worthy of remark. In the chapel (with its music gallery attached) is a black letter Bible, date 1617, and a copy of the original foundation deed, with many quaint rules and regulations for the six aged women who enjoy the benefits of the charity, and need not necessarily have been residents of Corsham. The coat of arms over the doorway shows a marriage of the Hungerfords with the Hallidays. The Church, with its central tower on Norman piers and arches, is a strange mixture of various styles, Norman, Early English, Perpendicular, and "Churchwarden Gothic" predominating. The south porch has a Parvise; the north doorway is a good specimen of Norman zig-zag, and some portions of a wooden screen remain. The Consistory Court was formerly held here, and has only lately been removed, the Vicar having still in his possession the ancient seal. The altar tombs of the Trepenell family, the supposed builders of Great Chalfield Manor House, during the reign of Henry V., are in the North Chapel, which is surmounted by a curious pinnacle at the eastern apex, and several quaint Latin and English inscriptions are on the north wall of the chancel and on the floor before the altar steps The well-known picture gallery at Corsham Court, principally the collection of Sir Paul Methuen, ambassador to Portugal, and author of the "Methuen Treaty," was next visited, and some time spent amongst the gems of ancient and modern masters which adorn the walls.

Some of the Members afterwards walked on to Castle Combe, where the Rector, Mr. Christie, kindly gave every facility for the inspection of the House, with its picturesque grounds, and the Church.

On Tuesday, June 11th, fourteen Members formed an Excursion to Witham, and from thence to Alfred's

Tower and Stourhead. They went by rail to Witham, where the Church with its Norman walls and windows, which have been restored within the last ten or fifteen years, was examined. This was the site of the ancient Priory, over which Hugh Grostête (afterwards Bishop of Lincoln) presided. No remains of the ancient Priory now exist.

From Witham the Members walked direct for Alfred's Tower, through lanes and field paths. The day was particularly fine. Alfred's Tower forms the boundary of the grounds at Stourhead, and is a triangular building erected by Sir R. C. Hoare the antiquary. An inscription upon the front face states that it was at that point Alfred the Great raised his standard, A.D. 876, against the Danes, and became the founder of English liberty. It is stated also that to him we owe the English Trial by Jury, and that he organised the militia, and also the naval service. Walking from Alfred's Tower the Members passed an ancient mediæval cross, set up at one of the sources of the river Stour, and said to have been brought from Bristol. There is another cross also standing in the grounds at Stourhead, not far from the Church, which was brought from Bristol, and stood there in the College Green. This latter contains figures of Edward IV., John, and other sovereigns, and a tier of more recent sovereigns of England—as Elizabeth, James I., and others.

The house contains some good paintings, especially that of the raising of the widow's son by Elijah. There is also one of Gainsborough's paintings worthy of remark. Ample time was given to examine the very interesting library of Sir R. C. Hoare, which has been carefully catalogued, and the catalogue printed and placed in different libraries. The Literary and Scientific Institution possesses a copy. This is not generally the case with private libraries in England, and Professor Hubner observes in his report of the Museums of England,

to the Academy of Berlin, that it is much to be wished that such catalogues as that at Stourhead always existed, as the valuable works shut up in private libraries in England would then be known.

The Members visited the Museum of Antiquities in another part of the building. This appeared not well attended to, one of the cases had been forced open, in another the glass was broken; and the rare and curious objects which had been obtained from the Barrows of Wilts, some of which are of gold and others very rare, are thus insufficiently protected. These objects are happily engraved in Hoare's "Ancient Wilts." The collection is full of ancient urns, the more curious and rare are put under cases. These have also been imitated in modern pottery, and the imitations are placed on the floor of the Museum.

The hall contains some Roman Funereal marble Cippi, which have been brought from abroad. They are of the heathen period. Two inscriptions were copied:—

1.

ORPHEV . OSSA . TVA
BENE . QVIESCVNT.

2.

D . M . S
C . VOCONIO
AVXETICO
QVI . VIX . ANN .
XIV . M . V . D . XX .
VIII. F . PAREN
TES . FIL . DVLC.

These were small, and had contained burnt bones. A large full-sized marble sarcophagus has lately been found near London, at Clapton, which is the first marble one discovered in England, it contains a medallion on the front, which is fluted; the medallion is not decipherable, except the last word, which seems to be "MARITIMIVS." A marble sarcophagus is mentioned by Bede as being found at Granchester, near Cambridge, and used for the interment of a Saxon Abbess.

In the grounds at Stourhead is a temple designed after the plan of the Pantheon at Rome, in which is a fine marble statue of *Livia Augusta;* she bears wheat ears in her right hand, and in the left a patera. This is original, and was brought from Italy. The remaining statues are copies, viz., "Diana," "Flora," "Hercules," "Faunus," "Meleager," and "Isis."

The head woodman, a very intelligent man, showed the Members an ancient spear-head found at Hanley Wood, near Bruton, in 1867. Length, 8½ in.; breadth, 1¾ in. Also a Roman horse-shoe found at the Pen Pitts, and a natural war hatchet, formed by the root of a beech tree, spreading itself over a portion of Split Basaltic rock so as completely to embed it, and thus became a formidable weapon. It was found by him inside the bed of the river Tweed, near Kelso.

Sketches were taken of the spear-head and horse-shoe by a Member of the Club.

Another day, Bowood and Laycock Abbey were visited. Arrived at Calne, the Members made several fruitless attempts to reach the former place by a short cross-country route, and eventually arrived by the principal entrance from Calne. Owing to the absence, however, of the Dowager Marchioness, a view of the interior and the pictures was not permitted, the gardens and pleasure grounds, with the American Arboretum, being alone on view. From Bowood

to Laycock Abbey another cross-country traverse was made. The Church, with its monuments to the former proprietors of the Abbey, the Sherringtons and Talbots, having been inspected, the son of the present proprietor most courteously received the Members, and escorted them over the old building, and through the cloisters, pointing out the objects of interest, amongst them the Nuns' so-called cooking saucepan.

The expedition to Longleat on Oct. 9th, will long be remembered as one undertaken under great difficulties. The pedestrian part of it from Warminster to Frome, by Sheerwater and "Heaven's Gate," being made in one continuous heavy down-pour.

The house and pictures were seen under great disadvantage; but the rain which so much interfered with the celebrated views from the park and grounds, failed to damp the spirits of the party as they joined the evening train at Frome, after a walk of ten miles, under circumstances somewhat calculated to subdue the ardour of any but the Members of the Bath Field Club.

Hanswell House, the *ædes solitaria* of Lansdown as not inappropriately named by one of the Members; the Rocks; Englishcombe; Westwood Church, with its well-proportioned tower and canopies, ogee turret staircase, and fine old glass in east window, representing the "Tree of Life, whose leaves were for the healing of the nations;" Twerton Church, &c., have, amongst other neighbouring places and Churches, been the objects of a walk, and the ancient British way along which King Arthur and his men came in the battle between him and Childric satisfactorily traced, under the guidance of Mr. Earle.

Numerous other walks have been taken weekly throughout the year for the investigation of some object of antiquarian or geological interest. The Secretary, however, takes this

opportunity of suggesting that a more frequent use of pencil and note-book by the Members during their walks, would supply more abundant materials for the Club chronicles, and tend to advance the object for which the Club was instituted.

H. H. WINWOOD,

Hon. Sec.

ADDRESS

OF THE

PRESIDENT, after the ANNIVERSARY DINNER, on FEBRUARY 18th, 1868.

GENTLEMEN,—

I propose doing what I did at our last anniversary dinner, if it meets your pleasure, that is, reading you a short address, which will not detain you many minutes, wherein I would speak to you of the affairs of our Club, and what seems connected with it, which I could not trust myself to do with any precision or distinctness, unless the same were written down. A social gathering like the present seems a fit time for drawing the attention of the Members to anything which, it seems to me, they might do in furtherance of the interests of those branches of science which we profess to cultivate; as also it is a good occasion for eliciting hints and suggestions on the same subjects from those who listen to me, after they have been led in this way to give their consideration to it.

I would first observe that we have reason, I think, to be satisfied, on the whole, with the present position of our Club, however fairly we may expect more from it hereafter. It is a matter, indeed, for congratulation that we are still a living body, and that we continue to show signs of activity; for not all these Clubs have succeeded—some have died a natural death within a very few years after their birth.

Two such instances have come to my knowledge—one that of a Naturalists' Society at Ely, some account of which was sent me by the Secretary about a year ago; the other that of a Field Club at Cambridge, formed by Professor Babington, which did good work for one or two seasons, but which he could not keep longer together, though consisting of members of a University where science is well cared for and encouraged,—it languished and came to nothing.

It is a noticeable fact, mentioned in an article on Field Clubs, published in the last October number of the "Journal of Science," that though these Clubs are so numerous at the present day, by far the greater number of them lie to the West. It was remarked that their geographical distribution in the country would almost be as curious a subject for inquiry as that of our native animals and plants. The writer mentions no less than fifteen "in a belt extending from Lancashire, along the western side of England to the South coast," while comparatively few exist in other parts. To what cause this is to be attributed it is not easy to say. It can hardly be that the Western counties open out a richer field for the Naturalist than the Eastern, for I conceive it rather the reverse; the Eastern, according to my experience, so far as Botany and Zoology are concerned, being richer than the Western. Few tracts in England perhaps yield a more abundant harvest to the collector—as well in respect of the number of species, as of the number of rare species—than the fen districts of Cambridgeshire and the adjoining counties, and the woods of Kent. There is no doubt a great difference, speaking generally, in the scenery of the East and West, and this may have its influence in bringing these Clubs together; the Western counties, with their alternations of hill and valley, and other striking landscape features—offering attractions to a walking party such as seldom present themselves in the East, while at the same time they reveal to the

Geologist a greater variety of rocks and beds, with their respective stores of fossils, than the flat secondary strata which prevail eastwards.

But however this may be, let the fact stand out before us as an encouragement, to make the most of any advantages we possess here at Bath in this respect, as well as to endeavour to retain possession of the place we occupy in the history and statistics of Field Clubs.

There are one or two circumstances, I think, which may be mentioned as affording some evidence of our Club being alive and vigorous, and, to a certain extent, carrying out the objects for which it was instituted. I do not judge of its healthiness from the mere number of its Members, for this is an uncertain criterion—men joining it from very various motives; but when we look back upon the many years during which the Club was content to take its weekly walks, without producing anything in the way of results to lead the public to think that we were a working body, and compare with the present state of things, we see much advancement. We have not only for two seasons previous to the present one had our winter Evening Meetings for lectures, papers, and discussion on scientific subjects, but last year we were able to lay before the public the first number of our Proceedings in a printed form; by which I should hope that those who do not join us either in the field or in our home gatherings have been satisfied of our good intentions, and our desire, at least, to do what we can for the advancement of the Natural Sciences in this city, and especially towards gaining a better knowledge of the Natural History and Antiquities of the Bath District.

One good thing which has arisen, if I am not mistaken, out of the weekly Excursions of our Club, is the circumstance of similar walks being now taken for exploring the neighbourhood, during the Summer months, by the Members of the "Widcombe Working Men's Mutual Improvement Asso-

ciation."—Last Summer, walks were taken by this body regularly on Saturday Evenings, under the direction of one of our own Members ; and I consider it a great point gained that working men should have been initiated in such a practice, —that in this way a taste should have been created for the same pursuits as our own, pursuits so conducive to a healthy state of the mind as well as the body,—and which by supplying agreeable occupation, as well as by opening out sources of self-improvement, help to fill up profitably the leisure hours of a working man's life, and thereby add to his happiness.

It was stated in a paragraph in one of the Bath papers last autumn, in which were mentioned some of the places visited by the Widcombe Club, that the object of their walking excursions was—"to visit the places of natural and historical interest, as well as to become acquainted with the wild flowers and plants of the neighbourhood."

I was glad to read this last sentence, for it is to such Clubs that we may look for the addition of many rare specimens to our Museums, which are more likely to be hunted out when numbers are put upon the search, than by single observers. And this seems not an unfit occasion to say a word in reference to the local Museum, which we are at this present time endeavouring to get together at the Literary and Scientific Institution, and the help which our Club may give in the matter. The circumstance may not be known to all our Members that two ladies in Bath, a short time back, made a munificent donation to the above Institution for the purpose of starting a Museum of this character. I have before expressed my belief (in a lecture read to the Club in 1865, on Museums in general, and since printed and circulated among the Members) that local collections are of far more interest and value in provincial towns, as well to the inhabitants of the place as to strangers visiting it, than any

collections of a more general nature, which, from the very circumstance of their being general, can only be most imperfect and fragmentary. Intended as such general collections are to embrace all things, the few things for which space can be found in a building of very limited extent have little or no connection with each other.

Too often specimens are mixed together of all kinds and sorts, and from all countries, odds and ends (if I may use the expression) got, as it may be, by chance, or gift, or purchase; which are neither arranged, nor indeed are capable of any such arrangement as can assist the student or instruct the general public.

I will not repeat all I then said; but apprehending there are still some who do not entirely fall in with this opinion, may I be permitted to quote a short passage from the Address of the President (Mr. Bentham) of the Linnæan Society, the oldest and chiefest of the Natural History Societies in this country, delivered at the anniversary meeting of last year, serving to corroborate my views, and showing them to be no other than what are held by one of our highest authorities in all Natural History questions. In that address Mr. Bentham speaks at some length on what so commonly follows the attempt to get up a general Museum, except in cases where it is "supported at the public expense, or by the annual proceeds of a sufficiently large inalienable capital." He remarks how, after a time, such collections outgrow the means of private scientific bodies; how the "specimens required for study or comparison are encumbered by a mass of trash, presented by persons who do not know what else to do with it;" how packages, from which there is not even a selection made, still less any attempt to arrange their contents, are "consigned to oblivion and decay in cupboards and garrets, the members generally taking no further interest in what they can make no use of." He then passes on to the con-

sideration of "local Museums on a smaller scale in the smaller cities and provincial towns." He remarks that there are "many such, both on the continent and in our own country, and that, if judiciously formed and adequately maintained, they ought to be very useful in encouraging the taste for observation at home, and giving the scientific visitor from a distance authentic information on the Natural History of the district;" and he ends by giving an opinion "that local provincial societies cannot better apply their funds and influence than in the establishment of a Museum aiming at completeness in representing the local district; that exotic specimens should be restricted to such a limited number of representative types or specimens for comparison as their means will afford, selected solely in proportion to their utility in the Museum, without reference to the individuality of the donor; or, if a certain number of complimentary specimens must be retained for a time in order to keep up the public interest in the establishment, such specimens be unhesitatingly expelled as soon as the cause for retaining them is gone." *

Now if this be so (to return to the matter from which I have somewhat digressed)—if local Museums be indeed desirable—it seems to fall within the especial province of Local Natural History Field Clubs to assist in getting them together.

Gentlemen, without being all of you professed Naturalists, you can do much for us in the matter we have now in hand. One of our Members, indeed, has already set an example which calls for our warmest approbation and thanks, by making a collection during the past year of the land and fresh water shells found about Bath, numbering more than sixty species, and embracing probably a great proportion of

* Proceed. of Lin. Soc., May 24th, 1867.

those inhabiting the district. Another Member has collected many of the birds, which I have reason to hope may find a place in our new local Museum, as soon as it is ready to receive them. You may not all have the same zeal that these gentlemen have, or the same opportunities; but without any trouble to yourselves, and with very little knowledge of the subject, you may, if you will, in your weekly walks, be on the look out, or make such inquiries as may be of great service. You occasionally fall in with country gentlemen who assist you in your antiquarian researches—indeed, we have some present at our table to-day, whom we are glad to welcome in return for the attentions they have shown the Club in this way; and I feel sure they would be equally glad to help us, so far as they can, in our Natural History researches. They may have keepers, or know of keepers in their neighbourhood, who could procure rare birds and animals for our Museum. Many such are constantly being killed by game preservers which are lost to science, from their value not being duly estimated, or from the parties who obtain them not knowing anyone who would care to have them. Or you may talk to any intelligent persons you meet with about these things. There is no trouble in asking questions, even if we get no answer to our inquiries at the time. Tell one what we want, and he tells another, and the second tells a third, and sooner or later something will turn up to our advantage. Or again, you may inquire what fish occur in the brooks and rivers you come to; what snakes or lizards are seen about, securing any you happen yourselves to meet with; or you may make it the object of a walk on some occasion to search—as I suggested after the reading of Dr. Bird's paper at one of our evening meetings—whether you cannot discover any traces of the great edible snail *(Helix pomatia)*, supposed by some to be connected with Roman Villas and old Roman towns. There is no good foundation, perhaps, for such opinion; but

still, as this species is found in certain stations on the Cotteswold hills in Gloucestershire, there is no reason why it should not equally occur on the oolitic downs about Bath, or in some of the old over-grown quarries—not at all an unlikely *habitat* for it. It would further your chance of success, if you took with you a specimen to show labourers, and others much in the field, and asked whether they had ever seen such snails about.

But I must not dwell longer on this subject. I will only add that, Bath being on the confines of three counties—Somerset, Wilts, and Gloucester—a local Museum might legitimately be allowed to receive within its walls any specimens or objects of interest obtained in either of the three.

Having said this, I am content to leave other topics to another occasion, committing the interests of science into your hands. It has been supposed that there are no less than "4,000 members on the lists of Naturalists' Societies now in operation in Great Britain," and it has been stated that "such a company should be able to give a good account of the Natural History of their own country."

Gentlemen, remember that you occupy a place among that 4,000, and make an endeavour to give in your day a good account of the Natural History of Bath.

CONTENTS.

PROCEEDINGS

OF THE

BATH NATURAL HISTORY

AND

ANTIQUARIAN FIELD CLUB.

No. 3.

1869.

PRICE TWO SHILLINGS.

RULES

OF THE

Bath Natural History & Antiquarian Field Club.

1869.

1.—The Club shall be called "THE BATH NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB," and shall consist (for the present) of not more than Seventy-five Members.

2.—The object of the Club shall be to make Excursions around Bath, with the view of investigating the Natural History, Geology, and Antiquities of the neighbourhood.

3.—The Founder of the Club, the Rev. LEONARD JENYNS, shall be considered the permanent *President;* and a *Vice-President* and *Secretary*, the latter acting also as *Treasurer*, shall be chosen each year from among the Members at the Anniversary Meeting on the 18th February.

4.—Quarterly Meetings for the election of Members, and for other business, shall take place on the *First Tuesdays* in April, July, October, and January.

5.—There shall be a Committee of Management consisting of the officers and two other Members of the Club (the latter to be elected annually), whose business it shall be to consider and determine all matters connected with finance, and printing the proceedings of the Club, or papers read at any of its meetings; or any business requiring consideration previous to the Quarterly Meetings.

6.—There shall be Four Excursions during the year, to be fixed at the Anniversary Meeting, *subject to alteration* at any previous Quarterly Meeting, if agreed to by all the Members present—Six to form a quorum. A list of such Excursions, with the respective Places of Meeting, shall be suspended in the Vestibule of the Bath Literary and Scientific Institution. Such Members as feel disposed shall also meet every *Tuesday*, at the Institution, at 10 a.m.

7.—The hour of meeting shall not be changed, except for the convenience of taking particular trains, when it is arranged to go by rail to any place; in which case the altered time shall be posted at the Institution, not later than Twelve o'clock on the Tuesday previous.

8.—In arranging the Excursions, due regard shall be paid to Natural History and Antiquities, so as to secure an equal share of attention to each subject; with this view, when the same Excursion does not include them both, they shall, so far as practicable, be taken alternately.

9.—Special Meetings shall be appointed for the Reading of Papers or Exhibition of Specimens, notice being given to the Secretary, at, or previous to, any one of the Quarterly Meetings, by Members having such communications to make to the Club.

10.—Persons wishing to join the Club may be proposed by any Member at one of the Quarterly or Special Meetings, and elected (by Ballot) at the next meeting afterwards. Three black balls to exclude.

11.—Any Members of the Club may invite friends to accompany them on the proposed Excursions.

12.—It shall be the business of the Secretary to take Notes of the Day's Excursion, and to draw up a summary of the Year's proceedings, previously to the next Anniversary; he shall also see that the proper Notices of Excursions are suspended at the Institution, and communicate with the Members by letter, when occasion shall require. His accounts, as Treasurer, to be passed at the Anniversary.

13.—A Subscription of Seven Shillings and Sixpence shall be paid yearly by each Member, to defray any expenses the Club may incur otherwise than by journeys and refreshments. This Subscription to be considered due on the Anniversary.

14.—Members whose Subscriptions are in arrear for one year shall be considered as having withdrawn from the Club, if, after application, the same be not paid up.

15.—There shall be a Supernumerary List for Members whose absence from Bath is only temporary. Such Members, on their return, and on payment of their Subscription for the then current year, may be admitted to the Club at once, or so soon as a vacancy occurs.

H. H. WINWOOD,
Hon. Sec.

BATH
NATURAL HISTORY & ANTIQUARIAN FIELD CLUB,

INSTITUTED FEB. 18th, 1855.

LIST OF MEMBERS FOR THE YEAR 1869.

President.

*REV. LEONARD JENYNS, M.A., F.L.S., F.G.S.

Vice-President.

*REV. PREBENDARY SCARTH, M.A.

Secretary and Treasurer.

REV. H. H. WINWOOD, M.A., F.G.S.

Rev. THOS. STEELE, LL.D. & D.C.L., 2, Bathwick Terrace
*C. E. BROOME, Esq., M.A., F.L.S., Elmhurst, Batheaston
*Captain W. V. HEWITT, 3, Church Street, Widcombe
*CHARLES MOORE, Esq., F.G.S., 6, Cambridge Place
W. DOBSON, Esq., Oakwood, Bathwick Hill
Rev. H. N. ELLACOMBE, Vicarage, Bitton
Colonel E. P. ST. AUBYN, 7, Great Bedford Street
JOHN BARRETT, Esq., F.R.C.S., 13, Pierrepont Street
Rev. THOS. JACKSON, 32, Sydney Buildings
Rev. GEORGE BUCKLE, Vicarage, Twerton
Rev. JOHN EARLE, Rectory, Swainswick
JOHN JOHNSTON, Esq., 8, Sion Place
Mr. J. P. TYLEE, 7, Bridge Street
Mr. CHARLES EKIN, F.C.S., 8, Argyle Street
A. B. BRABAZON, Esq., M.D., 12, Darlington Street
C. J. FOX, Esq., M.D., Brislington, near Bristol
Captain HARDY, R.N., Kilkenny House, Sion Hill
W. LONG, Esq., West Hayes, Wrington.
Major NICKLE, 5, Lambridge Place
Colonel WYNDHAM BAKER, 12, Green Park
Mr. S. HAYWARD, Hanover House
Rev. D'COURCY MEADE, M.A., 1, South-west Buildings
J. LE MARCHANT, Esq., 17, Sion Hill
W. S. MITCHELL, Esq., LL.B., F.L.S., F.G.S., St. George's Lodge
EDMUND SMITH, Esq., 1, Spencer's Belle Vue
Lieut.-Colonel WICKHAM FREEMAN, 3, Johnstone Street
Captain F. R. FRAMPTON, R.N., 46, Pulteney Street
Rev. H. HODGES MOGG, Newbridge Hill, Bath
W. RODWELL, Esq., F.L.S., 9, Catherine Place
J. F. GOODRIDGE, Esq., 5, Henrietta Street
Lieut.-Colonel S. W. HENNAH, 2, Perrymead, Widcombe

* *Original Members.*

Rev. W. S. SHAW, Beechen Cliff Villa
Rev. Prebendary BOND, Vicarage, Weston
Captain LYSAGHT, R.N., 3, Sion Row
Rev. C. BAKER, Tellisford Rectory, near Bath
Lieut.-Colonel W. H. BAYNES, 18, Russell Street
Major J. H. BEAN, 8, Sydney Place
EMANUEL GREEN, Esq., Holcombe, near Bath
Mr. J. T. IRVINE, F.S.A. Scot., Combe Down
H. D. SKRINE, Esq., Warleigh Manor
Rev. T. P. ROGERS, Vicarage, Batheaston
ALFRED BANKART, Esq., Weston Manor House
JOSIAH GOODWIN, Esq., F.S.A., Batheaston
W. ALLEN, Esq., The Cloisters, Perrymead
Colonel W. COCKELL, 18A, Queen Square
CHAS. E. DAVIS, Esq., F.S.A., 55, Pulteney Street
A. F. JANVRIN, Esq., 7, Royal Crescent
J. McMURTRIE, Esq., Radstock
S. KEMP, Esq., Oriel House, Widcombe
J. WEDGEWOOD YEELES, Esq., Bathford
H. BONHAM ACTON, Esq., 4, Great Bedford Street
Lieut.-Col. ENGLAND, 7, Norfolk Crescent
H. B. INMAN, Esq., Batheaston
Capt. J. T. CHANDLER, 33, Marlborough Buildings
Rev. ROBT. DRUMMOND, St. Catherine's Court, Batheaston
T. F. INMAN, Esq., Batheaston
Captain P. SAUMAREZ, R.N., 21, Paragon
HENRY BIRD, Esq., M.D., Christow, Exeter
WALTER ELLIS, Esq., 2, Royal Crescent
T. F. WALKER, Esq., F.R.G.S., 6, Brock Street
CHAS. TIMINS, Esq., 3, Cavendish Place
Rev. T. H. TOOKE, Rectory, Monkton Farley
T. FELTON FALKNER, Esq., 8, Southgate Street
Col. VINCENT, Hampton Hill House, Bathampton
J. M. HEYWOOD, Esq., 8, Cavendish Place
Rev. H. S. SAYCE, Apsey House, Batheaston
Col. R. L. TAYLOR, C.B., Ivy Lawn, Weston Road
Rev. G. W. BRAIKENRIDGE, M.A., F.L.S., F.S.A. Scot., Winash, Brislington
R. E. CRICKITT, Esq., 4, Belvedere Villas
THOS. ASHWORTH, Esq., Claverton Lodge
Major-General MATTHEWS, 3, Pulteney Street
W. JAMESON, Esq., M.D., F.L.S., 13, Edward Street

Hon. Member.

W. BOYD DAWKINS, Esq., F.R.S., F.G.S., &c.

Supernumerary List.

Colonel TUDOR
H. J. HUNTER, Esq., M.D., Privy Council Office, Whitehall
Sir GEORGE J. R. HEWETT, Bart., Albury, Guildford, Surrey
Capt. G. W.V. VILLIERS

LECTURE

ON THE

VIA JULIA AND ITS COURSE BY SILBURY,

BY THE

REV. H. M. SCARTH, M.A.

NOTICE.—*Any opinions expressed in the Proceedings of the Club must rest on the authority of their respective Authors.*

upon it, sufficiently marks its antiquity.

The name *Via Julia*, or Julia Strata, has been taken from the poet Necham, who was Abbot of Cirencester, A.D. 1215-25, who mentions this road by that name,* and is cited by Camden. (See Monmouthshire.)

> "Intrat et anget aquas Sabrini fluminis Osca
> Preceps, testis erat Julia Strata mihi."

*See his book "De Sapientiâ Divinâ," or the passage quoted by Leland, Itin., 9, 10.

Rev. W. S. SHAW, Beechen Cliff Villa
Rev. Prebendary BOND, Vicarage, Weston
Captain LYSAGHT, R.N., 3, Sion Row
Rev. C. BAKER, Tellisford Rectory, near Bath
Lieut.-Colonel W. H. BAYNES, 18, Russell Street
Major J. H. BEAN, 8, Sydney Place
EMANUEL GREEN, Esq., Holcombe, near Bath
Mr. J. T. IRVINE, F.S.A. Scot., Combe Down
H. D. SKRINE, Esq., Warleigh Manor
Rev. T. P. ROGERS, Vicarage, Batheaston
ALFRED BANKART, Esq., Weston Manor House
JOSIAH GOODWIN, Esq., F.S.A., Batheaston
W. ALLEN, Esq., The Cloisters, Perrymead
Colonel W. COCKELL, 18A, Queen Square
CHAS. E. DAVIS, Esq., F.S.A., 55, Pulteney Street
A. F. JANVRIN, Esq., 7, Royal Crescent
J. McMURTRIE, Esq., Radstock
S. KEMP, Esq., Oriel House, Widcombe
[illegible] WEDGEWOOD VEELES, Esq., Bathford

[illegible]
Major-General MATTHEWS, 3, Pulteney Street
W. JAMESON, Esq., M.D., F.L.S., 13, Edward Street

Hon. Member.

W. BOYD DAWKINS, Esq., F.R.S., F.G.S., &c.

Supernumerary List.

Colonel TUDOR
H. J. HUNTER, Esq., M.D., Privy Council Office, Whitehall
Sir GEORGE J. R. HEWETT, Bart., Albury, Guildford, Surrey
Capt. G. W.V. VILLIERS

LECTURE

ON THE

VIA JULIA AND ITS COURSE BY SILBURY,

BY THE

REV. H. M. SCARTH, M.A.

THIS is the subject which I have to bring before you this evening, a subject not without its interest at the present time; but in order to do this effectually, I must say something respecting the name of the ancient road, the course of which I am to describe. That name does not rest upon any classical authority, but it is the name by which this road appears to have been known in mediæval times. Portions of two of the ancient Itinera may be traced along its course, and this, as well as the important Roman towns which lay upon it, sufficiently marks its antiquity.

The name *Via Julia*, or Julia Strata, has been taken from the poet Necham, who was Abbot of Cirencester, A.D. 1215-25, who mentions this road by that name,* and is cited by Camden. (See Monmouthshire.)

> "Intrat et anget aquas Sabrini fluminis Osca
> Preceps, testis erat Julia Strata mihi."

*See his book "De Sapientiâ Divinâ," or the passage quoted by Leland, Itin., 9, 10.

And Camden says, "This Julia Strata was no doubt Port-highway;" and he considered it to have been constructed by Julius Frontinus, the vanquisher of the Silures.

Camden is followed by other writers, as Sir R. C. Hoare, who has adopted this name, but Sir Richard calls it Via Julia Maritima, or inferior, to distinguish it from another Roman road, to which he gives the name of *Via Julia Montana*, being that from Chester to the Menai Strait.

The "Itinera" of Richard of Cirencester is now believed to be a forgery, and therefore not to be relied on; yet he must have had access to some ancient maps or notes on which to found his fabrication, and from which he has supplied some names omitted in the Antonine "Itinerary."

Thus his XI Iter is more exact than the XIV Iter of Antonine. He terms the course of it "*Via Julia*," probably from Camden, and traces it from Bath to St. David's, in Wales. The Iter is as follows:—

Ab Aquis per viam Iuliam Menapiam usque, sic.

Ad Abonam (Bitton)	M.P. VI.
Ad Sabrinam (doubtful, Sea Mills)	VI.
Unde trajectu intras in Britanniam Secundam et stationem Trajectum (doubtful, Sud-brook)	M.P. III.
Venta Silurum (Caerwent)	VIII.
Isca Colonia (Caerleon)	IX.
(Unde fuit Aaron Martyr.)	
Tibia Amne (doubtful)	VIII.
Bovio (Ewenny) (?)	XX.
Nido (Neath)	XV.
Leucaro (Loghor)	XV.
Ad Vigesimum (castle-Flemish)	XX.
Ad Menapiam (St. David's)	XIX.

Ab hac urbe per XXX. M.P. navigas in Hyberniam.

He makes it therefore to commence its course at Bath

(Aquæ Solis); thence to Bitton (Abona), six miles; thence ad Sabrinam (doubtful), six miles; then gives three miles for the transit across the Severn; thence to Caerwent (Venta Silurum), eight miles; and on to Caerleon (Isca Colonia), nine miles more; and so on, marking particularly the stations and distances to St. David's, from whence he gives the distance across to Ireland, thirty miles.

The XIV Iter of Antonine is carried along the Via Julia, ab Isca Calleva, or from Caerleon to Silchester.

It begins—Item alio itinere, ab Isca Calleva, M.P. CIII., Sic. The former Iter, to which here allusion is made, is the XIII, which is also *ab Isca* Calleva, but passes through Usk, Monmouth, Ross, Gloucester, Cirencester, and Speen, to Silchester. But the XIV Iter, commencing from Isca (Caerleon), is as follows :—

Venta Silurum (Caerwent)	M.P.	IX.
2 Abona (Bitton)		IX.
1 Trajectus (doubtful, Sea Mills)		IX.
Aquis Solis (Bath)		VI.
Verlucione (High Field, near Sandy Lane)		XV.
Cunetione (Folly Farm, Marlborough) ...		XX.
Spinis (Speen)		XV.
Calleva (Silchester)		XV.

This Iter therefore carries the Via Julia as far as Silchester, and we may therefore apply the name to the whole line of ancient Roman road between Silchester and St. David's. But it extends beyond Silchester to London, and again from London communicates with the sea at Dover. The Romans, therefore, had a direct line of road from Dover to St. David's, which passed through this city (Bath), and crossed the Severn near the New Passage, as it is now called, not far from where the present line of railway from Bristol crosses to Portskewett. Indeed, the old camp of Sudbrook, which protected the passage, is still existing. General Roy, in his

"Military Antiquities," book iv., c. ii., speaks of this road where it passes through Monmouthshire and Glamorganshire, and says it is found to be continued as far as St. David's in Pembrokeshire; and on this road he supposes the traces of Roman milestones to exist, particularly upon Stalling Down, eastward of Cowbridge, and again westward of that town; on Newton Down, "the vestige of the Roman way," says he, "are very visible."

Higden describes two of the great Roman roads as beginning at St. David's. It is not my purpose in this paper to consider the whole length of this way, or to mark the exact site of every station. This would almost be impossible, though much has been done through the efforts of Sir R. C. Hoare, Mr. Leman, and others, yet, as Mr. Ormerod has observed (in tracing the course of this road between Bath and the passage on the Severn), "Where numerals are corrupted, and the very ruins and vestiges of former roads have disappeared, precise confirmation is hopeless."*

I have endeavoured, in my work on Roman Bath, to point out its course from Silchester to this city,† and since that was written have had the opportunity of examining one portion of that course more carefully, viz., that by Silbury and Marlborough. Over the chalk downs the line of the road can be clearly traced; it is only when it comes into the valleys and traverses the low ploughed lands, that we lose its track. Even then tokens of it may be found, or traditions of its course are still existing. I shall not touch upon its track from Silchester to Speen, or from thence to Marlborough. To the members of the Wilts Archæological Society more properly belongs this portion of its route, but as this Club has visited Silchester, and seen the interesting excavations there, and examined the collections made by Mr. Joyce, it is

* See Ormerod's "Strigulensia," p. 35.

† See "Aquæ Solis," p. 110.

well to allude to this city, as, according to the Itineraries, marking one point of its course.

Before giving an account of the recent examination of its course by Silbury, and the clear evidences of it that there exist, I ought to mention that one of the chief difficulties in its line is the direction which it took between Bath, or rather between Bitton, and the point where it must have crossed the Severn. Its course can be traced satisfactorily to Bitton, and probably beyond, and the distances up to this point agree with those marked in the Antonine "Itinerary" (Iter XIV), but at Bitton we are in doubt about the name, as the Iter appears to be corrupted in the reading. *Abone* must surely be on the Avon, as Bitton is. *Trajectus* must surely be the passage of the Severn, where a ferry is required over the estuary, not the mere crossing by a bridge.

Sir R. C. Hoare traced the course of this road over Durdham Down (near Clifton, where it is visible) to the great station of Sea Mills, which he supposes to be Abona. At Sea Mills there is a Roman station, and Roman remains have been found. These are recorded in Seyer's "History of Bristol," where a plan of the station is given (ch. ii.); and it is very probable that the Romans had a port there, from whence they could sail into Wales. *Sea Mills* being on the Avon, might claim, as well as Bitton, the name *Abona*, but it seems to have a better right than Bitton to that of Trajectus. It probably was a point from whence the passage was often made into Wales, although the road passed on from thence to the shores of the Severn, near Aust. Sea Mills would certainly be a more sheltered station and a safer anchorage for vessels than any creek near Aust. I wish to call the attention of the Club to this point, and suggest to them that some examination of this station should be made, as well as the line of road from Sea Mills to the Severn. Between Clifton Down and Sea Mills many Roman remains were found in

making the new line of railway on the eastern bank of the Avon to the mouth of that river.

Sea Mills is 16 miles from Bath, but in the "Itinerary" of Antonine the distance of Abona from Aquæ Solis is VI. It may be that an X has been omitted in transcribing, but then no mention is made of Bitton.

The same Iter. makes the distance from Caerwent to Abona IX miles, which, if Abona is *Sea Mills*, ought to be XIX; and we have again to add X, and suppose the numbers corrupt in the original. In this Iter, "*ad Sabrinam*" is omitted altogether, which Seyer would fix at *Aust* (ch. ii., p. 138); but others fix it at the *New Passage*, as this would avoid the embouchure of the Wye.

Abel Wantner, in his "Natural History of Gloucestershire," says:—"At Pollbury, where Trim goeth into Avon, much coin has been found, conjectured to be the ancient station of the Romans." The fields within the area are now called Portburies. Roman coins have been found all around. (See Seyer's "Bristol," pp. 155, 156.)

The passage from Aust across the Severn is one mile wide at high water, but it was probably in Roman times much narrower. The tradition is that anciently voices could be distinguished across the passage. Within three miles of Aust, on the Gloucester side, is a station at Elburton, undoubtedly Roman. It is rectangular, containing two acres.

From Sea Mills a road can be traced to Trajectus, if Trajectus is the Aust ferry. It is marked by the stony way on the west side of the Trim, and continued on to Henbury. (See Seyer, ch. ii.)

Mr. Reynolds, in his commentary on that part of the "Itinerary" of Antoninus which relates to Britain, in treating of the XIV Iter and the stations on it, proposes to fix *Trajectus* at *Bristol*. (See "Iter. Britan.," p. 361; Cambridge, 1799.) After considering the reasons given

by others, he observes, "But another equally good pleads in favour of Trajectus, and this is—*Brigstow;* the ancient name of Bristol, has nearly the same meaning with *Trajectus. Brigstow* plainly points out to us a bridge or passage over a river." The early growth of Bristol is very obscure. It comes before us first in Saxon times. In the bridge of Athelstan we have the first historical proof of its existence. (See Seyer, p. 243.) But Roman coins have been found in and around Bristol, in 1750 at St. Michael's Hill, in 1808 in Bell Lane, and in 1866 two pigs of lead bearing the Roman stamp, one of which is now in the British Museum, and the other in a private collection in Bristol. These are described in the "Archæological Journal," vol. xxiii., p. 277. They were found in Wade Street, in the ancient course of the river Frome, and bore the stamp of the Emperor Antoninus Pius.

Bristol would not agree with the numbers given in the Antonine "Itinerary" any more than Sea Mills. We see, therefore, the difficulty of fixing the exact point of the stations in this portion of the Iter. We are certain of the direction, we can trace the road at certain points. Its course has been ascertained in part to correspond with that of the present turnpike beyond Bitton. We know that there was a station there, as well as at Sea Mills and at Elberton, but we can make neither names nor distances agree. On the whole, I am inclined with Dr. Gale and others to reverse the stations of Abone and Trajectus, and fix Trajectus at Sea Mills and Abone at Bitton; and seeing that Wesselin, in his notes to his edition of the Antonine "Itinerary," calls it "Vitiosissimus Liber," we may be allowed to take some liberty in the alteration of the numerals.

I will now go on to detail that portion where the course has been less interrupted, and where distances and stations agree better.

We have seen that the XIV Iter begins with Caerleon, which was visited two years ago by the Field Club, under the

guidance of the local antiquary, Mr. Lee, of the Priory, who has so accurately recorded all the discoveries there made in his interesting book, entitled "Isca Silurum." The museum at Caerleon is one of the most interesting and instructive local museums in the kingdom.

The Roman road from Caerleon to Caerwent is well ascertained. It was noted by Horsley, and is followed in much of its course by the line of the present turnpike, and passes straight through the station of Caerwent, the walls of which partly remain, and also some of the towers, with the ditches. Caerwent has also been visited by the Club. From Caerwent it followed the direction of the Chepstow road for a short distance (about a mile), and then turned off in the direction of Caldecot, and made for Sudbrook Camp. This spot has also been visited by the Club, and near this camp appears to have been the Roman landing place. For particulars of Sudbrook Camp and the ruined church near it, I must refer to the proceedings of the Monmouthshire and Caerleon Antiquarian Society for A.D. 1858.

I suppose the passage to have been from hence to Sea Mills, on the Avon, according to the Iter, though there probably was a landing place also on the Severn at Aust, and it may be at the New Passage as well. From Sea Mills to Bitton, which is about nine miles, we have not much certainty of the road till we come to near Bitton, where it has been traced, and, as I am informed by the Rev. Mr. Ellacomb, Senior, is known as the "Aggis Way," and from thence to Bath by Northstoke and Weston. My arrangement of the Iter would therefore be, from Caerleon to Bath, as follows :—

Caerleon (Isca) to Caerwent (Venta)	...	M.P. IX.
Caerwent (Venta) to Sudbrook (ad Sabrinam)		III.
Sudbrook (ad Sabrinam) to Sea Mills (Trajectus)		IX.
Sea Mills (Trajectus) to Bitton (Abona)	...	IX.
Bitton (Abona) to Bath (Aquæ Solis)	..	VI.

From Bath the Via Julia passed out by the East Gate in the direction of Walcot. An interesting discovery near the Cleveland Bridge seems to mark the line of its course. In digging the foundations of a house at one end of Cleveland Place, and directly opposite the Eastern Dispensary, three interments were found, one in a stone coffin, where the skeleton was perfect, and two small cists of stone, containing burnt bones. These lay a few yards apart, but in a direct line. The two cists were covered with one large stone. This covering had slipped off one cist, which was found to contain only soil, the bones having perished, but the other was full of calcined bones. In a line with these was found also what appeared to be a stone hearth, surrounded by burned clay.

These interments were found within the space occupied by the new house, built by Mr. Sweetland, and appear to have bordered the ancient Roman road which passed that way between the present street and the river. Roman pottery of various kinds was found near these interments, and some fragments of very nice Samian. But the most interesting part of the discovery is a coin of silver, small in size, having on the obverse the heads of the Dioscuri, Castor and Pollux, with two stars over them. On the side of them are the words RVFVS IIIVIR, on the reverse is a female figure holding a balance, with the word CONCORDIA under it. Unhappily, the reverse has been injured by rubbing, and the figure and lettering can with difficulty be traced. But the size and description of coin coincides with one given in Cohen, as a coin of *Cordia*, on which he makes the following remarks :— "Manius Cordius Rufus was Monetary Triumvir of Julius Cæsar, and this coin may be presumed to have been struck about 50 years B.C." Cavedoni thinks that the Venus with Cupid on her back has reference to Venus "Verticordia" (who changes hearts), according to Ovid, and which also has

allusion to the name Cordius. The figure on the shoulder of Venus in the coin found in Bath can scarcely be discerned, owing to the coin being injured. It is happily now in the possession of a member of our Club. This is undoubtedly the earliest coin yet found in Bath, being older than that lately dug up on the site of the New Pump Room Hotel, formerly the Old White Hart. From hence the Roman road followed the course of the present turnpike road to Batheaston and Bathford, where it ascended the hill a little to the south of the church, and having gained the summit, went in a direct line, as marked in the ordnance survey. Mr. Leman, in his MS. notes to "Horsley's Essay" on the Itin. of Antonine, has carefully described the whole course of this road to the station of Verlucio, or High Field, near Sandy Lane, which is the next station noted in the Iter.

"Sandy Lane is a small village in the parish of Calne, through which the old Roman road and the old turnpike road to Bath formerly passed. It is a wide lane with houses on each side. Behind the houses to the south runs Spy Park. Several remains have been found in the park, as tessellated pavements and coins. Behind the houses to the north-east of Sandy Lane lies Bowood Park, in which also pavements and Roman coins have been found, and nearer to Calne a Roman bath was discovered." (See "Reynold's Itinerary," p. 364.) The mileage, XV, here corresponds to that given in the "Itinerary."

The next station was at Folly Farm, beyond Marlborough, on the Kennet, from whence it took the name of Cunetio. This has been ascertained. Roman remains are also found at Mildenhall. The station at Folly Farm is clearly defined on two sides, and has been rectangular. The farm buildings at present stand on the east side of the station, and have obliterated the rampart. The situation is very fine, overlooking the Kennet and the town of Marlborough. The

present occupier of the farm, Mr. Lucas, showed me a coin lately found, on the reverse was GENIO POPVLI ROMANI. It appeared to me to be a coin of the Emperor Maximianus, struck in Britain, similar to that given in the "Archæological Journal," No. 94, p. 156, pl. II., 1867. (See paper on Roman coins struck in Britain, by the Count De Salis.)

There is now at Tottenham House, the seat of the Marquis of Ailesbury, some very good Roman pottery and coins, found at Stinchcombe, parish of Mildenhall, on the farm of Mr. Joseph Butler, where a tessellated pavement has also been found. The pottery consists of coarse red ware and Samian, one or two vessels being nearly perfect, and many fragments of various kinds. Several of the potters' marks may be read. The coins have been examined and described, but I believe not published; one I read was in good preservation—ESVVIVS TETRICVS. There is also a piece of rough sculpture preserved at the farm, of which I made a sketch, 3rd October, 1867. From Sandy Lane the Roman road can be traced to Speen, the Roman *Spinæ*, in Berks., but the distance is longer than that given in the Iter. Six miles east of Marlborough is Rudge, where the metal cup was found in a well, having on the circumference below the rim the names of some of the stations on the line of the Roman wall in Northumberland. It is engraved in Horsley's "Brit. Rom.," p. 192, n. lxxiv., and described pp. 329, 330; also in Bruce's "Roman Wall," p. 252, second edition. The inscription reads thus—"A Mais Aballava, Uxeloduno Amboglannis, Banna." The Roman town of Spinæ was, according to Stukeley ("Itin. Cur.," p. 69), on the spot where now stands the north part of the town of Newbury, still called *Spinham*. *New*bury has derived its name from the ruins of the old town of Spinæ. From hence the road passed on to Silchester, the ancient Calleva, which is the termination of this Iter.

I must now give some account of the examination of the

course of this road betwixt the two stations of Verlutio and Cunetio, at the point where it passes near to the famous stone circle at Abury, with its accompanying avenues at Beckhampton and Kennet.

The course of the Roman road is correctly marked in the ordnance map from Bathford to Marlborough, and I believe throughout its whole line to Silchester. Throughout part of this course it appears to coalesce with the Wansdike, and to have adopted that boundary line for its direction. The junction of the Roman road with the Wansdike is clearly seen at Morgan's Hill, and has been delineated by Stukeley in his "Itin. Cur." The Club three or four years ago visited the spot, under the guidance of Dr. Thurnam.

In its course from Verlucio, or Sandy Lane, to Marlborough it passes over West Down, on the brow of which the direction can be clearly traced by anyone travelling on the road from Marlborough to Calne, who knows where to look for it. The point at which it cuts the brow of the hill on the horizon is very distinct. In coming from Marlborough along the turnpike road to Calne you pass by Silbury Hill, about six miles west of Marlborough, and here the Roman road unites with the turnpike road. A controversy lately arose as to the exact line of the Roman road at this point, whether it passed underneath Silbury Hill, or kept to the south of it, uniting with the turnpike a little to the east of the hill. Letters were published in the "Athenæum" on the subject, and it was asserted that if Silbury Hill could be shown to stand upon the Roman road, it must of necessity be more *recent*, but if the Roman road was diverted from the straight course which it takes over West Down, and deflected at this point, it proved that the hill was older than the Roman road.

A clear and concise statement of the controversy on this point is given in the last number of the "Wilts Archæological Journal," Nov., 1867, vol. xi., p. 113, by the Rev. Preben-

dary Wilkinson. Mr. James Furgusson had in an article in the "Quarterly Review," July, 1860, on Stonehenge and Avebury, attempted to show that Silbury Hill, a part of the arrangement of Avebury, was situated on the Roman road, and proved that the whole belonged to a period subsequent to the departure of the Romans, and regarded the monument at Avebury as intended to commemorate Arthur's twelfth and last battle of Baden Hill, fought A.D. 516 or 520. He regarded the arrangement of the stones as marking out the line or place of the battle, and Silbury Hill as marking the place where the leader fell. This was disputed by Sir J. Lubbock and Professor Tyndall, and the discussion turned upon the exact course of the Roman road. Mr. Fergusson maintained that the hill was on it, Sir J. Lubbock and Professor Tyndall agreed with Sir R. C. Hoare, Mr. Long, and others that the road swerved to the south, and did not pass under the hill. To settle this point it was arranged that the Wilts Archæological Society should investigate it, by digging into the hill and by opening the course of the Roman road at certain intervals. Through the courtesy and kindness of Mr. Wilkinson and Mr. Cunnington, I was invited to take part in this investigation, which was fixed for Tuesday, 22nd Oct. of last year, 1867. The weather was fortunately most favourable, and having met Mr. Wilkinson at Calne, I proceeded on the line to Abury, and took up my abode with Mr. Cunnington, at the Wagon and Horses Inn, Beckhampton. Having at the request of the Archæological Institute made a report to them upon what was then done, I shall now lay it before this meeting, only supplying from Mr. Wilkinson's account any circumstance that is better stated than in my own.

Bath; November 26th, 1867.

DEAR MR. WAY,

In compliance with your request that I should place before the Archæological Institute, at their meeting in this month, some

statement of the recent examination of Silbury Hill and the Roman road contiguous to it, by Members of the Wilts Archæological Society, I send you the following account of what was done, only premising that I fear I can add but little to the account which has already appeared in the *Athenæum* of Nov. 2nd, 9th, and 16th :—

I am informed that the Wilts Society are at present having plans and drawings made, and that a detailed account of the excavations will appear in a forthcoming number of the Journal of that Society.

Although I am a Member of that very useful and intelligent body of Antiquaries and Naturalists, and residing in a neighbouring county, I am not often able to join in their proceedings, which I much regret; but on the late occasion I am indebted to the kindness of Mr. Wilkinson and of Mr. Cunnington for enabling me to take part in a very interesting examination.

Having, by previous arrangement, joined Mr. Wilkinson at Calne, he drove me from thence to Silbury Hill, on the afternoon of October 22nd, and being well acquainted with the country and having himself traced the Roman road, he carefully pointed out what he believed to be the direct line of it before we met the other investigators at the Mound.

On reaching the hill we found that excavations were in progress on the eastern side, where two trenches had been dug, one a little north of the other, in the direction in which it was expected that the Roman road could be traced. As Mr. Fergusson has already stated in his letter to the *Athenæum* (Nov. 2), "The intention was to dig down until the old turf was found, and following that to join the two trenches, and to see if any trace of the Roman road existed between them." But, as he further states, "Before the trenches had gone far into the hill, it was discovered that the chalk had been excavated to the depth of 10 or 12 feet below what must have been the original surface of the ground, so far as could be inferred from the lay of the surrounding country, and no turf or soil of any kind remained on the present surface of the solid chalk." He infers from this that the hill was probably

projected on a smaller scale, and afterwards made to cover the ground from which material had been excavated.

In the course of this excavation reindeer horns were found in the northern portion; and in the southern, 6 feet from the surface, in the solid chalk, some wood ashes, and among them the blade of a knife, with a small whetstone lying beside it.

Those who are familiar with the published proceedings of the Archæological Institute, will recollect that an examination of Silbury Hill was carried on in August, 1849, and that a tunnel was then driven into the centre of the hill, and even beyond; an account of this is given in the Salisbury volume for 1849, and it is recorded that stags' antlers were then discovered. (See pp. 75 and 80.)

The present examination of the hill has been as nugatory as the past in revealing anything that might lead one to infer the original object of its construction, and no trace or indication of any road was found. The direction of the Roman road has, however, been ascertained beyond a doubt. The question whether the Roman road passed underneath Silbury Hill is set *at rest for ever*, the line of the road having now been laid open, and its true direction ascertained.

The evening of my arrival I stayed all night at the "Wagon and Horses," the small inn at Beckhampton, which was the point from which the former examination was conducted by Dean Merewether and others who assisted him. Mr. Cunnington, of Devizes, being my companion, I had ample opportunity of talking deliberately on what had been done and what appeared best to do on the day following; accordingly, as soon as the weather permitted, we set to work to lay out the line of the Roman road which he had examined with some care the evening before. There are generally some "indicia" by which you can ascertain the Track. These, to the uninitiated, would appear trivial, and might be overlooked; but to the practised eye they are as certain as the prognostics of the storm to the shepherd and to the sailor. In the north of England, over the moorland country in Northumberland or Yorkshire, you can follow the course of the long-forgotten

road by marking the Sheep Track, which indicates the hard and dry portion of the ground, where it passes through a boggy or swampy district; and in the ploughed land, as in this case, you discern it by the short stunted crop of grain, where the root of the plant is the shallowest, and so trace the course of the road; but in autumn, when the crop is reaped, you must judge by the size of the turnip where the ditches were which accompanied the road on each side, there the turnips, by reason of the greater depth of soil in the ditches, will grow to a larger size, having more root; and if you look out for the largest flints you will often find that they also mark the line of the road, having been dragged by the plough out of the bed of the road. Aided by these "indicia," and having ascertained the exact point at which the road traversed the summit of the hill, we marked out the line which we supposed it had taken through several fields, and then having brought it near to the Mound, at the point where it seemed to deflect, we caused a section to be made about from 30 to 40 yards from the Mound itself. (Mr. Wilkinson says 30, see "Wilts Archæological Journal," November, 1867, p. 117.) I did not, however, take the exact measurement, which I think has since been made, but only write from recollection.

This section revealed the road and the ditches on each side, and this was opened before the rest of the party arrived. On their arrival, it was considered well to make other sections in the line that had been staked out (seven or eight trenches were cut). These were made at intervals varying from 50 to 100 yards or further apart, and each section revealed the road and the accompanying ditch on one or on both sides. The length traced by means of sections is 477 yards. The first section was made very near to the point where the Roman road unites with the turnpike road between Bath and Marlborough. I believe the line marked out in the Ordnance Survey to be perfectly correct. The road did not run up to Silbury Hill or under it, but deflected before it approached the low ground upon which Silbury Hill is placed, and the present turnpike road marks its track some short way beyond Silbury.

I do not propose here to enter upon the question which is the more ancient, the hill or the road; but I strongly incline to Mr. Wilkinson's view, that the line of the Roman road was run direct for Silbury Hill. He says, in his letter to the *Athenæum*. (Nov. 9), "The only perfectly straight portion of the Roman road over the Downs is that which lies between West Down (2 miles west of Silbury) and the hill itself." Mr. Wilkinson supposes the road to have been planned from Bath, and the work to have been carried out in the same direction. On this point I dare not venture an opinion, except that the Iter. (viz., XIV Antonine) begins with Isca (Caerleon) and ends in the Callera (Silchester), thus marking the distances in this same direction from west to east.

We know very little about the methods of Roman engineering, I believe there is no work of antiquity which treats of it. Statius tells us the manner of forming the bed of a Roman road over a marsh,

"Hic primus labor inchoare sulcos," &c., &c., &c.

Vegetius (5th century) mentions "Itineraria" in the plural, and speaks of them as showing the distances between towns, and the qualities of the roads, and the situations of mountains, rivers, &c.

Mr. Reynolds, in his introduction to the Itinerary of Antoninus (p. 122), observes that no proof of the existence of "Itineraria" can be drawn from expressions such as "Itineraria Regionum quibus bellum geritur plenissime debet habere prescripta," and "Solertiores Duces Itineraria Provinciarum—non tuntam annotata, sed etiam picta habuisse firmentur," yet I cannot but think from such expressions we may infer that much pains were taken in the planning of roads, and that stations having been skilfully fixed upon in the first instance, connecting roads soon followed as a matter of course, and these were planned with as much care as in the present day. Certainly, considering the condition of the country at that time, they evince the greatest skill and knowledge of the art of road making.

It is much to be wished that more attention was given to the Roman roads in this country, and that a regular and systematic examination

of them could be planned and carried out. A correct and complete plan of Roman Britain containing all the late discoveries of Roads, Camps, and Villas, would be an undertaking worthy of our own Society, in conjunction with the Society of Antiquaries and kindred Societies. In referring to Horsley's "B. R.," in the Library of the Literary and Scientific Institution in Bath, and which was bequeathed by Mr. Leman, Chancellor of Cloyne, I find a marginal note on the course of this Iter, stating that he traced it in 1795 and 1796 and in 1805, and discovered the long lost station of *Verlucio* at High Field, near Sandy Lane, at the exact distance of 15 miles from Bath. He then specifies the direct course. That much remains yet to be done by the antiquary in tracing exactly the Lines of Roman Roads, and correctly naming the Stations on them, is evident from remains that have been laid bare within the last month in Walcot parish, on the north side of the river Avon, at the point where the Cleveland Bridge unites the parishes of Walcot and Bathwick.

In the course of excavating for the foundation of a house, three interments were laid open, two being in stone cists, one in a stone coffin. These were in a straight line, at some interval apart, *i.e.*, the stone coffin lay by itself, and in it was found a perfect skeleton, said to be that of a female, but the teeth were worn perfectly flat at the crown of the tooth; and the two cists were covered with one stone. In the smaller cist were burnt bones, but the covering having become detached from the larger one, which had sunken, the bones had perished and the cist become filled with mould. With these were found Roman pottery of various kinds, some of the Samian is very delicate and the figures sharp and well delineated. These interments are in the line of the Via Julia, as it leaves Bath for Marlborough. The road seems to have run nearer to the river than the present street which marks its line. I have sent rough sketches of these sepulchral remains from drawings by Mr. Irvine, and in concluding this statement have only to inform you that this morning the intelligence has reached me that in the course of clearing away the foundations of the old White Hart Hotel, and at the level of the Roman City, another

portion of the Frieze of the Temple, now placed in the Vestibule of the Bath Literary and Scientific Institution, has been discovered.

You will find with the sketches of the funereal interments the drawing of a fragment of a memorial cross, found on the site of the same building. This, probably, had stood either in the old Abbey Churchyard, or in that belonging to Stall's Church, which once stood directly opposite the White Hart, but the only vestige of it which now remains is a vault in the cellar below Mr. Arnold's wine stores.

I have written to the Society of Antiquaries an account of two memorial slabs (incised) which were found in taking down the White Hart. They had each been turned to the purpose of a chimney piece, and commemorated two ecclesiastics.

I remain,

Yours very truly,

H. M. SCARTH.

To ALBERT WAY, Esq., F.S.A., Hon. Sec. Archæol. Institute.

And now having occupied so much time in tracing this road, and in endeavouring to settle the stations on it, the question arises—Why take all this trouble and occupy time in minutely describing what is now no longer of use? If present utility were the only object, an investigation would be useful, if carried only to the point of confirming the authority of a written document of ancient date, and settling history upon a solid and stable basis. But there are still further uses, and there are deep reflections to be drawn from investigating anything that has been achieved in ancient times.

The Roman roads are, perhaps, the most wonderful and most enduring record of the power of that great people. The examination of them gives us probably a larger and clearer conception of the range of their power and influence than any other of their works which yet remain. We trace these lines

of communication not only throughout England and Wales and into Scotland—and see how complete was that system of communication, how carefully guarded, and how skilfully planned—but we find these roads extending throughout every country which had been brought under the sway of Roman rule. We trace them from the banks of the Euphrates, and from the borders of the Ethiopian and Lybian deserts, to the extremities of our own island, and from the Rhine and the Danube to the extreme limits of Spain, and even into Maritania. Wherever the power of Rome penetrated, there it left behind this monument of rule, and this precursor of civilisation; and before the decline and fall of the Romans there had been constructed an unbroken line of communication between Syria and Britain, between the Euxine Sea and the pillars of Hercules. By means of these lines of communication the Imperial decrees could be carried without interruption from the central point of Rome to the remotest corners of the empire in an incredibly short space of time; armies could be marched to any point with the utmost speed, and thus centralisation and unity of purpose was wonderfully achieved.

If commerce and civilisation, if law and justice, had rolled on with the stream of conquest, very different would have been the condition of all those countries at the zenith of Roman greatness. But while the power of conquest paved the way for future good, there was something wanting to follow in its wake and complete the work of consolidation, and this was not to be found in the system of Pagan Rome. Yet these highways of the Roman armies had a use for which they were never originally designed,—they furnished highways for messengers of a far higher and sublimer system than was ever dreamed of by their constructors. On these roads travelled the heralds of peace and goodwill to man, and the feet of those who were to spread the pure light of Chris-

tianity were accelerated by these preparations! The Roman highways conveyed the missionaries of Christianity into every remote region, and enabled them to penetrate the Roman world to a degree which has never been equalled since that great empire has fallen.

It is singular that with the fall of the Roman power seems to have declined also the true art of road making, until it revived in more modern times. When the Roman Empire was divided, and when independent European nations were formed out of its members, the ancient Roman roads seem to have endured for centuries as the approved lines of traffic, with very little care bestowed upon them. We know that in this island they were protected by laws in Saxon times, but their condition was probably not much attended to; their solid and durable construction seems for a long while to have defied the changes of atmosphere and the ordinary use they were put to. From the laws of Edward the Confessor, which, though revised by him, were really made by King Edgar, we learn that there were at this time in England *four great roads*, protected by the King's pence—Watlinge Street, Foss, Rickenilde Street, and Erming Street. These were of Roman construction. The privilege of these four roads was confirmed by William the Conqueror, and continued by his successors, and probably extended in the twelfth century to all the highways of the kingdom. This implies that care must have been taken for keeping them in some degree of order, and making them serviceable; but their condition, even up to a comparatively recent date, must have become very bad. Historians give woeful accounts of their condition, and in remote parts of the island the old Roman ways were quite forgotten, and had become covered with sward, and are now to be found nearly a foot under the turf, and sometimes in wet ground much deeper. Bridle-ways, or old packhorse roads, in some parts superseded the old Via Strata, and until

within a century parts of the island were only accessible by riding.

But since then a mighty change has taken place. The turnpike roads in England had been brought to a state of perfection quite remarkable, when they were superseded by the newly-invented railway, which was destined to remove from them all the direct travelling and the heavy traffic of the island. These are the great achievements of modern times, and it is instructive to contrast the ancient system of Roman roads in its perfect condition with our present iron-bound way, and see how the lines of railroad, which now form a network over every part of the island, very often run in the same lines as the ancient Roman roads. A comparison of the different systems is very suggestive of the changes that have taken place in the habits and manners of the people, where the physical features of the country must remain much the same. When the Roman first entered Britain, and found only the trackways of the native inhabitants, the effort was probably as great, and it required as much skill to construct his lines of communication, as it has needed in modern times, with modern experience and modern appliances, to construct those lines of rapid communication which are the great feature of the present age.

REPORT

OF THE

DEPUTATION from the BATH FIELD CLUB of the OPENING of the BLACKMORE MUSEUM, SALISBURY,

AND THE

CONTENTS OF THE MUSEUM.

In September, 1867, a deputation from the Bath Natural History and Antiquarian Field Club visited Salisbury for the opening of the Blackmore Museum, at the invitation of the Trustees.

The deputation consisted of W. Long, Esq., Chas. Moore, Esq., and the Rev. H. M. Scarth, V.P. The Blackmore Museum, which is intended to illustrate pre-historic Archæology, is, without doubt, the most complete in this country. Not only has the collection been got together quite regardless of cost, through the great liberality of William Blackmore, Esq., but the citizens of Salisbury are also indebted to him for the ample building in which it is located. The opening of the Museum was preceded by a Soirée, on the 4th September, when the large room of the Museum was connected by a tent with the Museum of the Salisbury and South Wilts Society, and several papers were read upon scientific subjects con-

nected with the contents of the Museum. This Soirée was well attended. On the following morning, at 11 o'clock several more lectures were given, and about half-past 1 o'clock p.m., a procession was formed at the Council House, from whence the Mayor and Corporation, together with the Bishop and Clergy, proceeded to open the Museum. This was done by an address from the Bishop of the Diocese, at the entrance of the Museum, after which the procession advanced into the Museum Room, and addresses were made from the platform, the Bishop occupying the chair, when the Museum was handed over by Mr. Blackmore to Trustees nominated for the purpose. The members of the various deputations from learned societies attending the meeting were called upon in succession, and it fell to the Vice-President of this Society to express the deep interest felt by the Bath Natural History and Antiquarian Field Club in the new Museum and its valuable contents.

The arrangements of the Blackmore Museum are very perfect, and well suited to facilitate the study of the objects contained in it. The room is large and lofty, and the contents arranged in different cases, according to countries, all of which are clearly lettered, and the design of the whole is comprehended without difficulty. It is intended to publish an illustrated catalogue, descriptive of the whole series, which will be a great boon to scientific students. The classification is as follows :—

ARCHÆOLITHIC PERIOD.

Fauna of the " Drift," England.
Flint Implements from the " Drift," France.
Flint Implements from the " Drift," England.
Fauna of the Dordogne Caves, France.
,, ,, Caves in the Pyrenees, France.
,, ,, " Genista" Caves, Gibraltar.

Flint Implements and objects of Human Workmanship in bone, Antler of Reindeer, &c., Dordogne Caves, France.
Ditto, ditto, Caves of the Pyrenees, France.
Ditto, ditto, Genista Caves, Gibraltar.

NEOLITHIC PERIOD.

Surface Series (Rubbed Stone Group).

Flint and Stone Implements, &c., from England, Ireland, France, Denmark, Italy, Arabia, East Indies, South Africa, America, &c. Pfahlbauten Series—Switzerland.

Surface Series (Drilled Stone Group).

Stone Hatchets and other objects from America, Ireland, and Denmark.

Surface Series (Carved and Drilled Stone Group).

Pipes and other objects from the Mounds of Ohio, America.

Bronze Series.

Bronze Hatchets, Spear Heads, and Personal Ornaments, from England, Ireland, France, and America.

Iron Series.

Iron Swords and Spear Heads, from England and France.

Illustrative Series.

Modern Stone Implements, chiefly in the original handles—New Zealand, Australia, Islands of the Pacific, Esquimaux, &c.
Modern Bone-armed Weapons—British Guiana, New Guinea, Islands of the Pacific, Esquimaux, &c.
Modern Iron-armed Weapons—Africa, &c.
Personal Ornaments, Fishing Tackle, &c., made from Seeds, Shells, Bone, Horn, Ivory—New Zealand, Islands of the Pacific, Esquimaux, &c.
Clubs, Spears, Paddles, &c.—New Zealand, Australia, New Guinea, Islands of the Pacific, British Guiana, Esquimaux, &c.

The illustrated series serve to show the correspondence, in many respects, between the implements found in tumuli, caves and pits, and those in use at the present day, and also the manner of attaching the stone or other implement to the wooden handle. The resemblance between the objects from the French caves and those still made and used by the Esquimaux, is very striking.

Among many other objects of interest, one specially deserving notice is the cast of a portion of the tusk of a Mammoth, found in the Rock Shelter of Madeleine, Dordogne, upon which is traced in outline the animal (Mammoth) itself. The specimen from which this cast has been taken was discovered in May, 1864, by M. Lartet, M. de Verneuil, and the late Dr. Falconer.

The "Squire and Davis" collection, which was formed by those gentlemen from excavations made in barrows and huge mounds in the valley of the Mississippi, and which have been recorded in the Transactions of the Smithsonian Institution of Washington, U.S., was purchased by Wm. Blackmore, Esq., and is now lodged in this Museum at Salisbury, an acquisition of which any country may be proud.

NOTES

OF

A SUMMER'S RAMBLE AMONG FLINT FLAKES,

BY THE

REV. H. H. WINWOOD, M.A., F.G.S.

(*Read March 11th*, 1868.)

Mr. President and Gentlemen,—

Allow me, at the commencement of the few remarks I am about to make on this subject, to disclaim any attempt to connect them with the great question of the antiquity of the human race. The answer to that question does not depend upon the fact whether certain flint "flakes" and "chips" *be* or be *not* the result of man's handiwork. The vast importance of the accuracy or inaccuracy of the hitherto generally-received date of man's advent upon this earth may well be left in the hands of the masters of their respective sciences—Lyell, Lubbock, Huxley, Evans, Boucher de Perthes, and others. My object this evening will be merely to lay before you some of the results of my last summer's ramble amidst the relics of the old folk of Cornwall, Devon, and Somerset, and to try and induce you all to come to the same conclusion as that at which I myself, in spite of my former predispositions to the contrary, have been compelled to arrive, viz.,

that these fractured flints, so abundant on the cliffs and headlands of our coasts, as likewise on every spot where a probability exists of there having been ancient occupation, are in reality fractured for a purpose, and in fact that they serve as the missing link in that chain which connects the past with the present.

Those who have taken any interest in that all-engrossing subject of the present day—the traces of early man—know that four successive epochs have been marked out, preceding what is commonly called the Historic Period, viz.,—

1. The Archæolithic, or Palæolithic Period—that of the Mammoth, Cavebear, and woolly-haired Rhinoceros, all now extinct, but the remains of which are found in the diluvium, or drift gravels, of our own and of foreign countries.

2. The Neolithic Period, or "polished stone age," when the art of polishing stone weapons prevailed.

3. The Bronze Age, in which a mixture of copper and tin was used for arms, &c.

4. The Iron Age, when this metal supplied the place of bronze for tools and weapons.

Although this antemetallic and metallic age has been questioned by some few learned archæologists, who think the division too sharply defined, and although undoubted instances may be produced of the over-lapping of the bronze, and even of the iron ages, by the later stone age, yet for all general purposes a better division of the debatable ground between pre-historic and historic times may very fairly be challenged.

With regard to these stone implements, relics of primitive industries, Messieurs Lartet and Christy state that "they are to be regarded as indicating a *grade* of *civilisation* rather than any *definite antiquity;* and although in some countries there are clear evidences that the use of metal has come in *gradually*, and that the use of stone has *gradually* gone out, yet there is no reason to

conclude that both have been *long* or *generally* employed together for the same purposes." (Vide "Reliq. Aquit.," pl. ii., p. 11.) Accepting then these four divisions, it is to the later stone age, as traced in our own country, that my remarks will especially refer, and to that sub-division which is distinguished by implements known as the "surface type."

These mute but, to the practised eye, undoubted evidences of man's presence are to be found in the greatest abundance, not only in our own country, but all over the world. The eastern borders of the Atlantic, the Steppes of Russia, the classic plains of Greece, the grottos of Bethlehem, the western slopes of Lebanon, the plains of Babylon, British India, the frozen shores of the Arctic Sea, Scandinavia, Africa, and America—the so-called Old and New Worlds—each and all alike bear witness to the industry of man, whether savage or civilised. With what interest, then, must he who wanders amidst the wild scenes of nature, where probably none but those bent upon searching into her hidden treasures ever penetrate, stumble upon traces of those who have gone before him; and with what surprise must the truth gradually flash upon him, that the spot whereon he stands, at present far removed from the crowded haunts of men, has been peopled—aye, and thickly peopled—by the busy tribes of ancient times!

Before, however, describing the numerous traces of the old folk found during my summer rambles, it will be necessary to initiate those who may not yet be acquainted with the subject, or who, from any preconceived notions, may still be incredulous, into the secret whereby these traces of man's craft may be surely recognised. A few words, therefore, by way of parenthesis on the manufacture of flint implements. When once the eye becomes acquainted with the marks which distinguish a natural from an artificial fracture, it is astonishing how easily the distinction can be traced. Like all other subjects and studies, it requires but education and

practice to obtain a ready facility in the discrimination of flint fractures. It is commonly said that this peculiar form of fracture may easily be seen by anyone who takes the trouble to examine a locality where flints are abundant. Believing, however, that this is not the case, I will endeavour as briefly as possible to give you a reason for my belief. Those who are unwilling to trace any design in the form of these flints, attribute the fractures to natural causes. Now these may be divided into causes arising from the action of either water, frost, or heat.

First, let us consider the action of water; taking the sea as the most powerful agent, do we find "cores" and "flakes," similar to those exhibited this evening, on any flint pebble beach of the existing period? Look at the sea in its most majestic and savage state, when the huge breakers, rolling on with irresistible fury, lash the coast in one long line of boiling foam. Tons of cliff may fall before its *undermining* power; huge masses of limestone weighing from two to five tons each may be carried along from one place to another (as indeed actually occurred from the northern to the southern slope of the Plymouth breakwater) by its *transporting* power; but neither of these agencies can form a "flake," and it is doubted whether they could even *fracture* a flint. The action of the breakers is that of *pounding* or *grinding*. Witness the belts of gravel and sand along the shore at low water mark. Look closely at this gravel and sand—chips there may be, but the chips are rounded and ground. The *gravel* has all its little roughnesses and angles worn smooth, and the grains of *sand*, when viewed through a good lens, present the same appearance. The waves may hurl one pebble against another. Examine this pebble closely; you will see it studded over with little concentric circles, and possibly a small bit knocked off an angle here and there; but the general appearance is that of semi-

circular pits, or indentations, so eloquent of the power of the sea in its fury to bruise and to pound, but not to *flake*. And once again, let us look at the sea in its more peaceful mood, when the tiny wavelets ripple in gentle cadence along the margin of the shingle beach, and the soothing sound of the advancing and receding tide alone fills the ear with that peculiar murmur so familiar to us all. What is this sound? Whence does it proceed? It is the rolling of pebble over pebble as the waves suck them back to their ocean home. And what is the result that we find here? It is this; those angles which yesterday's storm had made are now being rounded and smoothed until the pebbles gradually more and more assume those polished circular and oval appearances, so countless in their modifications. If, then, neither the gentle nor the violent action of the sea can produce the forms in question, we certainly cannot attribute them to river action, for here everyone must acknowledge that the smoothing, rounding, and polishing of one side at least of the pebbles is the chief work that the current of the water in its momentum effects.

It remains, then, but to speak of the agency of frost or of fire, either of which upon flint is somewhat similar. There is a peculiar kind of dark bluish-coloured flint found at the base of the London clay, which when exposed to the air shivers off in all directions, the slightest tap on one of the pebbles causing it to crumble in the hands. These, then, may be taken as examples of the fractures which occur from the effects of either heat or cold. These angular fragments are, however, very dissimilar from the true "flake," and few persons could mistake them. Should anyone wish to make an experiment of heat on flint, let him place a pebble in the fire, and what is the result? A calcined fracture speaks for itself.

Let us now pass on to the main object of this communication, the process by which the manufacture of flint "flakes" and "scrapers" is accomplished, and the marks by which they may

be distinguished. When broken by a blow, one peculiarity of flint is that it presents a "conchoidal fracture." Take a nodule, give it a sharp short blow, knock off a piece and examine the surface of the inner side of the piece struck off, you will then perceive a series of conchoidal or shell-like undulations extending in concentric waves down nearly the whole length of the piece—the elongated ends of the waves pointing away from the spot where the blow was given (vide fig. 3). This point, too, presents a peculiar bulbous appearance, and is called "the *bulb* of *percussion*" by those who have given their attention to the subject, and to whom I am indebted for most of the facts which I now place before you. Every true flake has this "*bulb of percussion*" at one end. Another distinguishing mark is the peculiar keeled or ribbed appearance of the opposite side.

We will suppose a *true* flint Jack (not the spurious fellow whose clever industry ought to have been turned to a better purpose than to that of deceiving antiquaries), with a flint nodule picked up from the sea-shore. He carries it to his post of observation on the cliff, and proceeds from it to fashion a weapon either for the chase, for the capture of fish, or for the preparation of the skins of the animals killed. His first object is to break off one end, and so get a smooth surface, his next to procure as many angles as he can. Having, then, obtained (we will suppose for the sake of illustration) an octangular core, he proceeds with another pebble (possibly of quartz, or of some other hard and tough stone) to strike off the four angles (a, b, &c.,* vide fig. 1) by certain well-directed blows, delivered with practised skill on the points (a. a. a. a). Each of these angular pieces will then, on examination, be found to present the true flake form; there will be a keel or central rib down the middle, and two or more less flat surfaces, with sharp cutting edges on each side: the part nearest

* Vide a Paper by S. J. Mackie, F.G.S., in the "Geol. Report.," for Jan., 1866.

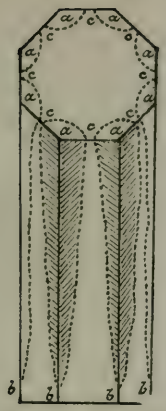


Fig. 1

Fig. 3.

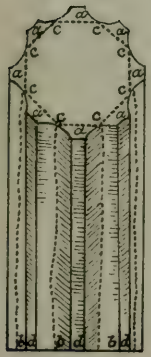


Fig. 2.

b
li
tu
o
p
o
d
e
w
b
w
a
y
e
r

w
p
r
p
a
t
o
h
c
c
c
t
k
l
f
c
f

the core, the under part, will generally be found curved, with a concave surface; and, in accordance with the goodness of the core and the skill of the workman, will be the length and tapering character of the "flake." Some of the "flakes" from Pressigny now in the Christy collection, seen by me during a recent visit to London, reach to a length of at least seven or eight inches, and show great skill in the art of flaking. After this first process the core assumes an altered form (somewhat similar to fig. 2), and the fashion of the "flakes" corresponds. This second series, instead of being keeled, has a flat band passing down the front (a. d.), and the flake c. a. c. b. d. is the result (vide fig. 2).

The core now resumes its former shape before the first set was struck off, and the process may be repeated—the third set being keeled as above described, the fourth flat, banded, and so on; the "flakes" and the core being of course reduced in size at each repetition of the operation. That this is no imaginary process, nor the result of our internal consciousness alone, may be shown by a reference to the workers in stone of the present day, in the New World. Recent travellers have described the manner in which the natives of Mexico and Australia prepare their flint weapons, the nature of the materials still causing the form of the weapons to be alike at all times and in all countries. Sir Edward Belcher, at the meeting of the British Association, at Nottingham, in 1866, gave an account of the method by which the Western Esquimaux tribes at Icy Cape, and yet further north, made their weapons, and exhibited some of the very instruments they used. In this instance the "flakes" appear to have been *pressed* off by a peculiar instrument made of fossil ivory, tipped with the hard point of the reindeer's antler. Again, we have a graphic description by Torquemada, the old Hispano-American historian, of the manner in which the Aztecs made their obsidian knives—still in use at the

present day—and with which that, to us Europeans, necessary act of shaving has been effected. Pressure too, in this case, seems to have been used by means of a stick placed in a particular way against the chest. (Vide "Reliq. Aquit.," Pt. II., p. 16.) To give an instance, however, of the method by which "flakes" are *struck* off, reference may be made to a letter from the great African traveller, Mr. Baines, to the editor of the "Geological Repertory," in which letter he states that in Australia he has "seen an area of considerable extent, say from one hundred to two or three hundred yards, more or less, thickly strewn with fragments, not relics of antiquity, but the refuse of recent labours in the manufacture of weapons for the chase;" and then he goes on to describe the process of the native operator.

In a recent communication from M. Cabot to Sir Charles Lyell, entitled, "An account by an actual observer, in California, of the process of making stone arrow-heads by the Shasta Indians, who still commonly use them," we have a description of the manner in which the Californian Indians make their more complicated chipped weapons. So ingeniously did an Indian, with an agate pebble, shape obsidian arrow-heads before his eyes, that he says,—"In a moment, all I had read of the hardening of copper for the working of flint axes, &c., vanished before this simplest mechanical process." ("Reliq. Aquit.," Pt. III., p. 17.) If, then, the peculiar flaked form be found among savage tribes at the present day, so likewise is that form which has the name of "scraper" given to it, which name alone sufficiently indicates the use to which this peculiar form has been applied, viz., to the preparing of the skins of animals for garments, by scraping off the loose tissue and fat which adhere to the inner side of the skin. The Christy collection contains some very good specimens of sharpened stone "scrapers" still used by the Esquimaux; likewise by the natives of Australia for the preparation of

kangaroo skins to wear as mantles. These implements generally assume a rounded form, they are usually shorter than the "flakes," and more circular, one end being neatly chipped all round to a cutting edge, by a series of careful and gentle blows; the other left plain for holding between the finger and thumb (hence called "thumb flakes"), or for insertion in a handle. In some cases a "*flake*" seems to have been adapted to this purpose at one end, the other left rough as it came from the core.

If, then, you have been able to follow my attempt to describe the process by which these stone implements have been adapted to various uses, you will readily perceive, in the specimens exhibited this evening, evident traces of design, and regard them as the *stone records* of a people long since passed away. They are the result of my late wanderings, but represent only a very small portion of my "finds." Being last summer at the small but ambitious watering-place called "Westward Ho!" in the neighbourhood of Bideford, with the fine coast-line extending from Braunton Burrows to Baggy Head before my eyes, the classic ground of geologists, and well known to me from former visits, I was induced by a recent article in the "Popular Science Review," for 1867, to revisit the old scenes. That article (it must be confessed) had somewhat astonished me. Certain views were there brought forward respecting the ancient "sea-beach," &c., described by Sir Roderick Murchison and others, which seemed to me decidedly heretical. These views appeared to me, from my recollection of former visits to the spot, so groundless, that the doubt crossed my mind as to whether the writer had ever visited the place at all; or if he had, that he certainly had done so without any great amount of careful observation. To verify this I crossed over to Barnstaple, taking the Fremington gravel beds on my way—and here I may mention that these beds rest upon the upturned

edges of the Devonian beds, which present a very disturbed appearance, the cause of this disturbance being apparent in a dyke of "greenstone" which exists on the left bank of Fremington Pill, and which, so far as I am aware, has never yet been recorded in any work on the geology of that locality.* Not the slightest trace of a worked flint rewarded my researches among these gravels: at Croyde and Baggy, however, the result was different. Wandering to the north of Croyde Bay in the direction of Baggy Point, on one of those summer afternoons when the enjoyment of mere existence alone seems to be the *summum bonum* of created things, intent upon any and every thought but searching for flint flakes, my attention was irresistibly called to their abundance on all sides. At the very end of the down—where the promontory projects far into the sea, and where nothing is seen or heard save the blue sky above mirrored in the calm sea beneath, and the scream of the gull mingling its echoes with the reverberating murmur of the tide as it heaves and gurgles in the many caverns and recesses of that picturesque coast—on the very topmost ledge, a well-formed "flake" was sticking out of the "head" about a foot and a half below the surface. Many of the rabbit-holes too were certain locales for these "flakes"—several were lying in the loose earth and sand which streamed away from their burrows. These busy little animals, finding a sharp "flake" sticking out of the side of their hole somewhat detrimental to their comfort, doubtlessly scratched it out with the other ejectamenta. Having been warned by the sloping rays of the sun that a retreat from this wild scene was advisable, I returned towards the village of Croyde over the top of the down, finding in my course "flakes" and "scrapers" plentifully scattered around

*Since writing the above I have seen an allusion to this dyke in Mr. Etheridge's exhaustive article on "The Physical Structure of West Somerset and North Devon."—Quart. Journal Geolog. Soc., 1867.

until coming to a field with a ravine at the bottom, it seemed to me as if the flint implements for the whole of Devon and Cornwall must formerly have been manufactured here. The corn had hardly been cleared off the field—in fact, the shocks were still standing—but nevertheless, in spite of the obstacle of the newly-cut stubble, I had but to sit down, and within reach of me on both sides gather a plentiful crop; and my bag and pockets were soon filled with "cores," "scrapers," and "flakes." Nearly the whole of these flints were discoloured by long exposure on the surface.

Descending from this field to the small ravine, with a trickling streamlet running seawards, I found myself on the spot where Spence Bate, Whitley, Hall, and others have discovered so many specimens. A short half hour's digging speedily showed me that their *facts* were true; however much one may feel disposed to disagree with their *theories*. The "head" here assumes a thickness of 10 feet; in the topmost layer of earth and *débris*, to the depth of 2 feet where the yellow clay commences, "flakes," "cores," and chippings were found in abundance. Time did not permit me to count them accurately, but Mr. Bate observes that there were about 144 "cores," to 1,000 other specimens. The last-mentioned writer thinks these implements were brought down in the "wash" from the field above. With this view I cannot agree, as the "flakes" in every case presented sharp, fresh, and unworn edges, which they could scarcely have done had they been carried down by a "wash." They were, too, in every case comparatively fresh in appearance, merely stained by the matrix in which they were found, not white and decomposed like those in the field above. It seems to me far more probable that just at this point, where the coast sloped down to the little cove, the manufacturers (whoever they might have been) lived and worked. This may have been the focus of their trade, and to this point the flint pebbles were

brought; for flint does not occur *naturally* in this part of Devonshire—the chalk, in which flints chiefly are found, being distant some 70 miles, and the greensand with flint about 13 miles, in a direct line across Barnstaple Bay. Proceeding to the south of Croyde, the "flakes" become more and more scarce, until Northam Burrows are reached. A slightly seawards-sloping sandy beach might be thought the last place where such things would be found, yet here they are again in abundance; only not on the surface, but buried some feet below in a thick tenacious blue clay deposit. At low tide, on the very verge of the receding waves, at certain times patches and long ridges of the blue mud appear denuded of sand; and about a foot beneath this clay traces of a buried forest are found—roots and branches of hazel, alder, oak, nuts, &c. In this clay and, in some cases, mixed up with the carbonaceous matter, flint pebbles, "cores," "flakes," and "chips" are numerous. When first exposed to the air, they appear as black and fresh as if chipped off but an hour ago from the chalk flints; and yet a considerable period must have elapsed since the time when those trees, of which we now find but the traces, extended their roots and threw out their arms over the people who worked beneath their shade. Every indication seems to point to the fact that these "flakes" were struck off in the place where they lie. Since then the land has subsided, and what was formerly dry land, or at least a marshy swamp, has now sunk sufficiently low to be covered by a deposit of thick clay with a top mantle of sand, and to be swept twice every day by the waves of the advancing tide some fathoms deep. A paper on this submerged forest was read by Mr. Ellis at the Dundee Meeting of the British Association, and my "flakes" were then exhibited. In that paper incontestable evidence was brought forward that man had once walked amid these bosky thickets, and worked away at his flints for purposes of everyday life—either for the chase or for

the capture of fish. But my wanderings are becoming tedious. Were I to take you with me along that most remarkable sea-coast extending westwards from Northam, where ancient "rock platforms," old pebble sea-beaches, and strata contorted in every imaginable form abound, you would soon be wearied out with detail. Suffice it to say that these specimens before you were found on every likely headland on that part of the coast, sticking out of the "heads," scattered over the sloping downs, especially numerous near those ravines and hollows leading down to the coast, where the land by its contour gave the readiest access to the beach, and where probably the native picked up flint pebbles well adapted to his purpose. I could as plainly picture to myself the primæval native squatting upon his haunches in the primitive fashion, knocking off flake after flake with rapid and unerring certainty, until out of many worthless fragments he at last got an implement adapted to his purpose, as I could see the native ploughboy of to-day sitting under yonder lime-kiln clearing the shell of the *patella vulgaris* of its raw and juicy contents with a rapidity sharpened by hunger. In both cases the traces of industry are most apparent, in the former the scattered "flakes" and chips, in the latter the heaps of empty limpet shells. In either case the evidences of design are equally traceable when sought for with an intelligent eye. One may almost apply the words of Professor Ramsay on the Amiens and Abbeville flints,—"For more than twenty years, like others of my craft, I have daily handled stones, whether fashioned by nature or art, and the flint hatchets of Amiens and Abbeville seem to me as clearly works of art as any Sheffield whittle." ("Athenæum," July 16, 1859.)

Not only on the North Devon but also on the Cornish coast do these flint "flakes," "cores," and "scrapers," occur. During a short stay at Bude I found them on each side of the haven. Many were lying about on the surface of the head-

lands where the top layers of turf had been stripped away. About six inches below the surface mould immediately above the angular *débris* of the slate rocks, I found a snug little nest of "flakes" of various forms and sizes. Immediately above the ladies' bathing place, to the north of the haven, several were picked out of the head. One of the best "scrapers" exhibited this evening (1 and 3-10th inches long by 1 inch broad) came from the south side, near the Storm Tower: near the flagstaff, too, where the turf had been worn away, several were scattered about; in short, in every likely place these traces of the old folk might be seen. To come nearer home, Solsbury Hill, over Batheaston, appears to have been the habitation of a people who once worked actively at this stone trade, a large quantity of "cores," "scrapers," and "flakes," have rewarded my visits there. The beautifully formed "leaf-shaped" arrow or javelin head (9-10th inch long by 6-10th inch wide) now before you was the result of the last walk of the Club in that direction. In a field which I have called the "Wansdyke Field" "flakes" and cores abound. In the very heart of this city even, near one of the most crowded thoroughfares, at a depth of 14 feet in the excavations at the old White Hart, they are numerous. During an accidental visit there about a month ago, whilst watching an excavation through some 12 or 14 feet of black unctuous earth, I saw several traces of flint chips; and learning on inquiry that no particular attention had been given to such *rubbish*, as they were without doubt considered to be, I watched these excavations from day to day with a considerable amount of interest. The result has amply rewarded me; you will see on the table before you a curious mixture of the industry of different periods. So far as they extend the excavations have now been carried down some 14 feet, to a yellowish and apparently undisturbed oolitic gravel and clay. In this a few "flakes" were found, but from this bed upwards they occur in abundance to

within a few (three or four) feet of the surface, where the Elizabethan pipes come in, with other and more modern refuse. The finest and best "flakes" occur just where the black earth terminates and the yellow band commences. These "cores" and "flakes" somewhat puzzle me. Of what use were they to the Romans? For that they were contemporaneous with that people may be fairly assumed as reasonable from the fact that they are found associated with pieces of Roman pottery, boars' tusks, ox teeth, &c. Is it that we here find traces of a people who had hardly passed from the stone to the iron age? Were iron implements a scarce article with the primitive inhabitants of Aquæ Solis? or, were these flint implements the relics of an ancient superstition, the saxum silex or lapis silex of the "pater patratus"? "O Jove, smite thou the Roman people, as I here to-day shall smite this hog. And having said this, he struck the hog with a flint stone." And thus were consecrated the solemn treaties of the Roman people. (Liv. i. 24; xxx. 43.) That the Jews regarded flint knives with reverence we know. Vide that remarkable passage on the death and burial of Joshua. (LXX. Josh. xxiv. 29, 30.) "Ἐκεῖ ἔθηκαν μετ' αὐτοῦ εις το μνημα, εἰς ὃ ἔθαψαν αὐτὸν ἐκεῖ, τας μαχαίρας τὰς πετρίνας ... καὶ ἐκεῖ εἰσιν ἕως τῆς σήμερον ἡμέρας." (Vide Tylor's "Early History of Mankind.")

But to whatever purposes these flint implements may have been applied, it surely is not an idle curiosity that prompts one to gather up every thread of a lost history, and thus to endeavour to "shadow out the period in the dim distance" when a people of somewhat similar habits and of like wants with ourselves lived, struggled, and perished in this land of ours.

At least this search for the missing links will give a zest to our rambles on the wild sea-coast and the barren moor; and we shall not enjoy the beauties of nature the less for finding that others have gone before us and have left their footsteps behind.

NOTES

ON THE

SUMMER of 1868, particularly the TEMPERATURE, as observed in Bath, and compared with that of Greenwich and some other Places.

BY THE

REV. L. JENYNS, M.A., F.L.S., F.G.S., &c.,

PRESIDENT.

(Read December 16th, 1868.)

THE object of this paper is to give some particulars relating to the past summer of 1868. The time has not yet arrived for determining all the elements of the Bath climate, the meteorological observations, made daily at the Royal Literary and Scientific Institution, not having been conducted for a sufficiently long period—a period which ought not certainly to be less than five or seven years—to enable us to speak, even approximately, of its true character. But the past summer having been one of an exceptional kind, and it being in exceptional weather and exceptional seasons that Bath is most distinguished from other places, it seems desirable to put on record some of the circumstances attending it, especially the temperature, as experienced at Bath, compared with what it was at Greenwich and a few other stations.

The character of the seasons in this country depends very much on the course of the winds,—whether they occur in a

normal or abnormal order. Some might think, from the constant changes that take place in the direction of the wind—the vane continually shifting backwards and forwards, occasionally even veering quite round the compass, and then retracing its steps within a very short time—that the winds could hardly be said to observe any order at all. Yet such is the case notwithstanding. Though fickle even to a proverb, long observation shows that they still conform with more or less regularity to a given law—the law first enunciated by Dove under the name of "the law of gyration"—all deviations from which are sure to be set right in the end. The law may be thus explained. In consequence of the rotation of the earth on its axis, combined with the circumstance of the several parallels of latitude moving with increased velocity as they approach the equator, any body of air flowing from north to south is, at every point of its progress, passing from places moving with less, to places moving with greater speed. The effect of this is to cause it to become more and more a north-easterly wind, while in the case of a current from south to north, or from the equator to the pole, the effect is in the opposite direction, and from a southerly it becomes more and more a south-westerly wind.

From this circumstance the wind has at all times a preponderating tendency to veer round the compass in the direction of the sun's motion, *i.e.*, to pass from north, through north-east, east, south-east, to south; and in like manner through south-west, west, and north-west, to north. It may remain stationary for a time in any one of these points, or it may retrograde even to the extent of a whole revolution, but after a time it always recovers itself, the normal direction being reassumed. At the end of a year, if the vane be found to have made a certain number of revolutions in the wrong direction, it will be found to have made a much larger number in the right. "The vane of Osler's Anemometer at Green-

wich, in twenty years, performed 248 more complete revolutions in one direction than in the other." *

Without entering at length into the subject of the winds, which would be foreign to the purpose of this paper, I would only observe further—that, while there is a normal direction they take at all times with more or less regularity, there is likewise a normal order they conform to with reference to the seasons, however this order may be occasionally broken in upon. All are familiar with the easterly, or rather north-easterly winds, which in general prevail in spring. In like manner, during summer, and often in autumn as well—sometimes even to the close of the year—the prevailing winds are north-westerly, or, perhaps, winds continually oscillating between north-west and south-west, causing that changeable weather which is ordinarily so characteristic of an English summer. Occasionally, however, the easterly winds are out of place; or they prevail to a greater or less extent than usual. They may be in excess, or at a mean, or at a minimum; though from what causes we may be unable to say. I have elsewhere remarked, "that, in all cases of a fine and dry summer, either the easterly winds are entirely out of place, occurring in summer and autumn instead of spring (as in 1846, the finest and hottest summer I ever remember); or else, though occurring chiefly in the spring, they still, in some measure, keep their ground, returning at intervals during the succeeding months. In fact, it is mainly due to the wind settling itself again in the dry quarter, such as the north-east usually is, that the weather remains steady."† No instance has occurred to my observation of a very fine summer, in which the amount of easterly winds was *much under* the mean. If the easterly winds are quite

* Those who wish to see this subject treated of in detail, are referred to Dove's work on "The Law of Storms." An English translation by Scott was published in 1862.

† "Observations in Meteorology," 1858, p. 117.

deficient in summer, the south-westerly taking their place, the summer is wet; if they are at a minimum through all the seasons, the result would generally be a wet year altogether.

How now has it been in the case of the late hot summer of 1868? If we look into the Registers, we shall find that while north-east, north, and north-west winds, or, as we may briefly call them, northerly winds, were all alike deficient from the middle of January to the end of May (with the exception of April, in which month they were more frequent), the south-westerly and westerly taking their place, these same northerly winds were the prevailing winds through a great part of June, nearly the whole of July and August, and the first half of September, the true north-easterly being especially constant in July, when the weather was hottest and most settled. *

But let us proceed to consider the whole season in detail, which, though certainly a very hot one, especially as regards the month of July, was not so entirely unprecedented as some persons suppose.† The first thing observable is that it was not merely a *summer* of high temperature, but the temperature had been higher than ordinary from a very early period of the year. November and December, 1867, had both been true winter months, each having a mean temperature below the average, accompanied by northerly winds. The first eleven days of January, 1868, were likewise cold, but the winter may almost be said to have then terminated, so complete and lasting a change in the weather occurred imme-

* Thus Mr. Lowe, of Nottingham, speaking of the hot weather in a letter to the editor of the *Times*, dated July 15, remarks,—"We had scarcely any east wind in the spring, and its prevalence now accounts for the great heat and drought."

† See "Symons's Meteorological Magazine," No. 34 (Nov., 1868), p. 161, where it is shown that at Linton Park, Staplehurst, "the average temperature of the five summer months of May, June, July, August, and September, was this last season only a trifle over that of 1865 for the like period."

diately after. The wind, which had previously been north-east, shifted on the 12th to south-west, the temperature rose and passed above the average, and there were very few days afterwards when it again fell below it. Mr. Glaisher states that "the average excess of temperature in the 80 days ending 31st March was rather more than $3\frac{1}{2}^{\circ}$ daily: the excess for the 91 days ending 30th June was $3^{\circ}.1$, and for the 171 days (from January 12th to June 30th) the average daily temperature was more than $3\frac{1}{4}^{\circ}$ in excess."* This, of course, was as observed at Greenwich, and does not necessarily apply to Bath, where we have not yet sufficient data for ascertaining what the true average temperature of each month is. It may be desirable, nevertheless, to give the general character of the weather here, compared with Greenwich, from February to July, when the hot weather culminated, and which month will call for more detailed remarks.

The months of February and March were both very mild; February more like spring than winter, having a mean temperature at Greenwich of more than $4\frac{1}{2}^{\circ}$ above the average, and March one of more than 3° above it.

At Bath, the mean temperature of February was about the same as at Greenwich, but that of March nearly one degree higher. As already observed, there was a great deficiency during both these months of the ordinary east winds, and winds compounded of easterly; south to west and west to north winds being greatly in preponderance, and serving to account for the unusually high temperature for the time of year, whereby all vegetation advanced with great rapidity, the buds of many trees and shrubs swelling, and some putting out their leaves, at a very early date.

April was warm, and the temperature above the average, but owing to the wind being more often northerly, not so

* "Reg. Gen. Reports," No. 77, p. 19, and No. 78, p. 19.

much above the average as that of May, which Mr. Glaisher states to have been exceeded in only two instances, the years 1848 and 1833, going as far back as 1771. "The mean temperature of April at Greenwich was 48°.1, being 2°.2 higher than the average of 97 years; that of May, 57°.3, being 4°.8 higher than the same average."

At Bath, the mean temperature of April was 47°.7, being 0°.4 lower than at Greenwich;—the mean temperature of May was 56°.2, being also lower than that of Greenwich by rather more than a degree. It is also observable that in no instance at Bath * did the maximum temperature during May reach to 80°, while at Greenwich it rose to above 80° on two, if not more occasions. On the 19th of May, when in the Institution Gardens the thermometer was never higher than 79°, it rose to 87°.6 at Camden Town, 87° at Greenwich, Staplehurst, Boston, and Gainsborough, 86° at Manchester, 85° at Selborne and Bury St. Edmunds, and at some height between that and 80° at various other places in England. At Wigston, in Leicestershire, it is recorded to have been even as high as 91°.†

In June, the temperature continued advancing beyond the average. The mean temperature of that month at Greenwich was 62°.0, being 3°.9 higher than the average of 97 years. At Bath, it was 61°.5, half a degree less than Greenwich. A more marked difference was observable between Bath and Greenwich, as well as between Bath and several other places, in respect of the maximum temperature attained on particular days. At Bath, the maximum never got above 80°.8, the mean maximum for the month, or the mean of the highest, being 71°.5. At Greenwich the highest temperature

* Here and in other places, when speaking of the temperature of Bath, unless otherwise mentioned, I speak in reference to the observations made in the Institution Gardens.

† This, and some other of the above high temperatures on the 19th of May, are given on the authority of "Symons's Meteorological Magazine," vol. iii., p. 77.

registered was 88°.0, the mean of the highest being 76°.3, or 4°.8 higher than Bath.

At Bath, there were only three days in the month, the 18th, the 27th, and the 30th, on which the thermometer got as high as 80°; while at Tunbridge, in Kent, there were five consecutive days, the 13th to the 17th, on which it rose to 90° or more, standing on the 17th as high as 95°.5.* The mean maximum for these five days at Tunbridge was 92°.1, the mean maximum for the same five days at Bath being only 72°.5, or *very nearly* 20° *less*. Again, on the 20th of June, when the maximum at Bath was 76°.2, at Greenwich it was 88°, at Nottingham 88°.2, at Derby and Bury St. Edmunds 86°, at the Cambridge Observatory 84°.9, while at four places in England the thermometer rose to 90° or upwards that same day, viz., Staplehurst and Gainsborough, where it was just 90°, and Wigston and Manchester, at each of which places it rose to 92°.

So much for Bath, in very hot weather, being hotter than other places, as commonly though erroneously supposed. But we come now to July, the hottest month in the year, in the long run, and true to its character during the past summer of 1868.

The mean temperature of July at Greenwich was 67°.5, being 6°.1 above the average of 97 years, which Mr. Glaisher fixes at 61°.4, and 8°.1 higher than the corresponding temperature of July, 1867. The only instance in which this month had a higher mean temperature is said to have been the year 1859, when it attained to 68°.1.

The mean temperature of July this last summer at Bath, was 66°.3,† being 1°.2 less than at Greenwich. I observe,

* See a letter from Dr. Fielding to the Editor of the "Times," dated June 18.

† I am not quite sure that this ought to be so high, in consequence of a manifest error in one or two of the entries in the daily Register. The mean temperature of the month in my own garden, in Darlington Place, as calculated from daily 9 a.m. observations, was only 63°.7. In general there is very little difference in the results obtained there and in the Institution Gardens. There was scarcely any in respect of the *mean of all the highest* for last July.

however, on taking each week of the month separately, and comparing the two places, the mean temperature was not always less at Bath: some weeks it was greater.

In the week commencing June 28th, and ending July 4th, the mean temperature of Bath was 1°.8 higher than at Greenwich.

In the second week, ending July 11th, it was again higher by 1°.0.

In the third week, ending July 18th, it was no less than 4°.3 *lower* than at Greenwich. This was the week of highest mean temperature during the whole season, and at Greenwich was 70°.7, being said to be 8°.5 above the average.

In the 4th week, ending July 25th, the mean temperature at Bath was almost identical with that of Greenwich, the difference being only 0°.2.

In the fifth week, ending August 1st, the two were almost again the same, there being just the same difference of 0°.2, the small excess being in each case with Bath.

This leads me to think that it is not in respect of the *mean* temperature, which is seen thus to fluctuate when compared with that of Greenwich, that Bath is materially different from other places in very hot weather.

What the true mean temperature of each season and each month of the year is at Bath, must wait to be determined till observations shall have been made for a longer term of years than they yet reach over. But going upon the data we possess, it may be of interest to compare the *mean* spring and summer temperatures at Bath and Greenwich, as also the *mean of the highest* in each of those seasons, in order to see how far the results confirm or negative the above inference. I accordingly give these results in the following Table, just premising that spring includes the three months of March, April, and May; summer, those of June, July, and August. The observations in the Institution Gardens did not commence till March, 1865,

consequently the averages given are those of four years only. The Greenwich averages are those of the same four years, 1865, 1866, 1867, 1868 :—

		Bath.	Greenwich.	Difference.
Mean temperature of	Spring ...	47°·9	47°·7	0°·2
	Summer ...	61·3	61·3	nil.
Mean of all the highest	Spring ...	56·1	58·0	1·9
	Summer ...	70·3	73·6	3·3

It will be at once seen, judging from these few years, that while the *mean* temperature of spring at Bath differs by only two-tenths of a degree from that of Greenwich, the mean temperature of summer being actually the same at both places, the *mean maximum*, or the mean of all the highest, at Bath, is very nearly 2° lower in spring, and more than 3° lower in summer, than it is at Greenwich.

Let us now see how the case stands with respect to the mean maximum this last July. At Bath, the mean of all the highest during that month was 78°.5, while at Greenwich it was 82°.0, or 3°.5 higher. This accords with what is stated above ; but let us pass on to inquire how it was on particular days.

At Bath, in the Institution Gardens, the temperature rose to 80° or upwards on 13 days. Taking the mean of the maximum temperatures that occurred on the *eleven hottest* of these days, I find it 83°. At Greenwich, the mean of the maxima for the same eleven days* was 88°.4, being 5°.4 higher than Bath.

At Bath, the only day on which the temperature rose as high as 90°, was the 22nd, when the maximum was 90°.5, and this was the hottest day in the month. In my garden in

* In making this comparison, my reason for confining myself to eleven of the above thirteen hot days was simply that I had no means of ascertaining what the highest temperature had been at Greenwich on the other two days.

Darlington Place, the maximum was 91°. At Greenwich, however, there were four days in July on which the temperature rose to 90° or upwards, and on that particular day (the 22nd) it rose to 96°.5, making a difference of *six degrees*. That same day (the 22nd) it rose at Nottingham to 97°.3, and at Wigston, in Leicestershire, to the extraordinary height of 98°. Altogether there were, so far as I have been able to ascertain, at least twenty places in England where the thermometer rose on that day (probably the hottest of which we have any record in this country) to a height varying from 90° to 98°, the maxima at all the places, except one, being higher, and most of them very much higher, than the maximum at Bath.

From all this I adhere to the conclusion I came to in a communication I made to the British Association, when it met at Bath in 1864, on the Temperature and Rainfall of the Bath District. I stated in that paper my belief that, though there is no great difference between Bath and other places in England, lying eastwards in about the same latitude, in respect of temperature, in *moderate* seasons or during moderate weather, there is a marked difference when the weather becomes of an *extreme* character, the difference being greater in proportion to the excess of heat, if summer, or the excess of cold, if winter, and amounting on an average to 5° in favour of Bath.*

The above results are all derived from the observations made in the Institution Gardens. It has been sometimes said that the locality is not a fair one, being low down by the river, partially shut in by the Institution and other buildings so as not to admit a free circulation of air, and tending unduly to raise and depress the thermometer in times of extreme heat and cold respectively. It is certainly not the best situation in

* Report of British Association, thirty-fourth meeting, held at Bath, 1864. Communications to the Sections, p. 18.

Bath for placing instruments in to determine the climate ; but it is the only one the Institution had at its disposal, and it serves at least to tell the character of the Bath climate in the lower part of the town, while we may hope some day to get that of other and higher parts from other observers.

Supposing, however, that the maximum temperatures during such hot weather as we had last July *were* unduly influenced by the situation of the instruments, and higher than they ought to have been, the consequence would only be, allowing for the error, to increase still more the difference between Bath and other places, and to prove the former to be relatively yet cooler than we have made it out to be.

To try, however, this question, I applied to Mr. Weston, of Ensleigh, on Lansdown, well-known in Bath as an astronomer, and a very accurate observer of meteorological phenomena, to know exactly what had been the temperature with him on some of the very hot days in July last, Ensleigh being, as far as possible, the very opposite to the Institution Gardens in respect of situation and altitude, on an open down, freely exposed to the air on all sides, and estimated by Mr. Weston to be 740 feet above the sea level.

That gentleman kindly sent me his register for the whole month, for comparison with the one kept at the Institution, and it proved, on examination, that though the mean temperature of July at Ensleigh was 1°.5 lower than in the Institution Gardens, the mean of all the highest was only 0°.7 lower. There were 13 days at Ensleigh, as at the Institution, on which the thermometer rose to 80° or upwards ; though they were not always the same days in the two cases. It is remarkable, however, that *on six of those days the temperature was actually higher at Ensleigh than in the Institution Gardens ;* on one of them, July 15th, the excess was as much as 2°.0, the thermometer standing at Ensleigh at 89°.2, when in the Gardens it was 87°.2. This result surprised Mr. Weston, as it surprised

myself; while it shows that the Garden at the Institution is not so very unfavourable a spot for determining high summer temperatures. What it may be in respect of low temperatures in winter, I am not prepared to say at present. Mr. Weston has suggested one reason why it may have been hotter on the above days at Ensleigh than in the lower parts of Bath, which is probably the true one. He attributes it to the solar radiation, which on those days was very great, especially on the 15th, when it was excessive, amounting at Ensleigh to 140°, the highest during the month. Unfortunately, we have not the means of determining the heat of the sun's rays in the Institution Gardens, there being no suitable spot where a proper thermometer for the purpose could be placed; but we might expect that, so low down as these Gardens are, and so near the river, the air would always be in a more humid state than higher up, and its transparency proportionably diminished. And that such is the case would seem to be shown by the circumstance of the mean temperature of the dew point for the whole month of July being very nearly one degree higher in the Institution Gardens than at Ensleigh. On that particular day, the 15th, the temperature of the dew point at Ensleigh at 9 a.m. was 59°.6, being a depression below the temperature of the air of 15°.9; in the Institution Gardens, at the same hour, the dew point was 65°.6, or 6° higher, with a depression of only 10°; and this difference in the temperature of the dew point was kept up throughout the day, remaining a constant quantity, though of course, at both places, the temperature of the dew point itself varied with the hour. This fact is quite sufficient to show the greater humidity of the town, compared with the higher part of the downs, at least on that particular occasion.

Mr. Weston, in his letter to me, makes an interesting remark on the appearance of Bath on a fine summer's morning from the elevated spot on which his house stands. He

says, "Our high position often shows us the whole Bath valley filled with vapour, while we are basking under a cloudless sky. On one occasion the Avon valley and all its transverse branches, together with a portion of Wilts, as far as the Devizes chalk range, were all submerged beneath a dense superincumbent *stratus* cloud, whose surface was characteristically plain, with its edges very strongly defined.

"The elevated table lands of this district appeared to rise up detached like so many islands, whose bases this silver sea seemed calmly to wash, and the numerous deep transverse valleys, reaching from the great oolite strata quite down to the lias formation, were converted into so many Norwegian Fiords, whose tortuous coast-line was strikingly brought out to view. Farleigh and Kingsdown appeared like a more important island of the group, and its Italian tower easily assumed the character of a lighthouse, while Lansdown stood up pre-eminently in the clear sky.

"A stranger might have thought that he was surveying some sea coast, with its outlying islands; and the geologist might have envied the opportunity of exhibiting such a graphic representation of the actual former state of this very district. The beauty of these scenes is not to be described, but cannot be forgotten."

This manifestly increased quantity of vapour in the valley helps us to explain, in some measure, the depressing feel in the air in the lower parts of the town of Bath in very hot weather. The sensation is illustrated in an amusing way by Mrs. Piozzi, in one of her letters to Miss Willoughby. Writing from Bath, June 15th, 1818, a year as remarkable for its very hot summer as the present year, 1868, she says,—"You are fortunate in finding a cool place during the unlooked for heats of a summer season long forgotten in our country. My house is, as you know, on the hill's side; but down in Green Park Buildings one can't help thinking how a fairy

would feel if held down at the bottom of a bowl from which the hot punch had just been poured away." *

She refers here, and most truly, to the combined effects of heat and a moist atmosphere, well known to be the ordinary conditions of a relaxing climate. Bath lies at the bottom of a basin, a river passing through it, from which there is going on constant evaporation, this evaporation increasing with the temperature of the air, at the same time that the temperature is itself augmented in the streets by reflection from heated walls. Under these circumstances the air becomes both moist and rarified, as well as to a certain degree stagnant, from the surrounding hills keeping off free circulation. In a locality thus circumstanced, any exertion in very hot weather is attended by more or less of exhaustion and languor, in consequence of the amount of moisture in the air checking evaporation from the surface of the human body. The air is what we call sultry. But the lassitude experienced is clearly not due to high temperature alone, for most persons would allow that at such times the air on the downs is more invigorating and salubrious than in the streets below ; though we see that during last July the heat generally was scarcely less on the downs than in Bath itself, while on some days of that month it was actually greater.

To return to the late summer : the hot weather culminated in July, but did not terminate with that month. The beginning of August was still very hot, and the temperature generally high, with a continuance of fine settled weather during the first week ; after which the heat moderated, and there was a change. The thermometer in the Institution Gardens was above 80° every one of the first five days of the month, standing on the 4th at 87°, but falling on the 5th to 83°, though on this last day it rose to 90°.5 at Greenwich.

* "Autobiography, &c., of Mrs. Piozzi," vol. ii., p. 241.

On the 10th it was again above 80°, standing at 82°, making six days altogether in August on which it rose to or above that point (80°).

The mean temperature of the week ending August 8th, at Greenwich, was 69°.8, being 7°.6 above the average of fifty years. The mean temperature of the same week at Bath was 70°.0, being a trifle higher.

The mean temperature of the whole month at Greenwich was 63°.6, being 2°.9 higher than the average of 97 years; at Bath it was 62°.6, exactly one degree lower than at Greenwich.

The mean of the highest for the whole month at Greenwich was 75°.1; at Bath, it was only 70°.5, or more than 4½ degrees less. So that here again we see the chief difference between Bath and Greenwich, in very hot weather, to be not so much in the *mean* temperature as in the *mean of all the highest.*

In September there was a return of hot weather during the first week, the thermometer rising at Bath considerably above 80° on three consecutive days (5th, 6th, and 7th), standing on the 7th at 87°.5, on which same day at Greenwich it rose as high as 92°.1. At six other places in England it is stated to have been above 90° that day (the 7th), though nowhere higher than at Greenwich. Probably there is no former instance on record, in which the thermometer rose so high in September.

The mean temperature of September at Greenwich was 60°.5, being 4°.0 above the average of 94 years; at Bath it was 59°.7 or 0°.8 lower.

The mean of all the highest for September at Greenwich was 71°.7; at Bath 69°.1, or more than 2½ degrees lower. Here, again, we observe the difference between Bath and Greenwich to be chiefly in respect of the high day temperatures.

And this further appears if, having gone over each of the

several months of the past season, we now take the summer *as a whole*, and compare Bath and Greenwich in the same respects. Here, however, I confine myself as before—when estimating the average summer temperatures from the four years 1865, 1866, 1867, and 1868*—to the months of June, July, and August.

The mean temperature of the whole summer of 1868 at Bath was 63°.5, being 2°.2 higher than the average above alluded to, and 0°.9 lower than the mean at Greenwich, which last Mr. Glaisher states to have been 4°.3 higher than the average of the preceding 97 years.

The mean of all the highest at Bath was 73°.5, being 3°.0 higher than the average of the four years above alluded to; and 4°.3 lower than the mean of all the highest, this last summer, at Greenwich. So, while the difference between Bath and Greenwich was *under one degree* in respect of the *mean* temperature, it was nearly *four and a half degrees* in respect of the *mean of the highest.*

Hot summers are almost necessarily dry ones, in accordance with what has been already stated in the first part of this paper. Fine settled weather in this country is, as a rule, attended more or less by easterly winds, *i.e.*, winds oscillating chiefly between north-east and south-east, though they may occasionally fall back to north or even to north-west. These winds are dry and parching, and cause great evaporation, bringing no moisture with them like the south-westerly and westerly. The longer they blow the clearer becomes the atmosphere, and the more open for the passage of the sun's rays. If the south-east winds are moister than the north-east in the first instance, they soon part with their moisture in passing over the large tracts of land they have to traverse before reaching the English shores.

We all know the drought of the past summer. We

* See back, to p. 51.

remember the parched state of the fields, their brown and arid appearance ; the commonest weeds, which usually stand their ground in the most unpromising seasons, in some places quickly running their course, and withering away after the first flowers had seeded. We remember, too, the complaints made of the short supply of water, the springs failing alike for cattle and for domestic purposes. Even in Cornwall, one of the wettest counties in England, at Bodmin, the streams are said "not to have been so low for nearly half a century."* Yet it is observable that the total fall of rain during the year was not at Bath so very much below the average—judging at least, as we alone can judge, from the very few years hitherto for which it has been measured. If we set this average at 33 inches and a half, which is perhaps not far from the mark, the fall for 1868 will have been about 3 inches below the average.† The marked feature, as regards the fall of rain during the past year, was its unequal distribution through the several months. More than one-third of the whole amount fell in the first and last months, January and December measuring each above 5 inches ; while in the three hot months of May, June, and July, the total for those months together was under 2 inches. This quite accounts for the drought, especially when we further take into consideration the great evaporation caused by the high temperatures, not of those months only, but of the previous months from an early period of the year.

The rainfall was also deficient in February and March ; but more fell in April, and in August it amounted to nearly 4½ inches, in some measure making up for the short supplies of the three previous months.

Extremes of weather in one country are met by opposite extremes in another. It has been remarked by Dove that

* Symons's "Met. Mag.," August, 1868, p. 110.

† The year having been completed since this paper was read enables me to say more on this subject than was stated at that time.

"a mild European winter is made up for by a cold one in America or Asia." * Such opposition of character seems to have shown itself in the weather experienced last spring. An American journalist, writing on the 23rd of May, speaks of it as "a cold and backward spring, from which they were (then) just painfully emerging." † There was also a remarkable contrast, as regards dry and wet, in the weather that prevailed in this country last summer compared with what it was in the East. It is stated that "while England and the greater part of the Continent of Europe were scorched to the colour of brown paper and suffering from drought, India was deluged with rain. In Bengal, the quantity of rain that fell in nine months was 11 inches more than the annual average. . . . . In Southern Europe, also, the rainfall was excessive. Parts of Italy were so drenched that prayers for fair weather were offered in the churches. Parma is stated to have been partially destroyed by floods, and railways broken by great gaps." ‡

Even within the range of the British Islands we find an instance of the same contrast. Mr. Jeffries, the conchologist, who was engaged in dredging operations in Shetland, was so hindered all the early part of the summer by storms and rain that he was hardly able to carry on his researches. In his Report to the British Association he remarks that the expedition had not been "so successful as in some previous years, owing to the stormy state of the weather. While my friends (he says) in England, Wales, Ireland, and Scotland were enjoying a calm sunshine, our climate was exactly the reverse; and the persevering course of the wind (from north-west to south-west) prevented our doing much at sea." §

* See "The Edinburgh New Phil. Journ.," vol. liv., p. 224, where several instances are adduced in confirmation of the above remark.

† Symons's "Met. Mag.," No. 30 (July, 1868), p. 86.

‡ "Athenæum" (Oct. 24, 1868), p. 535.

§ See "Ann. and Mag. of Nat. Hist.," Oct., 1868.

As would naturally occur during long-continued northerly and easterly winds, the barometer was high for many months in succession. Mr. Glaisher remarks that the "five months (February to June) were distinguished by having an almost constant atmospheric pressure above the average."* It was so also in Bath, and even to the end of July; this last month, February, March, and June, all having a mean pressure of more than 30 inches.

To the same cause — the long-continued prevalence of northerly winds—may perhaps be attributed another circumstance, which has been the subject of much remark, the infrequency of thunderstorms during the past summer. Mr. Glaisher observes, †—"It is very remarkable that notwithstanding the continuance of high temperatures, but one thunderstorm occurred at Greenwich during the quarter ending 30th of June, viz., on the 29th of May, . . . and generally over the country there have been much less than the usual number of thunderstorms." Mr. Lowe, too, of Nottingham, in his letter to the *Times*, referred to above,‡ states that "there has been much less thunder and lightning than is usually the case during a continuance of hot weather." This, it appears to me, may be explained by the conditions of the atmosphere, however high the temperature, remaining unchanged, so long as the wind keeps steady in the north or north-east, or with only slight oscillations one way or the other. Whenever the wind quits its northerly position for the south-west, and especially in its passage through south-east and south, an intermixture of dry and humid currents, of different temperatures, and probably of different electric conditions, takes place, and a thunderstorm then becomes very probable. It is in summers which, besides being hot,

* "Reg. Gen. Quart. Report," No. 78, p. 19.
† Id.
‡ See back, to p. 46.

are characterised by variable winds, oscillating from south-west either to south-east or to north-west, combined with a humid atmosphere, that thunderstorms are most frequent. In such states of weather, and with such winds, which always bring a good deal of moisture, thunderstorms often have a kind of periodicity, recurring regularly at about the same hour for several days in succession. This hour will be generally coincident with the hottest time of the day, it being then "that the quantity of moisture evaporated from the ground, and taken up by the ascending current into the region of the clouds, attains its maximum, while there is a corresponding accumulation of electricity arising from its 'condensation."*

That thunderstorms are not necessarily connected with hot weather, but that they are more directly due to changed conditions of the atmosphere, caused either by a shift of the wind, or by the ascending current (though from the latter cause they never occur except in summer), is shown by their not unfrequently taking place in early spring, and occasionally even in mid-winter.

In Bath, last summer, during the three hot months of May, June, and July, there were only three heavy thunderstorms, one in each of those months. The first occurred on the 29th of May,—the same day on which there was one at Greenwich, as stated above from Mr. Glaisher; the second on the 19th of June; and the third on the 15th of July. In the first case, the storm was coincident with the passing of the wind from south, through south-west, to north-west; in each of the two last cases with the passing of the same from north-east to south-east and south. In all three months, irrespective of the direction of the wind, the atmosphere was in a very dry state, some days—in May more particularly—remarkably so, as noticed by observers in several places. Both in May and

* See my "Observations in Meteorology," p. 293.

June the mean depression of the dew point below the dry-bulb thermometer was more than 10 degrees; while the relative humidity of the air (saturation being 100) in May was 69, in June 72, some days in the latter month as low as 56. In July the mean depression of the dew point was not quite so great, but the northerly winds were more constant.

There had been two thunderstorms previously, in April; one on the 21st, the other on the 25th; but the weather during the latter half of that month was very unsettled, with an excess of rain, and the air generally in a much more humid state than in any of the three following months. All this seems to afford testimony to what has been above stated with respect to the conditions under which thunderstorms usually take place.

It may be added that the summer of 1835, which was very hot and dry, like that of 1868, was also characterised by the occurrence of very few thunderstorms.

Having now spoken of the principal features observable in the summer of 1868, I proceed to notice a question which some may be disposed to ask, and that is, whether we are ever likely to be able to predict the character of the coming season, so as to foresee a hot summer like that we have just experienced? It would be presumptuous confidently to assert what science, even so backward a science as meteorology, compared with some others, may, or may not, be equal to in years to come. Assuredly, however, we are not in a position to do this at present. We may note some things as favouring our expectations. But while even the ordinary causes that combine to influence weather are so many and so complicated as not easily to be disentangled, there arise from time to time contingencies, which no human sagacity can foresee, to confound all our calculations.

I have no notes by me to refer to respecting all the

hot summers that I remember to have occurred in back years; but I have notes of some, and I find one circumstance worth mentioning that attended most of them, viz., that of their having been preceded by a mild winter. Such was the case with the hot summers of 1822, 1825, 1834, 1835, 1846, and 1859. The winter preceding that of 1822 was, perhaps, the mildest on record, as the summer itself was one of the most extraordinary, dry weather continuing for some months, the harvest beginning in many parts of England on 25th June, and corn being brought to market on the 30th.* The summer of 1825 was very hot and dry, the thermometer, according to Howard,† rising on the 18th July to 97°, and being above 90° for six days in succession: the previous winter was mild, though much less so than in the last case. The two consecutive summers of 1834 and 1835 were both of them hot and dry, and were very much of the same character, and of about the same mean temperature, having been both likewise preceded by a very mild winter, though the spring in each case was cold and ungenial. The summer of 1846 was extremely fine and hot throughout, one of the hottest of which I have any record of my own. It had a mean temperature in Cambridgeshire, where I was at that time resident, of nearly 66°, more than 5° above the average, and nearly 2°.5 hotter than the last summer of 1868. This also was preceded, like last summer (1868), by a *very mild* winter, and a spring likewise unusually mild and forward. The same was the case, as regards the character of the winter, with the very hot summer of 1859. The summer of 1842, which was particularly hot in the month of August, was preceded by a winter of moderate character, the early part mild; spring seasonable, with a dry April and

* "Jesse's Gleanings in Nat. Hist.," 1st Series, p. 250.

† "Climate of London," 2nd edit., vol. iii., p. 194.

May. The only other summers besides those just mentioned, that I remember as particularly hot, were 1818, 1826, and 1858, the last less hot than the two former—of none of which I have any note to say whether the previous winters were mild or otherwise.

From what, however, has been above stated, there would certainly seem to be some connection between mild winters and hot summers, yet it would be very unsafe to argue in all cases that, because the winter is mild, the next summer will be hot; for much depends also upon the character of the spring, and this will depend mainly upon the prevalence or not of north-easterly winds, the usual accompaniments of that season, and which, if persisting very long, are likely to give place at the commencement of summer to south-westerly, and so lead to wet; or if, on the contrary, deficient at that time, may be expected to return later, causing the bright cloudless skies and long run of dry weather such as we have had this year.

But supposing we knew, and could calculate beforehand, all the ordinary agencies at work to influence the seasons, there are extraordinary occurrences, which sometimes step in to defeat our conclusions, due to phenomena not directly connected with meteorology. It would take up too much space to go into details on this matter, but one or two such occurrences, resting on the experiences of back years, may be briefly mentioned. Thus, most persons are aware how very much the temperature of our springs, and sometimes of the early summer, is lowered by the passage southwards in the Atlantic of icebergs coming from the north in larger numbers than usual, chilling the atmosphere for leagues round, and giving rise to dense mists by the condensation of vapour, which through the induced cold can no longer be retained in a transparent state. Some years, "large fields of floating ice are said to have been encountered by ships in latitudes as low as

between 40 and 50 degrees north in the months of March, April, and even May." And such an occurrence was suggested by Mr. Fairbairn, in a communication to the British Association in 1842, "as a probable cause of the low temperature of the summers of 1838, 1839, 1840, and 1841."* But it would not be easy to determine beforehand what seasons, or at what particular time, these icebergs, which are detached from the general mass of ice in the Polar Seas by local and accidental causes, shall occur to produce the unfavourable effect which they have on our climate.

Take again the phenomenon of that "peculiar haze or smoky fog," as it has been called, occasioned by the presence of foreign matter in the atmosphere, traceable in some cases to volcanic eruptions in regions far away, and causing more or less obscuration of the sun for long periods of time. A notable instance of this fog occurred in the year 1783, supposed by some to have been due to a volcanic eruption in Iceland, which broke out on the 8th of May, and continued till August. This mist is said to have overspread "a considerable portion of Europe and Asia, as well as of the north of Africa,"† the darkness and thick air which it occasioned continuing for nearly two months. It forms the subject of one of White's Letters in his "Natural History of Selborne,"‡ and is also alluded to by Cowper in one of his letters to the Rev. John Newton, dated June 13, 1783. The latter says,— "The fogs I mentioned in my last still continue, though, till yesterday, the earth was as dry as intense heat could make it. The sun continues to rise and set without his rays, and hardly shines at noon, even in a cloudless day. At eleven last night

* See also "The Athenæum," No. 1,726, p. 710, where the late Admiral Fitzroy, in an article on "The Weather," suggested that icebergs may have been the cause of the wet cold summer of 1860.

† See "Humboldt's Cosmos," vol. iv., part 1, p. 405, where he expresses a doubt as to its having been caused by volcanic eruptions.

‡ Letter lxv. to Daines Barrington.

the moon was a dull red, she was nearly at her highest elevation, and had the colour of heated brick," &c. *

This unnatural summer is said to have been followed by a severe winter, with "a frost of nine weeks' continuance." And it is not improbable that the severity of the latter may have been in some way connected with it. But if a season is liable to be thus influenced by the character of the one going before, so will the weather at all times be more or less determined by the weather that precedes it, and not merely the weather in that particular locality in which the observer is placed, but in the countries generally around. No sooner has a change taken place, through the operation, it may be, of mere local causes, in any of the phenomena of the atmosphere in one place, than the change, or some effect traceable to it, is transferred by the agency of the ever-shifting winds to other places, even to distant regions—this effect liable to be itself modified by the local circumstances and conditions of each tract of country along which it is conveyed; and, lastly, the whole disposition of things, such as would have naturally followed if left to itself, subject to yet further interruption, as in the instances above cited, from extraneous causes, which no human foresight can well take in.

So complicated, indeed, are the conditions which unite to make up the weather at particular times and seasons, that a wise man may well pause before he confidently predicts what the next season is to be. We may rest our guesses upon this or that circumstance, but they are only guesses, which just as often turn out wrong as right. Lord Bacon says, in his Essay "Of Prophecies,"—"Men mark when they hit, and never mark when they miss," and this is especially true of weather prophets. Some years, we might almost imagine—from the great irregularity of the seasons, even to the entire dis-

* "Hayley's Life and Letters of Cowper," vol. i., p. 338.

placement of the ordinary weather we naturally look for as each season returns—that the machinery of the heavens was all out of gear, and no longer to be depended upon. I have known the thermometer on Christmas Day higher than it had been the midsummer day preceding. I remember one year in which, for three consecutive days in June, the maximum temperature did not exceed 52°, 54°, and 55°, respectively—other years in which it got up, in December, as high as 60°. I have seen the thermometer again, in the middle of March, as low as 7°, at another time near 70°. To take yet another instance. The first half of October, 1834, was characterised by hot summer weather, with a temperature some days as high as 75°; during the same month in 1836, at the time of the Newmarket races, there was so heavy a fall of snow that the course had to be swept before the horses could run.

The spring months, however, perhaps present the greatest irregularity. Thus, April is not unfrequently as cold as March, and one particular year (1837) March was the coldest month of all. Yet April is sometimes warmer than May, and I remember one year (1833) when May was as hot as, if not hotter than, any other month. It is singular that one month should thus stand between two others, characterised respectively as being occasionally, however rarely, one the *coldest* the other the *hottest* month (though probably never both in the same year), that intermediate month, April, partaking sometimes of the character of the one extreme, sometimes of the other.

And, further, in April itself, what sudden and extraordinary changes not unfrequently take place, even from one week to another. On the 7th of April, 1859, the thermometer at Swainswick rose to 78°, while in some parts of England, according to the papers, it was as high as 80°. Only a week previous it had been down to 26°—six degrees below the

freezing point, and not more than a week after it was again very cold, with sleet and snow.

Yet it is marvellous how things right themselves in the end; how, notwithstanding all these strange anomalies, heat and cold, wet and drought, in the long run compensate each other, causing a return of nearly the same averages for each season, when periods of years, say decades, are compared together. It is sometimes thought that the seasons are very different from what they were formerly, and we hear of "old-fashioned winters," or, as Mrs. Piozzi writes, of the "heats of a summer long forgotten in this country;" but such remarks more often arise out of an imperfect recollection of the past, than result from any comparison of trustworthy records. Moreover, we have few records to turn to for any accurate statement of what the true temperature was at any very distant day from the present. Extremes of weather, and extreme seasons, seem always to have occurred at intervals, and doubtless will continue to do so. It is now fifty years since the hot summer that Mrs. Piozzi speaks of, and I have mentioned several others between that time and the present; some as hot as the one we have just experienced. At the same time it is fair to mention that Mr. Glaisher, after a careful inspection of the Greenwich Registers, which have probably been kept for a longer period of years than any others, and kept more accurately, has come to the conclusion that our climate *has* altered in the last hundred years, the temperature of the year being 2° higher now than it was then. This difference, however, is most perceptible in the *winter* months, though "every month in the year seems to be somewhat warmer than before." *

Whether this slight secular change is due to the same causes, continuing slowly to operate, which brought about

* "Proceedings of Brit. Meteor. Soc.," vol. ii., p. 365.

such far greater changes of climate formerly, or to some independent agency, not yet discoverable, the circumstance is not one that need much alarm us. Geologists tell us that climates were very different ages back; that land and sea have, perhaps more than once, changed places, causing by their altered relative position a dis-arrangement of the meteorological conditions of whole latitudes. In this way countries once arctic have become warmer; those that were once tropical have become temperate. But these changes date back to a period very remote, probably long before the appearance of man on this earth. If the same changes are still going on, they advance by such slow degrees as to be only perceptible after the closest looking into all the phenomena by which they are accompanied.

Before our climate can again experience a complete reversal of its present character, man may have run his course. He need not fear, therefore, any interruption of those operations in the field which he looks to as the main sources, not merely of his daily sustenance, but of his wealth and prosperity. He may continue to "plough in hope." If now and then he has a bad season to contend with, he has a good one another year to set against it; or if the yield be deficient in one country, it is met by more abundant supplies elsewhere. He may trust the existing order of things. He has the promise that, "while the earth remaineth," so long at least as it is needed for man in his present state and circumstances, "seed-time and harvest, and cold and heat, and summer and winter, and day and night, shall not cease."

NOTES

ON THE

ROMAN SCULPTURE of the SUN, in the Vestibule of the Institution,

BY THE

REV. J. EARLE, M.A.

THE remarks which I have to lay before you this evening, upon the subject of the Sculpture in the Vestibule, will occupy such a very short time that I shall ask permission to touch upon another subject, one also connected with the antiquities of Bath. In the course of the last summer, excavations were made in this city under the direction of Mr. Irvine, which were seen by many, your Vice-President (Mr. Scarth) as well as myself being among the number, and these have opened up the old baths of the Romans. The rounded heads of the baths in which the Romans luxuriated, with their porcelain or enamelled surfaces, are actually visible; and I was so struck with what was then brought to light, some 14 or 15 feet below the present level of the city, that I now wish to bring before you a little passage which I met with a few days ago. Happening to have a friend staying at my house, who asked me to make a few inquiries among some historians, with whom I have but a shallow acquaintance, I took from my shelf some books which I had not looked into for a long time, and there I found what struck

me as somewhat remarkable in reference to Bath. In a small Latin chronicle—*Gesta Stephani, Regis Anglorum*—which is a history of the events of the reign of Stephen, there is a description of Bath and the baths of Bath, which seems to have a very important bearing upon the rounded baths, to which Mr. Irvine has taken me down. The passage is as follows :—"Quæ civitas Batta vocatur, quod ex Anglicæ linguæ proprietate trahens vocabulum, Balneum interpretatur, eo quòd ad illam ex omni Angliâ infirmi causâ in salubribus aquis diluendi, sani vero gratia mirabiles calidæ aquæ eruptiones videndi, et in eis balneandi concurrere solent." The hot water is spoken of as being conveyed through mysterious channels out of the depths of the earth, and as being collected in a bath, which was splendidly arranged into chambers, with bowed recesses—"ex abstrusis terræ visceribus sursum in receptaculum per cameratas arcuationes gloriosè dispositum"—and this description seems to apply to that which is the actual formation of the Roman baths. The period of Bath history here referred to was in the generation immediately after the time of John de Villula, and it seems from the wording of the passage absolutely certain that John de Villula had built the baths in the splendid Norman style in which you know he did rebuild the Abbey Church. It appears also to be equally plain that at that time the hot water came up in a large pond, from which pond there were recesses covered over with circular arches in the Norman style, and which formed the private baths. Those which have been recently exposed may possibly be the old baths preserved from Roman time, and John de Villula may have only built arches over them.

Having made these few remarks, I shall now refer to the other topic for consideration. The Sculpture of the Sun, which is exhibited in the vestibule of the Institution, is something so unique that I can only say,

for my own part—having all my life taken an interest in these things—that I have never seen anything like it, nor hardly anything which has thrown a large amount of illustration upon it; but in the course of last year, whilst reading over Collingwood Bruce's "Roman Wall"—a book in which there is a great variety of materials, considering it is limited to one line of country, which is the northern Roman wall—I found two or three facts which seem to throw an interesting light upon your own peculiar piece of sculpture, which I will now bring forward. It is, I suppose, generally known that you have in the vestibule a large circular stone figure of the face of the Sun; this face of the Sun is surrounded with a variety of designs, which have a mythological meaning, and it is enveloped in a wreath of oak and laurel. You have likewise other stones sufficient to demonstrate that there was a female figure supporting the circle on one side, and a female figure on the other. Now, under the Emperors, one of the most favourite representations was that of Victory, which, like the figure before you (a drawing by Mr. Irvine), was delineated as a winged female standing on a globe, evidently meaning the world, holding a chaplet in the right hand, and sometimes a palm in the left. This idea of the figure of Victory is very old, as it was set forth in Hesiod, 700 years before the Christian era, so that the "Victoria" of the Romans is really a borrowed Greek idea, and the most famous of her monuments was imported from a Greek city. The statue of Victory which stood in the Senate House at Rome was actually brought from Magna Græcia—from the Greek colonies in the South of Italy. Following out the idea conveyed by the drawing, you will observe that the figure is carrying a wreath in her right hand, ready to place it on the head of the victor. It is not at all an uncommon thing for that figure to be placed in the right hand of statues. For instance, in a temple there would be a variety of gods placed

in niches, and sometimes the god or goddess held on the flat hand that little goddess of Victory as here represented; for this goddess was one of the most common during the imperial time of Rome. In the other representation (admirably enlarged by Mr. Irvine after a woodcut in Mr. Collingwood Bruce's work on the Northern Wall) you have two "Victorys" with one garland between them. It is taken from Mr. Bruce's work, and is intended, in a splendid and exaggerated form, to depict the glories of Legion XX. It would be a sign or blazonry of the Legion, and probably occupied inside the gates a pre-eminence on the walls. There the small garland of Victory was transformed into a vast wreath, which took two Victorys to present it to the view. The effect of these graceful figures on either side is something like the "supporters" in modern heraldry; only more pleasing. That is plainly what you have represented in the fragments under consideration; but here you have the Sun—and Bath was known under the name of *Aquæ Solis*—depicted in the midst of a double garland, which two Victorys are holding up, with the globe for a foot-rest; but it is much more highly perfect as a work of art than the other. The one from the Roman wall was worthy a camp; the one in the vestibule was fit for a polished Roman city. In order to convey to you who are present some idea of the importance of Victory in the minds of the Romans of the first four centuries, I have marked in the work of Bruce a half-dozen places in which this symbolic figure (the single Victory), whole or in fragment, is pictured after relics actually found along the line of the wall.

The goddess also bears an important place in general history. I have already stated that the hall in which the Senate met at Rome was, in fact, a temple of Victory, and that there was a statue of Victoria which had been brought by Julius Cæsar from Magna Græcia and consecrated there.

There was likewise an altar to the goddess, at which each new senator took the oaths, poured forth his libations, and offered the offering of incense, before he took part in the deliberations of the empire. In the fourth century, when the empire of Rome was on the point of changing from Paganism to Christianity, the dispute turned upon this figure of Victory. In the year 326 after Christ, Constantius, the son of Constantine, who was the first professedly Christian emperor, had the altar and the statue removed from the Senate hall. This proceeding caused much controversy and great irritation, which lasted nearly through the remainder of the century, which then had yet three-quarters to run. During that time four celebrated deputations were sent to the Imperial Court from the Senate, soliciting the restoration of the figure and the altar. The first was in the year 382, the next in 384, the third in 388, and the last in 392. The quarrel between the Pagan senators and Pagan public on the one hand, and the Christian senators and Christian public on the other, then took the form of a request on the Pagan side that the statue of Victory might be restored, and on the Christian side that it should not be replaced. The second of these deputations was remarkable on account of the orators who then represented the opposing parties. Symmachus was the orator who spoke on the heathen side, and Ambrose, Bishop of Milan, was the orator on the Christian side. The latter, owing to his great influence and having truth on his side, in the end carried the day, so that the altar and the statue were never replaced. Though that controversy has passed away and is altogether a matter of ancient history, yet it may be considered as attaching to the figure of Victory an interest of a very peculiar kind. As I was last year looking over, for the first time, the Abbey of Malmesbury, in company with the Rev. Prebendary Kemble, who was showing it to me, I was very much struck with the

sculpture of the tympanum over the south door. By the kindness of Mr. Inman, I have a very small photograph of it, but as there is a large porch in front of the door the tympanum is very little displayed. It is well known that Norman architecture is only a modified form of Roman architecture. In fact, the pictorial ornamentation which belonged to the pediment of the Roman temple was transferred to the tympanum of the south door of the Norman church. Now, on the one at Malmesbury you have the figure of our Saviour, in the well known pointed oval (instead of the circular wreath) which formed the medallion of Christian art. Our Saviour is enthroned, and on each side is an angelical figure, which strikingly brings to mind the part assigned to the supporting Victorys. Besides, it is so like the sculpture at Bath, that one can hardly help thinking that there is a relationship or pedigree between one and the other. The work at Malmesbury may have been of the eleventh century; that at Bath must be, I suppose, of the third or very early in the fourth century, which makes you realise what long gaps there are in the pedigree of the family of art. In conclusion, I wish to draw attention to the owl and helmet of Minerva, forming part of the bas relief, which represents, with great propriety, the local associations of Bath—the place were Sul-Minerva was worshipped.

The serpents also in the hair contain a double allusion to Minerva. For in the first place they represent the snaky hair of the Gorgo, whose head was borne on Minerva's ægis; and in the second place, the serpent was no less than the owl an ancient symbol of the goddess. Once when Demosthenes was disgusted with the Athenians, he told them in a sort of half-angry banter, that he wondered at their dear goddess; that she should have chosen to take under her protection three such queer things as the snake, the owl, and the democratic populace.

SUMMARY OF PROCEEDINGS

OF THE

BATH NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB

FOR THE YEAR 1868–69.

MR. PRESIDENT AND GENTLEMEN,

At the close, Sir, of your address to the Members of the Club at their last Anniversary Dinner, you urged them to give a good account of themselves, as occupying a place amongst the many thousands in Great Britain devoted to the pursuit of Archæology and Natural History. Whether, Sir, your hearers have profited by those words and by your own unwearied labours and bright example in the cause of science, will be seen in the Summary of the Year's Proceedings, which the Secretary now lays before you.

Dividing the Proceedings, as usual, under their respective heads of Evening Meetings, Excursions, and Walks, I would here thank those gentlemen who have so kindly responded to my request, and have, at the expense of much time and trouble, given us the benefit of their researches in the various subjects with which they are familiar. It is a matter for congratulation that the papers prepared with so great pains will find a permanent place in the Proceedings, and will serve to lessen somewhat the discouragement which necessarily ensues from the frequently too meagre attendance of the Members at the Evening Meetings when those papers were read.

EVENING MEETINGS.

On February 12th, our Vice-President, the Rev. Prebendary Scarth, gave us an account of the results of his recent explorations in company with Sir John Lubbock, Professor Tyndall, and Mr. Connington, in the neighbourhood of Silbury, whereby it has been clearly ascertained that the Roman road had been deflected some thirty yards to the south of the Mound. This account was prefaced with some remarks respecting the general course of Roman roads through Britain, and the accuracy with which the "Itineraries" or road books described the various stations from the Euphrates to the north of Scotland, and from the regions beyond even the Pillars of Hercules to the Rhine and the Danube. The course of the Via Julia from St. David's, in Pembrokeshire, crossing the Severn Passage to Sea Mills and passing by Bath to Calleva or Silchester, was also described.

March 11th.—The subjects selected by Dr. Bird and the Rev. H. H. Winwood for this evening's discussion were of a somewhat cognate character. The former—under the title of "Odds and Ends of Olden Time"—restricted his remarks to the remains of the ancient races who inhabited this country, as seen in the megalithic circles, the chambered tumuli, or the long and round-headed skulls which have lately attracted so much attention; the latter—giving the results of "A Summer's Ramble amongst Flint Flakes"—described the weapons and implements used by these long or short-headed people. Dr. Bird having, by the aid of photographs and drawings, pointed out the difference in the shape of the various skulls, stated that in his opinion the form of the barrows in which they were found corresponded to the shape of the skulls; *e. g.*, as a general rule, the long-headed race in Wiltshire was interred in the long barrows,

the short-headed race in the round barrows. To the former he attributed priority in age, considering them to be the builders of most of the great pre-historic works in our island. Stonehenge, for instance, probably the most recent of the three large stone circles in our neighbourhood, was, in his opinion, of a date prior to many of the earthen barrows which encircle it, and was erected by the short-headed people, the Belgæ, for the object of sun worship, and for astronomical purposes. The long barrows and round stone tumuli cover the remains of the long-headed great building races of ancient times, the constructors of Cromlechs, Avebury and Stanton Drew. These structures, he thought, with flint flakes, arrow heads, &c., were the earliest records of the human race in Gloucestershire, Somersetshire, Wiltshire, and Wales. Great credit was due to Dr. Bird for the pains which he had taken in illustrating his subject with diagrams and specimens, and the thanks of the Members were returned to him—not, however, without a certain amount of dissent having been expressed at some of the theories brought forward. The object of Mr. Winwood's remarks was to call the attention of the Club, in their Walks and Excursions, to the numerous traces of these ancient people, as seen in their flint "flakes," "scrapers," and "cores;" disclaiming, at the outset, any intention to connect his subject with the question of the antiquity of the human race—a question which does not depend for its proof on these comparatively recent works of man —he endeavoured to show how the evidence of design was plainly traceable in the fractured flints exhibited that evening; that they were plentifully distributed in places where, from the traces of ancient occupation, they might reasonably be looked for; and that they were very similar in form to the implements in use by the savages in the present day in America and other parts of the world. Enumerating the places in Devon and Cornwall where they were found in such abundance, he stated

that several of the localities about Bath had yielded to him some very good specimens, and that they were plentifully distributed amid the black unctuous earth lately excavated for the foundations of the Grand Pump Room Hotel, on the site of the old White Hart. Several Members took part in the discussion, and, as might readily be supposed, were unwilling to give their adherence to some of the statements brought forward—one Member even going so far as to say that he believed a natural law would be discovered, whereby all or most of the fractures could be accounted for. At the same time, those who opposed the theory that these flakes showed design, and that they were the work of man, acknowledged that they had not been able to give sufficient attention to the subject.

April 22nd.—This evening concluded the series with a general *conversazione*, in which the President, the Vice-President, Mr. Charles Moore, and Mr. Weld took part; the President commencing the evening with a description of curious natural phenomena, certain apparent falls of worms in rain. Two small bottles of worms were exhibited in illustration; one contained a species of the common earth worm, *Lumbricus*, found by Mr. Johnston in a paved area below his garden in Sion Place, on the morning of the 8th of March, 1868, after a heavy fall of rain during the preceding night. Most of them were dead. The President accounted for their position by a heavy shower of rain having washed them off the gravel walks and the garden above, where they had been lying out during the night. The other bottle contained specimens of the genus *Mermis*, or thread worm, collected from a garden at Fairford, in Gloucestershire, after a tremendous storm of rain, accompanied with thunder, which occurred mid-day on June 15th, 1845. The box edgings, the vegetables, and garden beds were covered with these worms, which were even found alive and writhing about

on trees some seven or eight feet above the ground. The naturalist Dujardin, in the "Annales de Sciences Naturelles," for 1842 (tom. xviii. p. 129), gives details of their structure, and accounts for the circumstances under which they are found in the following way. The first period of the existence of these worms was in the form of parasites in the grubs of the cockchafer, which take many years before coming to their full growth. Heavy rains saturating the soil compel the grubs, already sick, to contract their bodies and expel these parasites, hence their occurrence after these showers. Their presence on the fruit trees, the President thought, might be explained by their existing in the cockchafers themselves, which had flown on to the trees previous to the showers.

Mr. Charles Moore spoke of the abundance of earth worms and slugs which crawled forth at night even in his small garden, and stated that to his personal knowledge upwards of 25,000 snails and slugs had been destroyed there in one year alone. He also alluded to a fall of small fish which had occurred between 1837 and 1843, over the North Parade and the neighbourhood of Bath. This the President accounted for by a strong whirlwind having caught up the surface water in which they were and deposited them in the places mentioned. Showers of frogs might be explained in the same way. Mr. Moore also exhibited a drawing in sepia from the ink bag of one of his cuttle fish, specimens of which were placed on the table. Their geological position was then described as being in a thin nodular band of the Upper Lias, from six to eight inches thick, the outer form of these nodules being an index to their contents. It was inferred from the great number of hooklets with which their tentacles were armed having been discovered between the ribs of the Saurians, which existed in the same seas, that these cuttle fish formed their food to a large extent.

The Vice-President read extracts from a copy of the original contract containing articles of indenture for the erection of the tomb of James Montague, Bishop of Winchester, in the Abbey of Bath, Nov. 25th, 1618; from which it appears that an agreement was entered into between Sir Charles Montague, of London, Knight, and William Cuer, freemason, of London, and Nicholas Johnson, carver, of Southwark, whereby the latter agreed "of their own proper costs and charges to make, compose, frame, erect, set up, perfect, and finish one tombe or monument of alabaster and touchstone with armes to be carved and engraven, and to be set in their proper colours and mettalls," in memory of "the late right reverend ffather in God James Montague, late bishop of Winchester and prelate of the most noble order of the garter, deceased." Minute details as to the size, ornamentation, and material are then given, and the whole to be "saffelie conveyed to the citie of Bath and in the cathedral church there—transported, erected, set up, and finished in consideration of the full some of two hundreth pounds of current money of England." The Vice-President also described the curious construction of the walls of Borough or Bower Camp in Leigh Woods, near Clifton, and compared them with the petrified forts in Scotland. (Vide "Walks," Tuesday, 31st, 1868.)

Amongst the articles exhibited was a silver medal belonging to the Institution, formerly the property of David Garrick, and worn by him at the Shakespeare jubilee in 1769; some glass slides with slug's teeth, by which the different genera are distinguished; several very fine Pontifical medals and a one hundred franc gold piece, kindly lent by Mr. Welwood; and a modern blowpipe, by which a dart could be expelled with great force.

The Evening Meetings of the present Season 1868-9 were inaugurated by a paper from the President "On Wind and Weather in connection with the Summer of 1868." As this

will appear in the forthcoming number of Proceedings, details are unnecessary.

Two valuable deeds were exhibited by Dr. Hunter, of the dates respectively 1526 and 1597. The earlier one conveyed the lease of the summer pasture of Hayes and Sidenham to one William Cokke, by William Hollewaye, prior of the Monastery and Cathedral Church of Saint Saviour, and of the holy Apostles Peter and Paul. The later conveyed the lease by the Exchequer Court of Queen Elizabeth of the winter pasture called "Sydenham Furlong" to one Robert Williams, of London, taylor. The land in question continued to be in two ownerships until the present century. The summer pasture became the property of the Bath family of Howse; the winter pasture formed part of Hugh Saxey's endowment of Bruton Hospital. To the civility of Mr. Edward Howse the Secretary is indebted for the loan of the deeds, with permission to copy them and print them in the Proceedings. The Abbey seal attached to the earlier of the two deeds is very rare.

The evening of Wednesday, Jan. 13th, was set apart for the Rev. J. Earle and the Vice-President. The former described the Roman Sculpture of the Sun in the Vestibule of the Institution, and the latter spoke of some recent discoveries in connection with Chedworth Roman Villa. Mr. Earle's remarks will be printed; details are, therefore, unnecessary. The discussion which followed is, however, worthy of notice. In reply to the questions whether the history of art indicated with any degree of certainty the period at which the sun was represented by the human face, and under which of the Roman Emperors the temple at Bath was erected, Mr. Earle said that the latter was the very thing they wanted to know, and he admitted it was a very difficult point. With regard to Mr. Rodwell's question, he must refer him to *Montfaucon's* great work, as he was not prepared to answer it. When this

particular sculpture was set up in Bath was a subject that he had often thought of. He looked upon it as not at all impossible that the reign of Elagabalus might be about the time. It was a very singular thing that the worship of the sun in the Roman empire was a matter of late times; it was totally unknown in the Republic, and was in fact a *cultus* that came from the east. They knew it was the great idolatry which the children of Israel were warned against. The worship of the sun and the moon was a practice towards which oriental nations —the Syrians, Babylonians, Assyrians, and Moabites—were most prone. The Baal which they read of in the Bible was nothing more nor less than the god sun, as Ashtaroth was the goddess moon. It was not until the time of the empire that the worship of the sun came to be received at Rome, when the old religion had decayed, when the worship of Isis and Osiris, as well as of Assyrian gods and goddesses, was introduced, and a compact of an amicable kind was made with the superstitions of the subject nations. It was about the year 230 that the worship of the sun reached its acme, when there sat upon the throne of the empire of Rome a person of the name of Elagabalus (Heliogabalus, as he was commonly called, being a Grecised form of the name), a Syrian youth who had been consecrated as the high priest of this idolatry, and hence the great favour in which it was held. It was possible therefore that the figure of the sun in the vestibule might date from the third century.

The Chairman (Mr. Scarth) said, the probable time when the Temple of Bath was erected was a subject that he himself had had under consideration. A German professor of some note—Professor Hubner—who was well skilled in Roman Antiquities, called upon him about a year and a half ago. He had to examine the local antiquities here for the purpose of making a report thereon to the Academy of Berlin, which had since been done. He (the Chairman) asked the Professor

what was the probable date of the pediment of the temple. The latter spoke with diffidence on the point, but carried it back nearly to the time of Titus, the style of the workmanship being in his opinion too good for so late a period as Heliogabalus. Nevertheless, there was a great deal in what Mr. Earle had said. The sun then became an object of general worship; he was upon all the coins of that day, and to Sol altars were very generally erected. He was inclined to think that the Gorgon's head had something to do with the subject represented. The Gorgon's head was on everything Roman—on the pavements, on the amphoræ, the coats of armour, and even upon Roman Fibulæ or buckles. With regard to the figures of Victory, it was curious to note that when adopted in Christian architecture they became angels. At Bradford, they had remains of two interesting figures of Saxon date, which had been separated from some other figure now lost, probably that of our Lord. In after times the angelic figures were superseded by those of the Virgin Mary and St. John. These were not found in early art; that was the latest development of this singular custom, an example of which had existed in the west front of Wells Cathedral, where our Lord had been the central figure in the tympanum, with the Virgin and St. John on each side. He thought they could not be too thankful to Mr. Earle for having drawn their attention to this sculpture, of the artistic merits of which he entertained the same high opinion as that gentleman.

Mr. J. Barrett thought that the baths of the Romans, examined under Mr. Irvine's superintendence, must have been some feet below the plane of those built in Norman times. He should, therefore, have imagined that the former had been filled up—had, in fact, disappeared—and could not have been covered in with the Norman apses to which Mr. Earle had referred. It would be very interesting if that could

be established. He had likewise been always under the impression that this face of the sun was in reality the Gorgon's head; that there was the principle of the ægis—they had the goat's skin which formed the shield, and in the centre was Medusa, or the Gorgon's head. He should like to know when the head was thrown aside, and that face of the sun introduced. The adornments of the face seemed more like the snaky tresses of the former, than the direct linear rays which surrounded the representation of the latter. Nor did he remember what ground they had in mythology for such a connection between the sun and Minerva to which their attention had been called. He should like to ask one question about the term Heliogabalus. Was not the name of the Emperor so called a Greek composite? Was it not more like an adopted Greek word, instead of the Syriac or Oriental name, and therefore that the "o" was introduced? It was singular that the Bible, which, above all things, taught monotheism and discountenanced the worship of anything representing the deity, should have the expression, "The sun rising with healing in his wings." It was, he thought, one of those instances in which the very superstitions of paganism were employed in illustration of the most exalted truth.

The Rev. J. Earle observed that it was an essential element in all learning and knowledge that the highest wisdom and the wildest error had had their points of conjunction, which could not be better illustrated than in the case of St. Paul, when he went to preach the Gospel at Athens. When the Scripture spoke of "the sun rising with healing in his wings," it might be taken as representing a natural fact, that the sun's heat was the most healing drug in existence; or it might be taken as embodying a far higher spiritual and supernal truth, which they, as Christians, all possessed—a truth which was but the expansion of the primary idea that the heat of the sun was, of all things, the most restorative. With

reference to Elagabalus or Heliogabalus, Mr. Barrett had represented the case with perfect justice. It was a question between the Hebrew, or the Hebrew family of languages, and the Greek. "El" meant God, as in Beth "el"—the house of God; "gabal" was the Hebrew for great; and "Elgabal" or "Elagabalus" signified the great God; but when the name came to be handled by Greeks, they already possessed the word "Helios" to denominate the sun, and they therefore translated it Heliogabalus. With respect to the difference in the levels which had been noticed, he believed that as the baths were continually in use and paved below, they would, for a very long time, have defied the alterations in the level to which the surrounding streets were subjected. He thought it not at all impossible, by means of extant literature, to establish a regular line of historical tradition from the Roman period to that of John de Villula, of the baths being in use here; and he considered it as likely as not that John de Villula might have constructed his beautiful baths over the real bases of those of the Romans.

The Rev. H. H. Winwood remarked that persons who had travelled in Lebanon or Anti-Lebanon saw, in some out-of-the-way place, a temple with a pediment very similar to that under discussion. The temple was dedicated to Baal, he believed, and in it the sun was ordinarily worshipped.

Mr. Crickitt made some observations on the extent to which heathen symbols were adopted by Christianity, after which

Mr. C. R. Weld called attention to a paper in the "Archæologia," 36, vol. i., p. 187, by Mr. Scharf, in which the writer maintained that the face on the pediment did not represent the sun or Medusa, but was a symbol of the hot springs, and that the double wreath referred to the groves surrounding the locality; thus, in some degree, perpetuating the old places of veneration.

The chair was now taken by Mr. Rodwell, and the Rev. Prebendary Scarth delivered his address on "The Chedworth Roman Villa." He said that the Roman Villa at Chedworth, in Gloucestershire, seven miles from Cirencester, upon the Foss Road, and two miles from Foss Bridge, was visited by the Field Club about a year and half ago. He called attention to a plan of the Villa, and having explained the arrangement of it, said. 'It is one of the most perfect that has yet been found in England, and the walls which remain are higher, and the pavements which have been preserved are more perfect than in most Roman Villas found in England. It was built upon the slope of a hill, at the foot of which flows the river Colne through a pretty valley. The villa was deserted probably shortly after its destruction, and the remains have continued undisturbed to the present time. It is situated on the property of the Earl of Eldon, who has taken great interest in the uncovering of the remains, and caused a museum to be built upon the spot, with a residence for the curator. An accurate plan has been made of the excavations, which was kindly lent to him by the Earl of Eldon's uncle, Mr. Farrer, from which, with his permission, the one exhibited to the Field Club was copied. From this plan it would be seen that the Villa consisted of three sides of a square, one of which was much longer than the other; on one side were the principal apartments, where the floors were almost perfect, and the patterns of the tesselated pavement were very interesting and well executed; one contained the figures of a dance, somewhat resembling our waltz. The heating apparatus and the baths were clearly shown, and the flues which run up the walls still remained. Beyond the principal bath was a building or chamber containing a tank, and here an altar without any inscription was found. It had probably been erected to the nymph of the fountain; near this a chamber was discovered in which were

found large pigs of iron. In front of two sides of the Villa extended long porticos, where the tesselated floors remained, though much damaged. Under the steps leading into the principal chambers the sacred monogram, the Labarum, had been discovered, incised in the stone. This had been found in three different places, and this seemed to indicate that the builder of the Villa was a Christian. The longest side of the Villa appeared to have been occupied by the wash-houses, baths for the slaves, and other offices; and buildings again behind these seem to have existed, as remains of walls and floors had been found. If we divided the Villa according to Pliny's arrangement—1. Villa Urbana, or owner's residence; 2. Pars Rustica, that appointed for the farm labourers; 3. Fructuaria, or the part appropriated to farm purposes—we might suppose that these were represented by the two portions just described, while the Fructuaria was probably yet to be discovered, unless the lower part of the longer side was appropriated to such purposes, as seemed likely, from a mill-stone being found in one of the chambers and also the appearance of a forge. The upper portion of the Villa had a large court in front of it, which was entered by a gate, the foundations of which still remained. Only one inscribed stone had been found, upon which was written in the Cursive character the word "PRASIATA" or "PRASINATA." This had been conjectured as connecting the Villa with Prasutagus, especially as a brick had been found in the same locality, with the stamp "ARVIRI" upon it, which seemed to connect it with Arviragus, another name preserved to us in Romano-British history; but it was conjectured, with more probability, that the word *Prasiata* or *Prasinata* rather related to the chariot racing of that age, and that it was only the colour of the owner of the Villa, which had been written up by some one favouring the *Green* Faction, of the circus games. This explanation had been suggested soon after the visit of the Archæological

Association to the Villa, which took place this summer, and seemed to be a very probable solution of the lettering. A variety of implements had been found within and around the Villa in the process of excavation, drawings of some of which were exhibited. The most interesting was a perfect pair of compasses, a sacrificial knife, a small pair of fetters for a child's hands, a silver spoon, and a variety of coins, chiefly bronze, ranging from about A.D. 80 to A.D. 450, and of the usual Roman type. Very few articles of any value had been found, and the Villa seems to have been well ransacked before it was burned. The date of its destruction might probably be assigned to the time when Cirencester fell into the hands of the Saxons, after the battle of Dyrham, A.D. 577. Excavations are still being continued, and further interesting discoveries might be anticipated. It was stated that another Roman Villa had been found in that neighbourhood since this Villa was visited by the Field Club; if so, it is hoped that it is situated upon a property where the same care will be shown in the preservation and illustration of the remains. No doubt as many elegant Roman residences had existed around Cirencester as had once stood around Bath, twenty of which might be counted within a radius of a few miles.' In conclusion, the Lecturer exhibited the drawing of a Roman Altar, which had been converted into a small window and placed in Daglingworth Church, a few miles from Cirencester, on the Gloucester Road. The window consisted of two lights, and was probably Saxon, as very interesting Saxon remains had been found in that Church. Between the two lights were some letters, which enabled the whole inscription to be restored. The altar had been dedicated to the Goddess Mothers, and to the Genius of the Spot, by some noble Roman. An inscription to the same Divinities was preserved in the museum at Cirencester. They were worshipped by some of the German

tribes, and drawings and inscriptions to these Divinities might be seen in Bruce's "Roman Wall," and in Roach Smith's "Roman London." Daglingworth Church would well repay a visit by the Field Club.

Both the reverend gentlemen were thanked for their interesting communications, as well as Mr. Irvine for his drawings.

EXCURSIONS.

The gloomy appearance of the morning did not prevent the Members of the Club from collecting in full force on Tuesday, April 28th, for the First Excursion of the season, to Marlborough and Savernake Forest.

The tedious railway journey to Savernake station having been counterbalanced by an excellent breakfast, provided by mine host of the Savernake Hotel, nineteen Members with their friends found themselves, at 10 a.m., under the guidance of Mr. Bolam, agent to the Marquis of Ailesbury, crossing the Park to Savernake House. The site of a Roman Villa having been pointed out on the right hand before entering the house, an inspection of the various objects of interest in the interior was graciously permitted. In the hall hangs the old ivory horn, with its curiously-chased silver mountings, the hereditary badge of office of the forest-keeper and heirloom of the family through many generations of the Seymours. Over a table whereon was laid out Roman pottery from Mildenhall, and two "corn crushers"—one an oblong flint pebble, the other a close-grained siliceous sandstone, showing evident traces of use—hung Bruce's sword. Amongst the marble statues and busts, three especially arrested attention—an antique head from the Tiber; a copy of the Apollo Belvidere, brought from Rome; and a Bacchante. The pictures, though few in number, are most of them the works of the great

masters of their art. Murillo is represented by "The Marriage of Cana in Galilee," a fine picture—with, however, one or two anachronisms, *e.g.*, a King Charles's spaniel sitting at the feet of our Lord. Salvator Rosa, Vandyke, Sir P. Lely, and others adorn the walls. The family portraits are numerous. Amongst them is that of Lady Jane Seymour, Queen of England (painter unknown). Leaving the house by the conservatory, the Members next visited the church of St. Catherine, consisting of nave, north aisle, transepts, and apsidal chancel, erected by Wyatt in 1861, at the expense of the late marquis—a conspicuous feature in the forest scenery, with its elegant spire overtopping the surrounding trees. The fine avenues stretching away from the house—the work of "Capability Brown"—lost much of their distance through the misty atmosphere, the dampness of the day (remarkable even for the month of April) left much for the imagination to fill up. The church of Great Bedwyn was the next point. This fine old cruciform church, dedicated to St. Mary the Virgin, with its late Norman nave of four bays, with deeply-cut zig-zag mouldings and beautiful capitals of varied design, presented a great contrast in the severe simplicity of its interior to the richness and colour so conspicuous in St. Catherine's. From the vicar of the parish, who kindly undertook the explanatory part, it was ascertained that during the restorations in 1866, foundations of a Saxon church were found on the present sites of the chancel, tower, and first bay of the nave. A much defaced image of the Virgin and Child was also discovered on the west face of the last pillar of the north aisle. The tomb of Sir Adam de Stokke, date about 1313, who is said to have built the north transept, and that of Sir Roger, are in arched recesses in the south wall of the transept. Over the cross-legged figure of the former is a very curious crocketed canopy surmounting a stone shelf, with a piscina below. In the chancel are the effigies of Sir John

Seymour, father of Lady Jane; a brass in the north wall to the memory of John Seymour, son and heir of John Seymour, knight; and a brass plate to the memory of Edward Lord Beauchamp, with the following couplet:—

> Bello camp' eram, Graia genitrice, Semerus;
> Tres habui natos, est quibus una soror.

Passing through the village of Bedwyn, once of considerable importance in Saxon times, the Members were conducted to Chisenbury Camp, a fine British stronghold enclosing twelve acres, and commanding an extensive view of the surrounding country. The Wansdyke takes its commencement not far distant and runs up to the camp, passing thence onwards through the forest and across the downs to Shepherd's Shore. Taking shelter in what is now a barn, but which a learned antiquary of the neighbourhood informed the Members was originally the Free Chapel of St. Martin, belonging to the Priory of St. Denny, the pedigree of the owners of Chisenbury Manor was given by the same authority, and several recondite facts connected with archæological lore dwelt upon. The orientation of the Chapel being somewhat S. of E., agreed with the supposed position of the sun as it rises on the festival of St. Martin, in November. The builder of the Chapel, which is of the decorated style, and the constructor of the mediæval moat which surrounds the camp on one side, are unknown; and archæologists even have not hazarded a guess. A couple of breaks here met the Members and conveyed them through the forest to Marlborough, by the magnificent avenue of thickset beeches, four miles in length, which might be compared to one long-drawn cathedral Gothic-aisle. The effect of the interlacing branches was, perhaps, grander as seen in the leafless state than when the foliage hides their many intricacies by its luxuriance, and must, consequently, somewhat dwarf the height of nature's columns. A slight detour from the "Eight Walks" was made to pay homage to

the monarch of the forest, the "King Oak," which now, alas! instead of four sturdy limbs, stretches forth one finger only to the passer by; even this is tottering almost to its fall, as a board beneath, with the ominous word "dangerous," indicates that royalty itself is not exempt from dissolution and decay. The "Queen Oak" shows a more vigorous existence, and is truly royal-looking. The last halt of the day was made at Folley Farm, the site of the ancient Cunetio. Several tesseræ of large dimensions and coarse construction were exposed a few inches below the surface by the aid of a spade, and appeared to have been laid on the surface of the native chalk in a very rough, though effective manner. A piece of red pottery was also found, with the letters (BOLICU) on it, indicating the maker's name. The descent of Forest Hill to Marlborough was the conclusion of the day's Excursion, which was rendered most instructive by the information afforded by several of the neighbouring antiquaries who kindly met the Members at various points, to whom and to Mr. Bolam, who made all the necessary arrangements, the thanks of the Club were cordially given.

The Members of the Club who remained all night at Marlborough, after being well provided for by the care of the landlord of the Ailesbury Arms, left that hotel at 10 o'clock a.m., and under the guidance of the Rev. Mr. Bleek, after visiting the interesting Church at Preshute, which has been well restored, and contains the handsome black marble font in which King John is said to have been baptised, proceeded to Clatford Bottom, to examine the cromlech called the Devil's Den, and the Grey Wethers, a continuous valley of large Sarsen stones which cover the surface of the ground for some miles. The morning was very fine, with a bright sun and fresh breeze, and the party having walked for some distance up the valley, diverged to visit a ruined cromlech, a mile and a half to the east. This, which lies upon the open Down

midway between Marlborough and Avebury, has at one time been covered by a mound of earth, and surrounded by large Sarsen stones. It has, however, been uncovered, and one of the side stones undermined, so as to let it fall inward; and the covering stone, which is very large, now lies above it, having slid down till it rested on the surface of the ground. The chamber consisted of four or five large stones, and has been at the east end of the mound. This cromlech much resembles that well-known as Weyland Smith's Forge in Berkshire, only it is not so elaborate in its construction. Having examined this interesting relic of a primitive people, the party proceeded over the Downs until they reached Hackpen Hill, and from the brow of this eminence contemplated the wonderful remains of Avebury. On their way thither many large barrows were passed, which seem to cluster around this gigantic circle of stones with its attendant avenues, of which, alas! now so little remains, the stones having been ruthlessly destroyed! Happily this monument of our early forefathers attracted attention before its utter destruction had been completed; and from the pen of Dr. Stukeley and from that of Aubrey, and in recent times from the diligent researches of a Member of this Club, whose careful and well-arranged account of Avebury may be read in the 4th Vol. of the "Wilts Archæological and Natural History Magazine," may be gathered all that can be known about it. The Members having arrived at the village of Abury, which stands in and around the sacred enclosure of the mystic circle with its ditch and mound, proceeded to walk round the outer circuit of the mound, and count the stones which remain within the enclosure of the ditch, and had once formed nearly a perfect circle within its boundary. The mound being thrown up *outside* the ditch, shows that this huge entrenchment could not have been for defensive purposes, but most probably for religious rites, or for

national assemblies. On the western side, where the mound has been levelled and the ditch filled in, the church stands, together with a farmhouse and its accompanying fold-yard and buildings. These break the continuity of the circle, and the church and the buildings, with the walls around, show the use to which the huge Sarsen stones have been put, which once formed the sacred ring. Within this ring have stood two other circles, some stones of which remain; and again, a cave or cell within one of these, all which are accurately laid down in the instructive paper already referred to. After carefully examining the circle, the Members visited the parish church, which contains a very interesting Rood screen, and the remains of the Rood loft, and the access to it, as well as an ancient Hagioscope, or squint. It was a subject of regret that a church which presents so many interesting features in its architecture, should, in these days of church restoration, remain in its old and unsightly condition, blocked up with huge pews, which are now almost universally condemned. From Avebury the Members walked to the vast artificial mound of Silbury, lately the object of such interest, when an attempt was made in the autumn of last year to ascertain the approximate date of its structure, by digging into the hill horizontally, to find traces of the ancient Roman road from Bath to Marlborough, upon which the hill was supposed to have been cast up, and therefore more recent than the Roman road. This, however, passes just to the south of Silbury, and no traces of any road could be found at the base of the mound or within it; but the course of the Roman road was clearly evident just to the south of the hill, and the bed of the road exposed by successive sections, at intervals of a hundred yards. The course was pointed out from the top of the hill, and the party, having surveyed the line of the Roman road from its summit and also traced the line of the Wansdyke which is visible

from hence, and could be observed in the whole course of this morning's walk, proceeded by the turnpike road to Calne, where they took the rail for Bath, and arrived at home after a second day of much interesting and instructive investigation.

The Second Excursion for the season was made on May 28th, to Camel and Cadbury Camp. Nineteen Members with their friends, amongst whom was the Dean of Ely, left Bath at an early hour for Sparkford Station, walked down the line to the cutting which runs through the quarries, and, seated beneath the shade of the bridge which forms a fine span across the line at this point, spent a pleasant half-hour in listening to Mr. Charles Moore's description of the section before them.

Referring to his paper lately read before the Geological Society in London, in which the details of the various beds are fully given, he alluded to the important effect which the uplifted range of the Mendip Hills had in altering the characteristic features of the secondary deposits to the north and south of that range. The thickness of the deep-sea deposits on the south being vastly greater than the corresponding beds to the north of the barrier—*e.g.*, the lower lias alone, which is 700 feet thick without the coal-basin, being reduced to 2 feet within. With more especial regard to the cutting in which they were assembled, consisting of a succession of 260 beds, with a thickness of 275 feet, Mr. Moore described the various physical and palæontological peculiarities of each bed, from the Keuper marls of the new red sandstones at the base on the south, ranging up through the Rhœtic clays to the white lias and Mr. William Smith's "sun bed" (the topmost bed of the Rhœtic series) and onward in ascending order to the blue lias proper up to the lower horizon of the lower lias. Every bed almost, after passing the Keuper marls (which are singularly destitute of organisms, and are probably a brackish

water deposit), has its peculiar fauna. The passage in this typical section of one bed into another was particularly well marked. After pleasantly discoursing upon his various discoveries in the Rhœtic beds, where traces of the first quadruped and the oldest land reptile have rewarded his research, Mr. Moore conducted the Members into the quarries on right and left of the line, and pointed out the succession of the beds, from the "sun bed" up through the insect and crustacean beds, to the "hat and cap," and other beds of the lower lias. A few fish scales and a tooth or two alone revealed themselves to the various hammers that were at work. The usual fossils were apparently but thinly scattered in these beds. Passing along the ridge to Camel Hill, the strike of the Rhœtic and lower lias was followed east and west, and a halt called on the hill to admire the fine view from the Mendips on the north to the Quantocks on the west and south. Here Mr. Moore again explained the geological features of the country, spread out like a map at his feet. From the disturbances of the strata, and their sharp dip in opposite directions to the north and south, it was suggested that the intervening trough would be the place where the landed proprietors in the neighbourhood might try for coal with a possibility of success. Mr. Scarth also here pointed out the line of the Roman road, from the Port ad Axium over the ridge of the Mendips to Old Sarum, passing along the line of the mining country. After a hurried but ineffectual search after crabs and lobsters in the crustacean beds in the quarry beneath, the Members passed on to West Camel Church, and were well rewarded for their hot walk, the well-restored little church containing many details of great architectural value. In the churchyard, raised on a temporary pedestal, stands a portion of a very ancient cross, one of its sides covered with the usual interlacing work of the period; two serpents forming an oval space, with their heads approach-

ing each other and tails crossed, and other hieroglyphical emblems represented on the other side; the remaining two sides have been cut away to form the portion of a jamb to a doorway at some early period, and the whole was found during the late restoration built up in the wall of the church, the sharpness of the ornamental details being entirely due to that position. A fine old font, with interlacing Norman arcading, stands on the left of the south doorway. The roof is a good specimen of 15th century work. A Hagioscope, or "squint," is preserved in the north transept chapel. Beneath the tower, which curiously takes the place of what would be the south transept, in the east wall, is a double piscina with sharply pointed arches, certainly not of a date more recent than early English. Over the site of the Rood loft the roof has been coloured. A very good so-called "lepers" window at the back of the pulpit on the south side, sedilia, and piscina in the south wall of the chancel constitute the remaining features of this very interesting little church, of which the rector of the parish (the Rev. W. L. Metcalf) was most obliging in pointing out the peculiarities. Returning thence to Queen Camel, a sulphureous spring was passed, which issues close to a little brook, possibly from the Rhœtic or liassic shales; the smell of rotten eggs indicated its vicinity, and Members who were conversant with the Harrowgate waters at once pronounced its identity. The natives call it the "water that never sweats," and the "black well." Queen Camel Church has a good tower and screen, and is the skeleton of a fine church. Whitewash, high pews, and a "parson and clerk" reading desk are the chief characteristics of the internal arrangements. After lunch at a small inn at South Cadbury, the chief feature remarkable about which was the high price of the viands, the Fort of Cadbury was stormed under the guidance of the clergyman of the place and H. E. Bennett, Esq., of Sparkford, who was the kind cicerone for

the day. It will be well here to state that certain preliminary difficulties had to be overcome before the ascent was commenced. The proprietor (Colonel Bennett, of Cadbury House) having suffered from the propensity of archæological visitors to overthrow walls, requires visitors to the Camp to acknowledge his rights, by first, as an act of courtesy, asking his permission. This having been granted, a winding ascent by fern-clad ditch and vallum was made past the usual King Arthur's well on to the summit. The hill consists of a capping of inferior oolite; the rock on the west side assumes a very peculiar form, and is of a close marble-like texture, very similar to white lias, from which it is with difficulty distinguished. Several pieces of ancient black coarse British pottery were found, with flint chippings and flakes.

Having enjoyed the magnificent view for a while, and a refreshing cup of coffee at the rectory, the Sparkford Station was reached after a pleasant but rather fatiguing day. The great heat of the sun was remarkable.

The Third Excursion, fixed for June 16th, to Shrewsbury and Worcester, did not take place, three Members only of the Club having signified to the Secretary their intention of going. The thanks of the Members are, however, due to Mr. Scarth, who kindly gave an account, at a Special Meeting summoned for the purpose, of the excavations recently carried on at Uriconium, and exhibited a map and plan of that ancient city, the foundation of which, he thought, might probably be as early as 50 A.D., and the destruction about 584 A.D.

Nineteen Members with their friends, met on Tuesday, September 22nd, for the Last Excursion of the season to Thornbury Castle and Aust Cliff. A four-horse break, after certain mishaps in the Bristol streets, conveyed the Members in safety through the villages of Horfield, Filton, and Almondsbury to Thornbury; the latter portion of the

road, before approaching the "Ridgeway," passes through a fine avenue of oak and elm trees; at Almondsbury, a few minutes' halt gave an opportunity of enjoying, from the quarry's edge, the extensive and well-known view across the richly wooded alluvial plains which bound the golden Severn. The long street which constitutes the ancient market town of Thornbury was more than usually animated this morning, and justified the accounts of its historical antiquity, as it was then holding its annual "Mop" fair—a piece of benighted barbarism which it was hoped the enlightenment of the nineteenth century had generally dispelled. After threading their way through "cheap Jacks," country girls in many-coloured attire, and an improved and somewhat recent addition of a "Merry-go-round," the Members found themselves in the quiet precincts of the lofty and well-restored perpendicular church, under the guidance of the vicar. The late Norman doorway to the south porch, the square-headed font of the same period, the Decorated sedilia with three seats of the same level, and piscina in the south wall of the chancel (brought to light during the late restorations), and a fine brass representing a female figure of the sixteenth century, probably the wife of "Thomas Tyndall, who dyed xxviii. April, 1571," memorialised in brass with some verses below, were among the chief architectural features worthy of record. It must not, however, be omitted to state that an animated discussion was carried on in the vestry, where the vicar had laid out for inspection some old registers of the parish. The opinion of one of the Members—to whom the sight of an old faded parchment is even more refreshing than that of tawny port wine which has lost its colour through age—was that the document was a copy of the old parish register, A.D. 1540, made by a painstaking vicar, who affixed his "Mem. John Jarsen minister, 1598," for the purpose of transmission to the then authorities in London. A tablet

fixed to the north wall of the chancel, in memory of Sir John Stafford, Knight, Gentleman Pensioner to Queen Elizabeth, and Constable of Bristol, who died 1624, attracted attention by the peculiar, but clear and legible, characters of the letters. From the Church to the Castle adjoining on the south side was but a short distance, under the kind guidance of Mr. Richard Scarlett (the solicitor to the proprietor, Mr. Howard), the various architectural details were pointed out. Entering through the south gate of the court-yard, which is surrounded by the outer loopholed walls, much of which is standing, admission is gained to the inhabited parts through a western Tudor gateway with socket for portcullis, and the badges of the Stafford family—the golden Stafford knot, the silver swan, the blue ermined mantle, and the spotted antelope—represented in the spandrells above; and an inscription on labels stating that this gate was begun by "Edw. Duc of Bukkingha, Erlle," of Hereford, Stafford, and Northampton, A.D. MCCCCCXI, with the motto, "Dorens avant." Shakespeare's—

> "Bounteous Buckingham,
> The mirror of all courtesy."

Though the principal remains of this Castle (a very good example of the mixed architecture of the Castle and the Hall, in which military and domestic conveniences were happily blended) are those of the 16th century, yet a much more ancient building once existed upon the site, built by Ralph Lord Stafford, temp. Edward III., of which apparently few historical details exist. Permission having been courteously given to pass through the interior—which has been most comfortably adapted to modern wants, the old keep being now turned into a dining-room—the Members were conducted to the south front, so far-renowned for its magnificent bay windows, and the elegant treatment of its moulded brick

chimneys, which, instead of being an eye-sore, as is generally the case, are by no means the least elegant feature in the building. The Stafford knot, with the date 1514, attests their antiquity, though the sharp moulding of the bricks by no means indicate such a lapse of years.

The remaining part of the day was devoted to an examination of the well-known Aust Cliff, with its "bone bed" so full of traces of ancient life, to which the age of the Castle, or even of those Romans who used the Augusti trajectus, is but as yesterday compared with the *œons* which have elapsed since those deposits were laid down. Diligent use was made of the waning day, and after a general view of the section had been obtained from the end of the causeway, where the three faults, and the succession of the different beds, from the red marls to the lowest beds of the lias which cap the top, are best seen, some preliminary remarks were made as to the conflicting views held by Dr. Wright and Mr. Charles Moore respecting the true position of the Avicula contorta beds; the former being of opinion that these beds, which are here represented by intervening bands of black shales, argillaceous limestone, and calcareo-arenaceous beds, with the celebrated bone-bed at the base, belong to the Keuper marls below; whilst the latter states that these shales, &c., are the only representatives in this country of the Rhœtic formation, which assumes so vast a thickness on the continent, thus placing them on a higher horizon. Mr. Moore also states that these Avicula contorta beds are almost invariably overlaid by the White Lias, which latter bed he also includes in the Rhœtic formation. The Members, however, in their walk along the beach failed to trace a single specimen of the true White Lias rock, although specimens of every other bed which exists in the section were found. Many specimens of fish teeth, scales, and saurian bones, Ostrea liassica and other shells were found in abundance.

A pleasant drive past a series of parks, through the villages of Henbury and Westbury, and across Durdham Down, concluded a very agreeable Excursion.

WALKS.

The Tuesday Walks and Excursions, by no means an unimportant feature in the Proceedings of the Club, have been maintained with the accustomed assiduity. One of the earliest in the spring of 1868 worth recording was on 3rd of March to Batheaston, for the object of testing the temperature of the water that flows from the shaft sunk to the depth of 670 feet in the trial for coal made A.D. 1812, into the Mill Brook, a distance of 108 yards. The result was the following:—

	External Air.	Brook.	Spring.
Negretti and Zambra ...	53° ...	47 ...	57
Casella (Alpine Therm.) ...	53 ...	47 ...	58
Wadham's	50 ...	50 ...	60

The Negretti and Zambra, when tested with the standard thermometer at the Institution Gardens, was -1°·8. The taste of the water was somewhat saline.

In the same month, the Roman road was traced from the Ford at Bathford, up the hill to the Church, through the churchyard and fields to Farley Down. The Secretary found some "flint flakes" and "scrapers" in the field through which the Roman road passes at the back of the Church; also on the top of the Down in a field behind Brown's Tower: flint pebbles are very abundantly scattered over this field.

Englishcombe and its so-called Barrow were visited on another day, and the grass-grown mounds which encircle what was formerly the baronial castle of the De Gournays. Whilst tracing the Wansdyke in the fields near the orchard to the west of the Church, several fine specimens of inferior

oolite coral, the Isastræa, were found lately dug out from a recently made drain. A lean-to on the west of the old Manor House, which once sheltered Monmouth on his way to Philip's Norton, and is now a public-house, having been blown down, exposed several windows of the original house.

On Tuesday, 31st March, 1868, the Camp on Clifton Down, and the two camps on the opposite side of the River Avon on each side of Stokesleigh Slade, commonly called Nightingale Valley, were visited. The new road made to the bridge has cut through the three ramparts of the camp, called Bower Walls, nearest the bridge on the Somerset side. These three defensive works are still marked by a corresponding number of undulations in the wall bounding the road, which has here obliterated the defences. The area of the Camp being required for villas, another road carried round the north side of the precipice overhanging Nightingale Valley has also destroyed the traces of the rampart on the north side, and the earth works between these two roads to the west are being carried away for the lime and stone they contain, and will soon be totally destroyed. The interior of the innermost and highest of these defences is very interesting, the core of the earth work being composed of lime and stones, with the remains of burned faggots, the whole being formed into a compact mass in the heart of the rampart, which is made of loose stones, overgrown in places with vegetation. The defence was thus rendered very strong and could not easily be cut through, and the manner of constructing these defensive works by the aid of fire and slaking the burned lime, which was again covered with stones, gives a good idea of the rough and ready defensive works of an early age, and somewhat resembles the construction of the vitrified forts found in Scotland and in Brittany. These defences were carefully examined by the Club, and sketches made of the core of the rampart. The

Camp on the other side of the ravine, called Stokesleigh Camp, which remains quite perfect, was also examined. A brief account and a rough plan of these Camps will be found in the volume of the Journal of the "British Archæological Association for 1857," and a very full account in Sayer's "History of Bristol." It is well that some notice should be taken of these interesting earth works, as Bower Walls will soon be entirely obliterated by the advance of building. These three Camps give an idea of the great importance of the navigation of the River Avon in very remote times, and furnish a clue to the early origin of Bristol.

In April, a most interesting expedition was made to the Willsbridge section (figured by Mr. Charles Moore, in "Quart. Journal Geological Society," vol. xxiii. part 5), on the Bath and Mangotsfield line. Leaving the train at Keynsham, the Members walked along the new cutting to Bitton, passing good sections of the lower lias (Am. Buchlandi beds) and drift gravels, which are four feet thick in some places, and consist of pebbles from the mountain limestone, pennant, "Bitton sawyers" (a hard siliceous close grained sandstone), lias, oolite, flint, &c. An engine and trucks under the superintendence of Mr. Donaldson, the engineer of the line, conveyed the party from Bitton to the last cutting near Mangotsfield, where a most instructive section of fire clays, shale, and sandstones, with occasional seams of coal cropping up at the surface, is exposed. Owing to the disturbances which have taken place here, the beds are much dislocated and almost vertical; the coal seams, about three feet thick, afford good fuel for the navvies' fire. On the upturned and almost vertical edges of the shales repose wedge-like beds of clay and coal, which seem almost like a later deposit or in-filling. Leaving the trucks at Oldfield Common, Mr. Moore conducted the Members down the line to his section, passing a great thickness of pennant deeply coloured with

hæmatitic iron, variegated red and blue marls of the new red (Keuper marls), Rhœtic, Avicula contorta beds, and white lias beds, with the invariable sun bed of William Smith, and the lower lias limestone and marls. The lias in this section lies in a basin, being probably pressed into this shape by the disturbances of the pennant rocks to the north. At the end of the cutting to the south, the Keuper marls, and new red sand stones are again met with. Crossing the hill to Bitton, a short delay was caused by the hospitality of Mr. Stanley, and the examination of a pit where the sands of the inferior oolite are seen. As a finale, Mr. Somerville's paper mills were inspected under the guidance of his son, and the whole process from the sorting and boiling of the rags, through the cleansing and colouring of the pulp into its final issue in sheets of foolscap cut and ready for packing, courteously explained.

On 2nd June an expedition to Bromham was arranged. The train was taken from Bath to Chippenham, the Church at the latter place, with its lately restored Norman chancel arch, inspected, and a drawing of the monument to the Pryn family made, and the inscription copied. Seend having been reached by train, and a visit made to the Church and Churchyard with its fine view of the Chalk Downs, a walk through pleasant lanes and across fields took the Members to Bromham. The Church is full of interest, especially the Baynton Chapel —all the monuments, with the heraldry, are accurately drawn and described in Dingley's MS., and they appear now quite as perfect as in the time of Charles II., when Dingley copied them. Under the kindly guidance of the Vicar, the points of interest in connection with the Church were explained. Originally a Cross Church with central tower, it formally belonged to Battle Abbey, in Sussex. The Baynton Chapel was added in the time of Henry VII., and the rich perpendicular work resembles that of Henry VIIth.'s Chapel in

Westminster Abbey. Thomas Moore, the poet, lies buried with other members of his family in a vault in the churchyard, and Sloperton Cottage, where he lived for 40 years and died, is only a short distance from the Church. A curious old timber house exists in the village, the floors of which are said to have been made out of the timbers of the ancient church roof. The Members having partaken of lunch, at the kind invitation of the Vicar, the Rev. E. B. Edgell, were conducted to Spy Park, and saw the new house in course of erection by Colonel Spicer; the old house of which Dingley gives a sketch is still standing. Exit from the Park to the church built by Capt. Gladstone was made through a very fine gateway, defaced by some modern constructions added for strength; thence over the brow of the hill, which commands a noble view with Lacock Abbey in the foreground, to Corsham, and by train to Bath.

On September 9th the Members joined the Geological Section of the Bristol Naturalists' Society in a Walk from Limpley Stoke to examine the now overgrown section of upper lias opposite Dundas. A single bed of upper lias about one foot thick, with an intervening band of gray clay, immediately underlies the sands of the inferior oolite, which here thin out to some 20 feet merely. Some very good specimens of the characteristic fossil, the Lingula Beanii, were found in the marlstones below, portions of a crustacean, together with the Ammonites Walcotii.

On the 23rd of the same month another pleasant Walk was taken with the same Society from Bathford to the oolitic quarries on Farley Down, and many good specimens collected. A curious recent conglomerate containing flints in a matrix of lime was pointed out by the Secretary. This recent deposit was evidently caused by an infiltration of carbonate of lime forming a cementing matrix for the flints.

Mr. Stoddart's aneroid at the base of "Brown's Folly" gave 623 feet as the height above sea level.

On November 10th, the Members visited the curious underground excavations in Redcliff Hill, Bristol, under the guidance of Mr. Reynolds. The branch line of railway from the Terminus to the Floating Dock has recently cut through one of these passages at the back of Guinea Street. Here an opening about 20 or 30 feet beneath the surface leads to a low corridor which was followed with considerable difficulty, owing to the sewage which had recently accumulated there, until several branching passages were reached, which opened out into arched chambers supported by roughly cut columns. One about 60 or 80 feet in diameter and from six to eight feet high was especially worthy of notice, as a well had been sunk through one of the central columns, and the sides lined with masonry—the depth from the floor to the bottom appeared to be about 40 feet; some of the passages had been walled up. The whole of these, which ramify in all directions and extend even up to the Church of St. Mary's, Redcliff, at which point they were entered about four or five years ago by those engaged in the restorations, are cut out of the new red sandstone rock, and bear in many places, on the roof and on the columns, traces of a sharp pointed pick. The entrance to these appears to have been from the wharf at about 14 feet above water mark, and they have been for many years used by Messrs. King, as storerooms. Various have been the speculations as to their origin and use; in a map of Bristol, A.D. 1250, the Hermitage of St. John is represented as existing on this spot. The lunch, so kindly provided afterwards by Mr. Reynolds, was most acceptable.

Several visits have been paid by some of the Members from time to time to the cutting near the Upper Bristol Road, opposite Twerton, on the new line of railway between Bath and Mangotsfield, and accurate measurement of the white

lias taken. At the end of the cutting farthest from Bath the various beds, together with their thin wafer like partings of clay, assume the thickness of seven feet, and are followed by masses of impure concretionary limestones and marls passing into blue clay, at the base of which a thin bone bed half an inch thick immediately underlies the metals. A very fine fault to the south-east brings down the lower beds of the lime series to the base of the cutting.

The dip of the white lias to the north-west of the fault is 5° south by west, but owing to the disturbances which have caused the downthrow of the upper beds, the same beds on the opposite side dip at an angle of 20° in a similar direction; the width of the fault from shoulder to shoulder of white lias is 106 feet.

In the last Summary, mention was omitted to be made of a Walk by the Club on the 2nd July, 1867, to Battle Field the residence of A. C. McDougall, Esq., for the purpose of inspecting two tumuli on that gentleman's property. A very hospitable reception awaited the Members after a damp traverse along the eastern outcrop of the oolite. The tumuli appear to have been already examined, so that it is doubtful whether they would repay the expense and the labour of re-opening.

The words of Mr. Gerkie in his address as President of the Edinburgh Geological Society will form a fitting conclusion to this summary. Speaking of the advantage of local efforts and the benefits to the cause of science by Members bringing to the Meetings notices of new facts and discoveries made either by themselves or others, he says—"The ambition of a local society should be to be distinguished by the amount of useful work which it can do, being well assured that no such work, no matter how local in its first aspect, can be honestly done without adding something to the stock of knowledge, and thereby advancing the cause of science."

Copy, made by the Secretary, of the Deed in the possession of Edward Howse Esq., conveying the Lease of the Summer Pasture of Hayes and Sidenham to William Cokke.

To all true Christen people to whome this present wrytyng Indentour shall come William Hollewaye by Gode is suffer(eu)nce Priour of the Monasterye and Cathedrall Churche of Saynt Saviour and of the Holy Apostles Peter and Paule of Bathe within the Countie of Somerst and Conuent and Chapitre of the same place senden greting in our lorde gode everlastyng Knowe ye that we the forsaide Priour and Conuent with our hoole assent and consent haue grauntede dimisede and to ferme letten and by this present writing Indentede confirmede to Richarde Cokke of Walcott by syde Bathe aforesaide yoman Margaret his wyfe Jeffreye and William the yonger of that name there sonnes all the Somerleyes or pasture of our close or pasture callede the Hayes that is to saye yerely from Thannunciation of our lady unto the ffeaste of Saynt Michell Tharchungell togither with the hool pasture and grasse of our Medowe callede Sidenham that is to saye yerely frome eight dayes after the ffeaste of Thannunciation of oure lady untill the ffeaste of Saynt Martyne the busshop in wynter Excepte oone acre of Mede lyeng in the South syde of the saide Sidenham whiche acre John Bygge now holdeth And excepte also foure goode wayne lodes yerely of the finest and beste haye there growyng for our hoggesfloke of Lyncombe to be mowede rerede made and caryede by the ffermour of our saide ffloke for the tyme beyng And excepte the yerely pasturyng and fedyng of foure oxen of our ffeerme of Mawdelene and of iiij (4) other oxen of our ffeerme of Gules whan the saide leyes shall be broken up And excepte the yerely somer pasture of oone kowe of Gybbes in the pasturyng in the saide Hayes And excepte also the tythes for info(rm)nts there due and yerely by theym to be paiede as custome hathe be to us the saide Priour and Conuent and namely to the Chauntre of the saide Cathedrall Churche for the tyme beyng and to our Successours which aforesaide hayes and Sidenham bene sett and doo lye within our lordeship of Lyncombe To haue and to holde all the forsaide Hayes and Sidenham in maner and forme aboue expressede excepte before exceptede to the forsaide Richarde Margarett

Jeffreye and Williame weill quietly and in pease durying there naturall lyves and the naturall lyfe of oone of theym longest lyves successively. Yelding therfore yerely and payeing to us the saide Priour and Conuent and to oure successours durying the terme aforesaide within the chapell of All Saynte situate within oure saide monastereye foure pounds of goode and laufull moneye of Englande in the ffeaste of the Natiuitie of oure Lorde Jesu Christe and of the Natiuitie of Saynt John the Baptiste by evyn portions And itt shal be weill laufull to the saide Richarde Margarett Jeffreye and Williame and to euery of theym to take and make att all tymes as nede shall requyre duryng the saide terme under Ten(ntes) to and of the saide grounde Soo that nottwithstonding they the saide Richarde Margaret Jeffreye and Williame shall stonde and remayne allweyes immediate Tenntes unto us the said Priour and Conuent and to our Successours accordyng to the forme and force of this Indentour And lykwyse itt is undestendede couen(a)ntede and agreede betwene the saide parties that the Hoggesfloke of Lyncombe shall duryng the saide terme goo lye and pasture in all the saide pastures of Hayes and Sidenham lyke as they haue doone in tyme paste whan the saide pastures were in the lorde is handes And the lorde is Ten(a)ntes shall yerely duryng the saide terme mowe rere and make all suche grasse and haye there as theye haue doone in tyme paste whan the saide pastures were in the lorde is handes Soo that thereby the lorde is owne werkes elles where and woode carriage be nott nestoppede att any tyme And the saide Richarde Margaret Jeffreye and Williame and euery of theym shall from tyme duryng the saide terme att there owne propure costes and charges make repaire and mayntene all suche hedges and diches as appurteign or belonge to the saide pastures And soo shall in thende of the saide terme leve theym weill and sufficiently made repairede and mayntenede And if itt happen the saide Reparations to be (v)ndoone by the space of a moneth after admonytion gyven therof by us the saide Priour and Conuent and our Successours or by our or there officers then shall the saide Richarde Margaret Jeffreye and Williame or oone of theym by whome suche faulte shalbe made forfeit and paye to us the saide Priour and Conuent and our Successours in the name of A payne for the furste tyme VI s VIII d And lykwyse after the seconde and thirde admonytion if de faulte be made to be leviede and paiede of the goodes and catalles of theym by whome suche forfeitour shall be made And if itt chaunse the saide yerely rent of foure poundes to be behynde unpaiede in parte or in all by the space of a moneth

after any terme or ffeaste that itt is due to be paiede Then itt shalbe laufull to us the saide Priour and Conuent and to our Successours or laufull Deputies in that behalue to entre into the saide pastures or into any parcell therof and distreigne And the distresses there founde take dryve carye and bere aweye And with us reteigne and kepe styll untill that we of the saide Rent soo beyng behynde and unpaiede with our reasonable costes susteignede in that behalue be fully content satisfiede and paiede And if itt chaunse the saide yerely Rent of foure poundes to be behynde unpaiede in parte or in all by the space of eight weke(s) after any terme or feaste that itt is due to be paiede And in the meane season no sufficient distresse for the saide Rent soo beyng due can upon the saide pastures be founde or if after the aboue namede thirde forfeitour defaulte be made and founde in the saide Reparations of hedgyng and dichyng or if all other couen(a)ntes of the parte of the saide Richarde Margaret Jeffreye and Williame aboue expressede be not kepte and fullfillede Then itt shalbe laufull to us the saide Priour and Conuent and to our Successours or laufull Deputies in that behalue to reentre into all the foresaide pastures and into every parcell therof And theym reseise repossesse and reteigne in oure owne handes as in our former or furste astate And the saide Richarde Margaret Jeffreye and Williame therof and frome utterly to expulse amove avoide and putt owte this present Indentour in any wyse nottwithstondyng And furthermore to arrest and take into our handes all the goodes and catalles movable and unmovable wheresoeur they be founde of the saide Richarde Margaret Jeffreye and Williame and of every of theym for the Rentes and averages that then shalbe due And theym soo taken reteigne and kepe styll untill that we of the saide Rentes and averages with our reasonable costes and expenses borne and susteignede in that behalue be fully content satisfiede and paiede And we the saide Priour and Conuent and our Successours shall the saide pastures duryng the saide terme to the saide Richarde Margaret Jeffreye and Williame in maner and forme aboue expressede ageynst all people waraunt acquyte and defende by this presentes And moreovere knowe ye that we the said Priour and Conuent by this presents haue ordeignede deputede and assignede our weilbeloued in Christe John Gaye of Lyncombe and John Bygge our true and laufull Attorneyes joyntlye and severally to entre into the saide pastures or any parte or parcell therof and seisyn therin for to take and after suche seisyn therin taken to delyver in oure name full and peasable possession and seisyn of the

same and every parcell therof to the saide Richarde Margaret Jeffreye and Williame or to oone of theym accordyng to the forme and effect of this Indentour Ratifyeng affermyng and approuyng all and euery thyng that our saide Attorneyes or oone of theym shall doo in the delyueraunce of the saide possession by this presentes In Witnes wherof to thoone parte of this present Indentour remaynnyng with the saide Richarde Margaret Jefferye and Williame we the saide Priour and Conuent have putt our comen or Conuent Seale And to that his parte of the same Indentour remaynyng with us the saide Priour and Conuent the saide Richarde Margaret Jeffreye and Williame haue putt there Seales Geuen in our Chapitre house within our Monasterye of Bathe aforsaide the xvth daye of August in the seventeenth yere of the Rigne of our soueraigne lorde Kyng Henry the Eight.

Indorsed

Somerset. William Coxe lease for the Somer pasture of Hayes and Sidenham.

Copy, made by the Secretary, of the Deed in the possession of Edward Howse, Esq., conveying the Lease of the Wynter Pasture called Sydenham ffurlonge to Robert Williams, of London, Taylor.

(1) To all Xpen people to whome theise presentes shall come or maye in any wise apperteyne Robert Williams of London Taylor sendith greetinge in our Lorde god everlastinge. Whereas our (2) Soueraigne Ladie Elizabeth the Queene's ma^tie. that nowe is by her highnes Letters Patentes under the Seale of her ma^ties. Courte of Exchequer bearinge date at Westm(tr) the eighte and twentith daye of June (3) nowe laste paste before the date of theise presents ffor the consideracon therein expressed. Hathe Demysed graunted and to ffearme letten unto the saide Robert Williams (amongest other thinge) (4) All that Wynter pasture or pasturage everye yeare yearely from the feaste of St. Michaell Tharchaungell unto the feaste of Thannunciacon of our Blessed Ladie St. Marie the Virgine to be taken of (5) and in a certeyne pasture called Sydnams ffurlonge lyeinge and beinge wythin the mannor of Lyncombe and Wydcombe in the Countie of Somersett nowe or late in the tenure of Willm Gaye and all feedinge pastures (6) comons profitte comodities advantage emoluments and

hereditaments whatsoever thereunto belonginge or in any wise appurteyninge or wyth the same or any pts thereof heretofore usuallye demysed (7) letten and used occupyed reputed or enioyed (excepte as in and by the saide lrts Patents are and bene excepted). To haue and to holde the saide wynter pasture or pasturag and all and singuler other the premises wyth the (8) appurtennce unto the saide Robert Williams his executors and assignes from the feaste of Thannunciacon of the blessed virgine marie nowe laste paste unto thende and terme of Twentie and one yeares from thence next followinge fullie (9) to be compleate and ended. Yeldinge and payeinge therefore yeareleye unto our saide Soueraigne Ladie the Queenes Matie her heires and Successors Sixe Shillinge and Eighte pence of Lawfull money of England (10) at the feaste of Sainte Michaell Tharchaungell and Thanunciacon of the Blessed virgine Marie by equall portions to be paide duringe the saide terme as in and by the saide lrts Patents amongest other (11) thinge therein conteyned more at large it dothe and maye appeare. KNOWE YEE NOWE that the saide Robert Williams ffor and in consideracon of a certeyne some of lawfull money of Englande to him by Robert Chambers of the (12) Citie of Bathe in the Countie of Somersett gentleman before thensealinge and deliverye of theise pnts in hande well and truelye contented and paide Whereof and wherewyth the saide Robert Williams acknowledgeth himselfe (13) fullie satisfyed. And thereof and of everye pte and prell thereof Dothe by theise presents clearelye exonerate acquite and discharge the saide Robert Chambers his heires executors and administrators and everye of them. Hathe gyven (14) graunted bargained soulde assigned and settover And by theise presents Dothe gyve graunte bargaine sell assigne and settover unto the saide Robert Chambers all that his estate Righte tytle use intereste possession clayme tearme (15) of yeares and demaunde whatsoever of in and to the saide Wynter pasture or pasturage and all and singuler other the premises with thappurtenncs before by theise presents mentioned and everye pte and parcell thereof (16) In as large ample and beneficiall manner and forme to all intents and purposes as the saide Robert Williams the same premises now hathe and enioyethe or of Righte oughte to haue and enioye By force and vertue of the saide lrts Patents or any thinge therein conteyned or otherwise And the saide Robert Williams Dothe Covenaunte promyse and graunte for him his executors administrators and

assignes to and with (17) The saide Robert Chambers his executors administrators and assignes and everye of them by theise presents That the saide Robert Williams his executors and assignes shall and will at all tymes (18) hereafter and from tyme to tyme Clearelye exonerate acquite and discharge or otherwise sufficientlye save and keepe harmeles the saide Wynter pasture or pasturage and all other the premisses with thappurtenaunces of and from (19) all manner of former bargaines Sales guyfts grauntes Leases and incumberauncs Whatsoever had made committed or donne by the saide Robert Williams or by any other person or psons by his meanes assent Knowledge or (20) procurement (The yearelye Rents Covenaunts and agreements mentoned in the saide lrts Patents whiche on the parte & behalfe of the saide Robert Williams his executors and assignes touchinge the premisses to our saide (21) Soueraigne Ladie her heires and Successors from henceforthe tobe paide doune or pformed onely excepted) Of whiche saide Rent Covenaunts and agreements The saide Robert Chambers Dothe (22) Covenaunte and graunte for him his executors and assignes to and wyth the saide Robert Williams his executors and administrators and everye of them by theise presents at (23) all tymes hereafter and from tyme to tyme (24) Clearelye to acquite and discharge or otherwise sufficientlye save and keepe harmeles the saide Robert Williams his executors and administrators against our saide Soueraigne Ladie the Quene her heires and Successors (25) and everye of them. In Witness Whereof the saide Robert Williams hathe hereunto sett his hande and Seale geven the Laste daye of June Anno Dni 1597. And in the neyne and (26) Thirtith yeare of the Raigne of our Soueraigne Ladie Elizabeth by the grace of god of Englande ffraunce and Irelande Queene Defender of the faithe etc

Signed Robt(s) R. Willms

Sealed signed and delyuered in
the presence of the psns undernamed
Wm. Burche
Giles Hunt servant
to Henry —— Gaye (?)

Sign. M Willm Archer

ADDRESS

OF THE

PRESIDENT, after the ANNIVERSARY DINNER, on FEBRUARY 18th, 1869.

GENTLEMEN,—

In a short Address I read to you at our last Anniversary Dinner, I spoke of the large number of existing Field Clubs devoted to the study of the Natural History and Antiquities of the districts they respectively belong to. These, however alone considered, give us but a very imperfect idea of the extent to which science is cultivated at the present day, and the immense amount of work it is doing, even confining our attention to what are called the Natural Sciences, and which are those we ourselves profess more particularly to follow up. I have thought, therefore, it might be interesting to the Members of our Club to hear something more on this subject, though, of course, the very few minutes we can devote to it on this occasion, will only allow of its being handled in the most comprehensive way.

Before, however, proceeding to this matter, I would observe that there are two respects in which, I believe, our Club differs from most other Field Clubs, and which are decidedly advantageous to it, if they can continue to be kept up. One is that of the weekly walks which our Members take—such, at least, as choose to join in them—in addition to the more

regular excursions (four in number) fixed at the Anniversary. It is to these latter alone that, so far as I am aware, other Clubs restrict their operations as a body; and very good work, no doubt, many of them do, while the Members receive a stimulus therefrom in furtherance of the pursuits they carry on at other times each in his individual capacity. Still, if there is any advantage to be derived from a body of labourers working collectively in this way—and what those advantages are I pointed out in the first Address I read to the Club in 1864—the same advantages must attend upon any other occasions of their meeting together for scientific purposes, and with increased good results the oftener such meetings take place. But there is another circumstance which gives a great importance to these weekly walks. In proportion as the field nearer home has been repeatedly gone over on the regular excursion days, more and more distant spots will be chosen for the Club's visits, until the immediate object for which the Club was formed, viz., the working out the Natural History and Antiquities of the Bath District, may come to be quite lost sight of. I do not complain of this arrangement, though some limit, I think, should be put to the distance to which the Club travels, if it were only in consideration of the expense to which it puts some of our Members, and the sacrifice of the time of two days, which is inconvenient to many. In principle I think the arrangement good, as offering more novelty and attraction than any other; but then it is only so long as the weekly walks are kept up, to which, under such circumstances, we must mainly look for the extending of our knowledge of the productions of our own neighbourhood, and accumulating those facts in Natural History, as well as details in matters of topographical and antiquarian interest, which shall afford material for our winter evening meetings at home.

And these home gatherings for papers and discussion on

scientific subjects form another feature of interest and importance in the proceedings of our Club, not generally, I imagine, adopted by other Field Clubs, as distinguished from regular Natural History Societies. The Cotswold and Berwickshire Clubs read their papers after each excursion, when their day's work is done. Our plan, affording opportunity as it does for communicating to others besides the Members of our own body the result of our researches, at a season too when little field work can be done, and which would otherwise be a blank in great measure, so far as the Club is concerned, seems to me an improvement upon theirs. And that it works well in one respect is evidenced by the increased number of papers that have been offered to us for reading this present season, indeed almost more than we can dispose of without having an additional time of meeting. The only discouraging circumstance has been the small attendance at these meetings on some occasions, especially of our own Members. Of course men will be of very different tastes. And out of the large number of Members we have now on our list, we cannot otherwise than expect that many, who perhaps joined the Club chiefly for its excursions, will not take the same interest that others do in matters of pure science. Still I think we might look for some increase of the few ordinarily present, if it were only for the sake of giving us their moral support, and showing their desire to uphold the standing and character of the Club as a scientific body. Though what we do for science must always depend mainly upon our own individual efforts in the way of research and discovery, yet will it generally bear a certain proportion to the encouragement we receive from others in our attempts to promote its advancement.

It would be a thing very much to be regretted, were we compelled to abandon our evening meetings, after having so often expressed our desire to let the public have the benefit of our researches, and especially to impart to our fellow-in-

habitants of Bath whatever we may have of new to tell them respecting the history of their own neighbourhood.

These are not days surely for going back, but rather for pressing onwards in the path which we have opened out for ourselves. All around us is on the move. Everywhere are men's eyes busily looking into the recesses of Nature, trying to fathom her lowest depths, to reveal, if possible, her most concealed processes, to bring to light the marvellous powers by which she elaborates her productions, even in their very first beginnings, the laws by which she works, and the ends she has in view. And everywhere are men's minds on the alert—eager to catch from others, if they cannot learn for themselves—the last new discoveries which science has to unfold.

There is no more remarkable feature in this stirring age than the influence which, of late years, science has brought to bear upon everything connected with the advancement of our race, whether we look at man in a physical, or an intellectual, or in a moral point of view. Nor can we wonder at it, when we notice the extent to which the several sciences are now studied, the extreme division and sub-division of the subjects to which they relate, the number of Societies and Institutions that exist for the cultivation of science, and not least, the slow but sure way in which science is being made to take its place, by the side of other branches of learning, in the education of all classes of the community.

This is what I proposed drawing your attention to at the beginning of my Address. And just let us glance for a moment at the past state of things compared with the present. The Royal Society, the parent of all our scientific bodies, was founded, as most of us are aware, in the time of Charles II., and for many a year it stood alone as the sole representative of science in this country, its researches being little cared for by the public generally, unknown probably to very many, and

where known, not unfrequently made the subject of satire and ridicule.

It was not till after more than a century from the time of the commencement of the Royal Society's labours that any other society sprung up; and even in the year 1788, when the late Sir J. E. Smith, on the occasion of the death of the celebrated naturalist Linnæus, started the Linnean Society—the Royal Society's first offspring*—so narrow was the range of science, as then conceived, and so limited the number of its followers, that I have heard it said formerly, by those who could remember the circumstance, that some remonstrated at the step, thinking it would affect the interests and success of the Royal Society, and be likely to lead to still further separations, leaving it in the end little or nothing to do.

Such other divisions and sub-divisions of the field of science have, indeed, taken place, and corresponding institutions sprung up, beyond anything that could have been looked for at that time, without, however, in the slightest degree lessening the work, or dimming the lustre, of the Royal Society, whose world-wide reputation stands as high as ever. And all these new societies have come into being since the beginning of the present century, most of them within the recollection of some among us. In 1804 arose the Horticultural Society; in 1807, the Geological Society; in 1826, the Zoological Society; these being followed in quick succession by the Entomological, Botanical, Ornithological, Microscopical, Ethnological, Palæontographical, and Meteorological Societies, the latest being the Anthropological Society, established only a very few years back.

* "In 1788 the Linnean Society was founded. . . . . This event merits more than a mere passing record, as presenting the first instance of a sub-division of *scientific* labour in the metropolis, by the establishment of a distinct association under Royal Charter."—*Weld's Hist. of Roy. Soc.*, vol. ii., p. 198.

Let it be remembered that this list includes none but what may be called the Natural Sciences Societies, and only those in London. Were we to take in all the other scientific bodies in the metropolis, and then further extend the list to the many different societies in provincial towns—setting the Field Clubs entirely aside—we should be amazed at the number. With regard to provincial institutions for the promotion of science, the wish expressed by Sir Isaac Newton in 1712, that "there were a Philosophic Society in every town where there was company enough to support them,"* is in the way of fast being carried out. And what a view does all this present to a thoughtful spectator, of the movement made for science at the present day. To go back to a still earlier philosopher than Newton, the great Lord Bacon, we seem, in all these societies, dividing the sciences among them, in some measure to realise the imaginary college sketched out in his New Atlantis, under the name of Solomon's House, instituted for "extending our knowledge of every part of nature," where the work was in like manner parcelled out to different classes of labourers, each class having its appointed duties to fulfil.

Yet various as are the pursuits of these different societies, they have all one common object in view, and that is truth. It was remarked by one of the wise men in Solomon's House, that it was their privilege to "know the works of creation and true secrets of them, and to discern (as far as appertaineth to the generations of men) between divine miracles, works of nature, works of art, and impostures and illusions of all sorts." So, too, it is both the privilege and the duty of the man of science at the present day to follow after truth, as the one thing at which he is to aim—whatever he takes in hand, whatever he looks into, whatever he reflects on, whatever he seeks to explain to himself or others.

* Weld's "Hist. of Roy. Soc.," vol. i., p. 422.

It is not always easy to get at the truth. It calls for much patience, much perseverance, along with fixed habits of close observation and thought, to separate what is true from the many deceptive appearances that present themselves to the student of nature; and when we have oft succeeded and found what we were searching for, let me add, it needs not a little humility of mind to believe that it is not by any methods of science that we can get possession of every truth which it is desirable for man to know in his present state.

Very necessary is it to remember this. For so grasping a hold does modern science take of all the operations of the human mind, whether directed to the phenomena of the external world, or to its own inward reasonings, that some would seem to think there can be no real knowledge elsewhere than in the structure science has raised, none which must not submit to her guidance, and be bound by her laws.

To this we do not assent. We believe that there are higher truths than any science can attain to—the truths of Revelation—made known to us neither by the evidence of our senses, nor by experience, nor by the mere exercise of our reasoning faculties; truths which are only spiritually discerned, and from which spring our best and surest hopes of the improvement of our race.

Men may argue as they will; but by no words or logic can they dislodge—I would say from our hearts, rather than our minds—the confident assurance we feel of the reality of these truths. They can never prove their non-existence, however improbable to their own thinking. Science stops short of the discovery of them, and we are in no way bound to listen to her voice when she steps beyond the limits of the field legitimately assigned to her.

But while we repudiate the unwarranted conclusions at

which these bold thinkers have arrived, let us not reject the positive facts which science is continually bringing to light, nor its theories, when based on facts for which the most indisputable evidence can be adduced. The simple question for us to determine is, are they true? If we are not able, from insufficient knowledge of the subject, to answer this question for ourselves, we must lean on the authority of those qualified to be judges. It then becomes a matter of faith; faith not only to believe what is told us respecting things we have not ourselves attended to, but to believe that the truths we receive from others in this way, if they *be* truths, can never prejudice or affect any other truths, even of the highest kind. We need not for a moment fear such a result —it is simply impossible. We may be led to think differently of these last truths, differently in respect of the witnesses we had called in to speak to their character, to look at them from a different point of view, or to separate from them what does not essentially belong to them; but the truths themselves will remain what they always were. For truth is one, and immoveable as a rock.

We may even be brought, by the aid of science, by the light of inductive philosophy, to a better understanding of some portions of Scripture, the great source of Divine truth itself. All must allow the clearer insight it has already given us into some questions connected with the early history of man, and of this earth his dwelling-place, as well as the assistance it has afforded in the right interpretation of many of the ancient records contained in the Bible. Nor can we doubt that science will do yet more for that inestimable volume, helping us to explain much that is obscure, yet leaving utterly intact all that concerns the highest interests of man, all that bears upon his moral and religious advancement, and his hopes of an hereafter.

Gentlemen, I know that these are solemn thoughts, not per-

haps quite in keeping with the immediate purpose for which we meet here to-day ; yet, I think, called for by the temper of our times, by the present aspect of science towards religion and of religion towards science, and allowable, I should hope, on the part of one who holds the office of a clergyman, besides being President of the body he is addressing.

I trust I have not said more than is acceptable to those who listen to me. I feel sure that none of us would wish to stop the onward march of science. Stop it, indeed, we cannot, any more than we can stop the advancing tide. And why should we desire to do so ? Science is doing a mighty work ; it may seem to be bearing down everything before it, but it is a work for good, so long as science, as an instrument of research, is legitimately used, and not overstrained in the attempt to apply it to questions which are beyond its ken, and with which it has no concern.

Science, I say, is doing a great and good work. It is clearing away the mists of ignorance, of prejudice, and superstition ; letting in light where men had been long groping in darkness or lost in error ; revealing to us, from time to time, in all their complicated relations, the wondrous workings of that Supreme Intelligence, by whose will and power we believe all things to have originally come forth ; opening up new fields of knowledge, new sources of the highest intellectual enjoyment utterly unknown to those who were before us ; and no less adding daily to our home and bodily comforts, guiding and quickening every art and invention by the help of which man lives and is happy.

Instead of desiring to arrest the progress of such a mighty engine, let us rather welcome its advances, and at the same time do what we can to further them. And this is the duty which devolves upon the Members of this Club. We have formed ourselves into a working body for the very purpose of gathering from this particular neighbourhood whatever

may be accounted worthy to be thrown into the treasuries of science.

Far distant be the day when the Bath Naturalists' Field Club shall have become a thing of the past. In our own time, at least, let it not be said—"There *was* such a Club, but, for lack of zeal on the part of those who engaged to do its work, for lack of encouragement and support on the part of others, who joined it as well-wishers for its success, if as nothing more, it gradually fell away to nothing."

PAPER

ON THE

FAULTS and CONTORTIONS of the SOMERSETSHIRE COAL FIELD,

BY

J. McMURTRIE, RADSTOCK.

(*Read February 24th*, 1869.)

At one of the Evening Meetings during last winter, I had the pleasure of submitting to the Members of this Society a general and typical section of the Somersetshire Coal Field. It was my intention to have supplemented that paper by another, treating of the geographical distribution of the different veins and sub-divisions of the formation; but circumstances having induced me to postpone this, I would instead direct attention to another branch of the same subject, viz., the faults and contortions through the agency of which the coal field has assumed its present form. As the question of faults generally has probably been often under consideration, it is, I presume, unnecessary that it should now be treated in an elementary way; and I propose, therefore, to describe only the distinctive characteristics of those of our own neighbourhood, which it will be found opens out a sufficiently wide field.

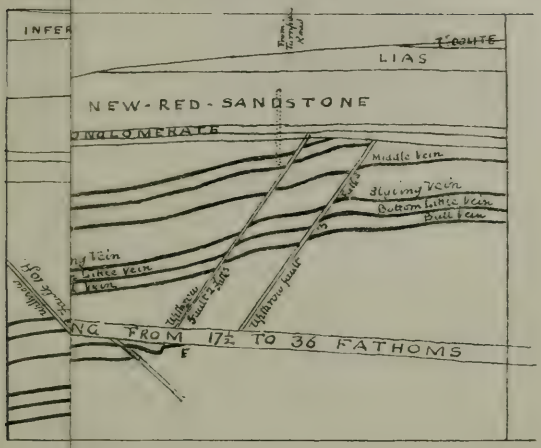
GENERAL FEATURES OF THE COAL FIELD.

In order that the bearing of the present paper may be the better understood, it may be well that I should at the outset refer again to the section of last year, and that I should in a word or two explain the general features of the district. The carboniferous rocks of Somersetshire, you will observe, rest upon the old red sandstone with which they are probably approximately conformable. They are well represented in this district ; the mountain limestone, the millstone grit, and the true coal measures being all present. The latter, with which we have principally to deal to-night, are composed of two great divisions, separated by an immense thickness of sandstone known as the pennant rock. The upper division consists of the first, or Radstock, and the second, or Farringdon series, these being divided by a thick intervening stratum of red shale. The lower division contains the third, or New Rock, and the fourth, or Vobster series ; the veins of the former being contained in hard sandstones, while those of the latter are usually associated with exceedingly tender shales. Above the coal measures, and resting unconformably upon them, are the secondary rocks ; but the disturbances which we have now to describe were mostly formed before the deposition of these strata, and rarely affect them.

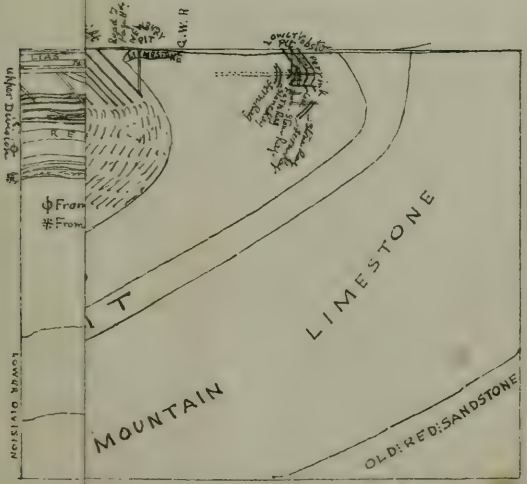
FAULTS AND CONTORTIONS.

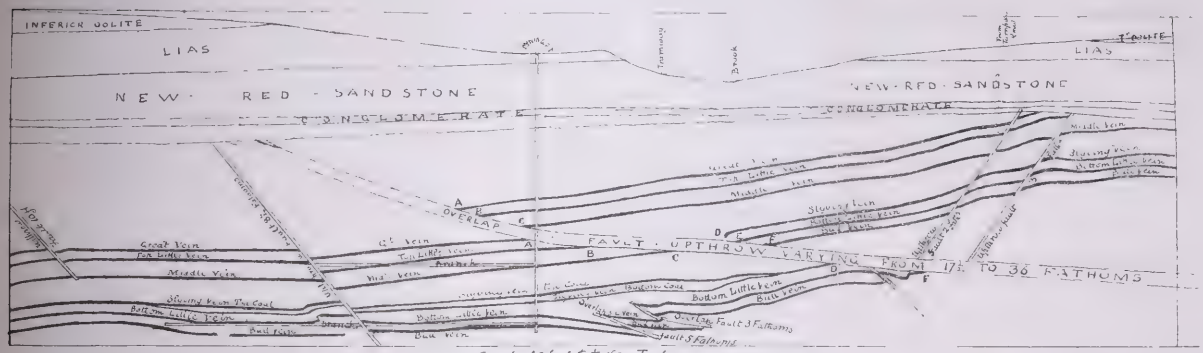
Whatever may have been the conditions under which the coal measures were originally deposited, there can be no doubt that they have subsequently been exposed to an amount of disturbance and dislocation so tremendous that when we try to realise the state of things then existing, we seem to pass into the region of romance rather than reality. In a paper recently contributed to the Geological Society, Mr. Moore has described in a striking manner the circum-

R OF RADSTOCK

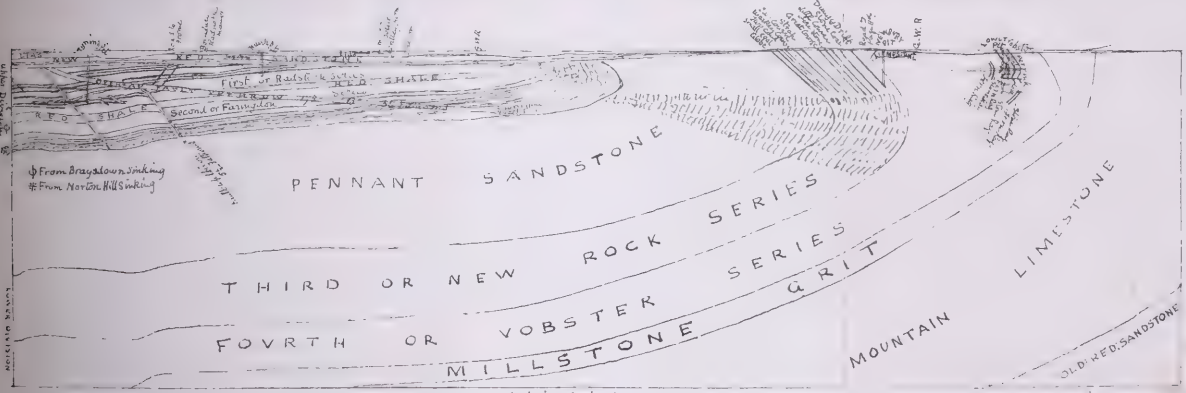


OCK·TO·LOWER·VOBSTER





SECTION OF STRATA FROM A POINT 616 YARDS NORTH OF TYNING PIT RADSTOCK TO LOWER VOBSTER



stances connected with the upheaval of the Mendips anticlinal, and none can have failed to be deeply impressed with the extraordinary physical phenomena there brought under notice; but when we pass from that range of hills to the coal field adjoining, we find a state of things still more remarkable. We seek in vain for anything analagous to it or approaching it in interest amongst the other coal fields of this country, and to find its counterpart we must cross the channel to the mining districts of Belgium and France.

The coal measures of this neighbourhood having been divided by the Kingswood anticlinal into two separate basins, I propose to-night to omit the more northern of these, with which I have had few opportunities of becoming acquainted, and to confine my remarks to the southern or Somerset basin, respecting which I have had better means of obtaining information. In a district which has been subjected to so many alternations of upheaval and depression, in which faults are so numerous that there is hardly an enclosure in the length and breadth of the county which does not contain several—in a district too in which so small a portion of the whole area has been proved—any attempt to enumerate the faults must be necessarily very incomplete; but omitting all under fifty feet, the following tabular list embraces most of those at present known. It briefly describes in each case the course of the fault, its size, and any other particulars connected with it; the more extraordinary faults and contortions being reserved for individual treatment afterwards.

Size in Fathoms.	Size in Feet.	Down-throw.	Course of Fault.	Remarks.
100	600	West	From Lower Conygre Pit, Timsbury, through Radford to Clandown Pit, thence through Radstock to Bramhill Farm, Kilmersdon.	Called "the 100 fathom fault." See detailed description.
36	216	North	From Lower Writhlington Pit, passing midway between Ludlow's and Tyning Pits, Radstock, between Old Pit and Well's Way Pit, Radstock, and between Clandown Pit and Old Welton.	The overlap fault, afterwards described.
100	600	South	From Wallmead, passing 900 yards south of Farmborough, under Barrow Hill, and a little to the north of Fry's Bottom Colliery, Clutton.	Known as the Farmborough fault, and afterwards referred to.
75	450	N.N.W.	Runs out of the Farmborough fault due south of Farmborough Church, passes under the sleight, and has been traced to a point 200 yards south of Old Haygrove Pit, High Littleton.	14 fathoms under the sleight, and 75 at Haygrove.
52	312	East	From Woody Haygrove Pit, south through High Littleton village to a point 130 yards west of the Church.	
14	84	East	Traced from its junction with the Farmborough fault due south of Farmborough Church, and runs in a S.S.W. direction, passing midway between the Hayswood and Tyning Pits, Timsbury.	
20 to 40	120 to 240	East	Leading out of the Farmborough fault, due south of the village, and running in a southerly direction towards Withy Mills Pit.	

Faults of the Somersetshire Coal Field (Continued).

Size in Fathoms.	Size in Feet.	Down-throw.	Course of Fault.	Remarks.
14	84	North	An east and west fault, 200 yards north of Tyning Pit, and 175 yards north of Upper Conygre Pit, Timsbury.	
30 to 70	180 to 420	South	From Meadgate to Clutton Union, passing 220 yards south of Timsbury Church, and 260 yards south of High Littleton Church.	30 fathoms at Meadgate, and 70 at Withy Mills.
24	144	North	Branches out of, and forms an acute angle with, the fault previously described, at a point a little to the east of Meadgate, and runs westward towards Lower Conygre Pit.	
18 to 44	108 to 264	North	Has been traced from a point 200 yards south of Bengrove Wood, Camerton, through the two Camerton pits, to Radford.	44 fathoms at Camerton New Pit, and 18 at the Old Pit.
13	78	N.W.	Takes a south west course from Radford Brewery.	
18	108	East	Runs N. and S., passing 120 yds. W. of Radford Brewery.	
10	60	West	Ditto 350 ditto	
18	108	East	Ditto 480 ditto	
10	60	South	East and west fault, on the south side of, and close to, Radford Old Pit.	
18	108	North	East and west fault, 90 yards north of Camerton Mansion House.	
10	60	North	East and west fault, between Camerton Church and the Mansion House. To the west of Camerton Church it splits into two parts, forming an acute angle with each other.	

Faults of the Somersetshire Coal Field (Continued).

Size in Fathoms.	Size in Feet.	Down-throw.	Course of Fault.	Remarks.
42	252	North	East and west fault, 220 yards south of Camerton Church, and running in the direction of Paulton Church.	
30	180	North	East and west fault, 500 yards south of Camerton Church, and extending eastward, keeping parallel with that last described.	
10	60	North	Passes under Woodbarrow House, and runs W.S.W.	
17	102	North	From Clandown Church, through Smallcombe, passing 220 yards north of Braysdown Pit.	
9	54	West	Runs north and south, 200 yards west of Braysdown Pit.	
9	54	West	Branches out of "great fault," opposite Middle Pit, Radstock, forming an acute angle with it. Runs between Smallcombe and Clandown.	Known as the Nine Fathom fault.
23	138	West	In Woodbarrow Bottom, on the opposite side from Woodbarrow House, running south-west towards Upper Writhlington Pit.	
$8\frac{1}{2}$	50	South	Runs east and west nearly,—proved at a point 275 yards north of Tyning Pit, Radstock.	Some peculiarities connected with it are afterwards described.
40	240	North	East and west fault, 80 yards south of Upper Writhlington, 140 yards south of Writhlington Church, and 330 yards south of Foxcote Pit.	Query.—Is this the overlap?
10	60	North	110 yards south of Tyning Pit, and runs east and west.	A double overlap afterwards referred to.

Faults of the Somersetshire Coal Field (Continued).

Size in Fathoms.	Size in Feet.	Down-throw.	Course of Fault.	Remarks.
12	72	West	North and south fault, passing 40 yards on the west side of Foxcote Pit.	
20	120	East	275 yards east of Foxcote Pit.	More a roll than a fault, see detailed description.
18	108	South	110 yards north of Paulton Church, and runs due east to the great fault, 800 yards north of Clandown Church.	
10 to 14	60 to 84	North	An east and west fault, 520 yards north of Farringdon Pit, and 200 yards south of Ham Hill Pit.	
9	54	East	Runs north and south through Munger.	
14	84	S.S.E.	Runs S.S.W., passing 175 yards west of Welton Hill Pit.	
18	108	North	Runs east and west nearly, 310 yards north of Clandown Farm buildings.	
10	60	North	Runs east and west nearly, 175 yards north of Clandown Farm buildings, and keeps parallel with the lane.	
40	240	West	Runs due south from a point 440 yards west of Clandown Farm, passing 185 yards west of Old Welton Pit, and 185 yards east of Norton Hill Farm.	
13	78	West	Under Radstock Grove.	
			Several cross faults exist in the folded strata, between Nettlebridge and Vobster, but it is impossible to give accurate particulars of them.	

From the foregoing it will be seen that at least two-thirds of the faults recorded range parallel with the line of the Mendips between Ashwick and Mells, and that a majority of them are downthrows to the north, or traps down from that range.

Passing on to describe more in detail those faults and contortions which deserve special notice, I would begin with the

FARMBOROUGH FAULT.

This, as already stated, has been met with 900 yards south of the village of the same name, and it is an upthrow north or otherwise a downthrow south of 600 feet. The remarkable thing connected with it is that the upper or Radstock series has not been found to the north of it, and that it has formed in the Timsbury district an effectual barrier to the northern extension of mining enterprise.

After the dislocation occurred, the strata on the "rise" side must have been exposed to great denudation, and, as a consequence, the upper strata have there been almost entirely washed off. A pit was sunk many years ago to the north of the fault and near the village of Farmborough, with the expectation of winning the veins of the upper series, which have been extensively worked at the adjoining Timsbury collieries; but only a mere trace of them was found in the upper part of the pit, and on continuing the sinking it was found that the veins of the second series, which are elsewhere of considerable value, had there been sub-divided into so many thin pieces as to be practically useless, so that after expending £10,000 on the adventure the owners gave up the attempt in despair. Although this trial terminated so disastrously, it does not necessarily follow that the upper series may not be found farther to the north. Dr. Buckland has assigned to it certain veins which were worked a century

ago in the neighbourhood of Pensford, and there is every probability that an outlying basin of the series may exist there, but as there is a decided tendency to deterioration in proceeding northwards, it is a question whether at so great a distance it may be of much practical value. We now pass on to the

GREAT FAULT (OR 100 FATHOM FAULT).

This is the largest fault of the district, and it has been proved from Timsbury to Bramhill Farm, not far from the village of Kilmersdon, south of which it has not been traced. It is a downthrow west, varying from 120 feet at Timsbury to 384 feet at Kilmersdon, and reaching its fullest development at Clandown, where it has been proved to be 720 feet.

Of many faults it is difficult to say whether they are "downthrows" or "upthrows," whether the strata on one side have dropped into some chasm far down in the earth's crust, or whether they have been upheaved by some force from beneath on the other; but as to the Great Fault there is little room for doubt. Taking the average inclination of the strata and their levels on its eastern side in connection with the levels of the strata and their inclination at a point half a mile to the west of it, we are led to infer that they originally formed one uniform gradient. The beds have evidently dropped down on the west side of the fault, the veins rising at a high angle for the first hundred yards as they recede from it, and then resuming the usual inclination.

The fault is interesting, inasmuch as on the deep side of it at Clandown we find the greatest development of the coal measures to be met with in the district, a greater thickness of strata above the upper series having been preserved from denudation than is to be met with at any other part of the coal field. The only cause for regret is that in the additional

strata thus thrown in we have as yet failed to discover workable veins of coal.

Hitherto we have been considering dislocations, which, although of great extent, present nothing that is unusual or abnormal. We will now take an example of another kind, viz.,

THE 8½ FATHOM FAULT,

situated 275 yards to the north of Tyning Pit, Radstock, which exhibits an extraordinary peculiarity, for which it is extremely difficult to account.

It has commonly been regarded as a fixed principle in practical geology that a fault may exist in the lower part of a formation without the upper strata showing any trace of the disturbance, but that the reverse of this cannot occur. It has been considered certain that a dislocation met with in the upper part of a formation must, as a matter of necessity, affect the strata immediately beneath it, and that it must affect them to the same extent and in precisely the same way. In the 8½ fathom fault, however, we have a very extraordinary exception to the rule, inasmuch as in the "great" or upper vein of the first series it is an upthrow of 51 feet, while in the lowest veins of the same series it has been proved to be a downthrow of 21 feet. How this can have arisen it is difficult to say, but of the fact itself there is no room for doubt.

It may have originated in the fault having occurred as a downthrow of 72 feet shortly after the lower vein had been formed, and the upper veins having in the meantime been deposited without disturbance by the strata being upheaved in the old line of fracture to the extent of 51 feet. Or it might be accounted for were we to suppose some extraordinary perpendicular pressure applied to the strata on the south side of the fault while they were in a semi-plastic state, causing the remarkable thinning of the stratification which exists at that point. But it is impossible to imagine a cause

to produce such an effect, and the first theory is probably the correct one.

As another unusual example of dislocation I would mention the

FOXCOTE FAULT,

which, although commonly described as a fault, is more properly a fold or contortion.

At Foxcote Colliery the veins of the upper series rose steadily and rapidly to the eastward, and there was every appearance of their speedily outcropping beneath the new red sandstone; but most unexpectedly the measures after becoming level for a short distance were folded down perpendicularly to a depth of 120 feet, throwing in a large area of coal, the existence of which was previously unknown. I am unfortunately not in a position to give a section of strata at this point, but I may say briefly that the beds assume as nearly as possible the form of the letter Z. This cannot be called an ordinary fault, inasmuch as the veins—to use a mining phrase—"roll down" without material break to the depth already mentioned, at which they resume their rise to the eastward. We now pass on to describe the great

OVERLAP FAULT OF RADSTOCK,

coupling with it two smaller overlaps adjoining, which I believe to be splits from the main fault.

Overlaps—that is, faults by which the strata have been displaced horizontally instead of vertically—form a distinguishing feature of the Somersetshire coal field. I know of none in the other coal fields of this country, but in the upper division of Somersetshire they are very numerous. They seem to be most frequent in the vicinity of Radstock and Writhlington, where they assume considerable variety in size and form, but the "great" overlap so far exceeds in extent all the others

yet known that it deserves special attention, and of this I will endeavour to treat more in detail.

The dislocation to which I refer appears to attain its fullest development within the manor of Radstock, where all the facts connected with it have been well ascertained and established. In each of the veins of the upper series the workings have been carried against the fault within the manor, several of the shafts have been sunk through it, and several "galleries" have been excavated in the "leader" or line of fracture, so that there have been the fullest opportunities of obtaining information respecting it.

Its course has been traced from its junction with the 100 fathom fault at a point near the west side of the parish of Radstock to the neighbourhood of Writhlington on the eastern side, but its eastern and western extensions beyond those points have not been so well ascertained. At one time it was believed that it terminated at the 100 fathom fault—proceeding no farther to the west; but from inquiries which I have been permitted to make at Clandown Colliery I have satisfied myself that it exists there, although in that direction it probably decreases in extent. It must die out before reaching Paulton, for although that neighbourhood has been well explored I cannot learn of its having been met with there. Its eastern extension through the Writhlington property has been satisfactorily established, but the veins in its vicinity have been less explored, and less is known respecting it than in the Radstock Manor. In proceeding eastward it seems to divide into a succession of overlaps, which, taken together, throw in the same extent of extra coal as at other points where there is one clearly defined dislocation.

Whether the breaking up of the fault into several parts may be taken as an indication that we are nearing its eastern termination, is a question which we may hope one day to solve, but meantime I would consider it not improbable.

In order to give a clear idea of this extraordinary dislocation, I have constructed a cross section of the strata affected. (*See Section No. I. appended, which is a reduction from the original.*) The section begins a little to the north of Tyning pit, passes through the fault at right angles, and shows its effect on the upper series. The extreme extent of the overlap would be found in the centre of the village a little farther to the west, but I have selected the line indicated partly because at present there are more particulars obtainable there than at any other point in the manor, and partly to take in the two smaller faults which I have already mentioned. You will observe that the veins have been moved bodily forward, the letters AA, BB, and so on indicating the fractured ends, now far apart, but which were once united. The maximum amount of overlap may be estimated as follows:—

On the	Great Vein	120 yards
„	Top Little Vein	uncertain
„	Middle Vein, not less than ...	160 yards
	but the full extent not ascertained.	
„	Slyving Vein	291 „
„	Under Little Vein	308 „
„	Bull Vein	330 „

Some may be disposed to ask whether there may not be some mistake about this forward movement, and to inquire whether the strata may not have been originally deposited as we find them; but in reply I would explain that each vein possesses so many distinctive features of thickness, subdivision, and surrounding strata as to render its identification easy and mistake impossible.

I have classed the overlap in the catalogue of true faults, because it does not consist of a folding of the strata, but, like all dislocations properly so called, it possesses a clear, well-defined line of fracture. In vertical faults the lines of fracture have originally formed chasms or crevices which have

subsequently been filled by the infiltration of other matter, and in horizontal faults we could hardly expect to find similar effects; but although in them the lines of fracture are differently composed they are not the less distinct.

In the under surface of the upper strata or the part thrust forward the fractured ends of the beds are frequently bent downwards, but the inequalities appear to have been rubbed off, leaving a smooth and polished surface. The upper surface of the strata beneath has also been worn smooth in places, but on the whole it is more irregular, the ends of the veins and beds having invariably been either turned up where broken off, or forced into a succession of smaller overlaps by the immense mass moving above. Between these clearly defined lines there exists a thick layer of crushed materials of every kind. Shale, generally much disintegrated, with occasional fragmentary pieces of coal and sandstone, fill up the intervening space, the whole being so loose and friable that when a shaft has been sunk through the fault, ordinary masonry is scarcely sufficient to hold the broken materials back. In the two smaller dislocations, which I have associated with the great overlap and shown on the section, the same general features prevail, the only difference being that they appear to affect only the two lower veins. In order to show more clearly the effect of these disturbances, I have had a section of part of the Bull Vein constructed on a larger scale, and on examining it you will find many evidences of the violent action to which the strata have been subjected.

I would now in conclusion pass on to describe the

FOLDED AND CONTORTED STRATA OF THE VOBSTER AND NETTLEBIDGE VALLEY,

and I hope afterwards to make it clear that the various disturbances referred to are not so unconnected as may at

first sight appear, but that they owe their origin to one and the same great cause.

The contortion to which I refer stretches along the northern flank of the Mendips, and has been traced from the hamlet of Nettlebridge on the west to the village of Mells on the east, but whether it may ultimately be found to extend still farther to the eastward we can at present only surmise.

At Nettlebridge the strata have their natural inclination, dipping from the Mendips at an angle of 35 degrees, but becoming less highly inclined as they recede from the influence of that anticlinal. The section of strata at Old Rock Collieries exhibited will explain better than mere verbal description the state of affairs at this point, and it will be seen that beyond the high angle of elevation there is nothing unnatural in the position of the strata. But proceeding eastward we find an amount of confusion and distortion which literally baffles description. It would be impossible to construct a section which would give anything like a fair representation of the disturbances which exist, and I have abstained from attempting it; but the series of small cross sections exhibited, which are the work of an ingenious but unfortunate local man, will throw some light on the subject. It is only necessary I should warn you that while in each case they correctly represent the prevailing inclinations, and while the appearance of regularity and continuity which they exhibit in the New Rock series may be approximately correct, they would give a very erroneous impression of the state of things existing in the fourth or lowest series of the district.

You will observe that on leaving the Old Rock (or present Nettlebridge) Colliery, where, as I have already said, the strata occupy their natural position, we pass on to Old Nettlebridge, where they are very nearly vertical. This has been accomplished without any break in the beds. The strata gradually become steeper as we proceed eastward, until at the point

alluded to they are so nearly upright that the northern dip is hardly appreciable.

Proceeding still farther eastward we find this abnormal state of things becomes more and more decided, until the strata, having been folded back upon themselves, dip towards the Mendips instead of from them.

At Barlake the southern inclination is 72 degrees, at Holcombe 50 degrees, and when we reach the neighbourhood of Newbury and Mells the distortion attains its maximum, the southern dip being only 20 degrees. From this point eastward there is a gradual increase of inclination, and at 700 yards east of the road leading from Kilmersdon to Vobster, the strata, as proved at Mells New Colliery, show an angle of 45 degrees—indicating, as it appears to me, an approach to that point at which they will again become upright before resuming their legitimate northern dip.

So long a continuation of this southern inclination would, were the facts not well established, be apt to mislead us, and to induce the belief that some enormous fault had thrown the coal measures down near the Mendips, making them appear to dip beneath the limestone. But the fact that at Nettlebridge every yard of the ground has been proved, and the gradation traced from the point at which the true northern inclination exists to where the abnormal southern inclination shows itself, precludes the possibility of mistake; and did we require additional proof, it is to be found in the order of succession of the veins, which, at the point where the wrong dip exists, has been completely reversed—those veins which elsewhere lie deepest being found uppermost, and each individual vein, judging from internal evidence, being undoubtedly upside down.

That the strata must, as they are followed downwards, resume their proper dip there can be no doubt, but to what depth the abnormal inclination may hold good it is at present

impossible to say. The deepest sinking bearing upon the subject is at Lower Vobster, where, at a depth of 300 yards, the prevailing inclination appears to be to the north at an angle of 30 degrees; but there has been so much confusion in the upper part of the pit that it would be hazardous to assert that the bottom of the fold has been reached and the true northern dip discovered.

When we consider the amount of disturbance to which the coal measures of this part of the district must have been subjected, we cannot be surprised at the amount of confusion and distortion which prevails. In this respect, however, there is a very striking difference in the upper and lower parts of the lower division. The New Rock series, being chiefly composed of strong sandstones, has undergone the folding over without sustaining material injury. If we could penetrate deep enough, we should probably find that at the axis of the fold the strata have been rudely fractured; but where we have an opportunity of examining them, the veins of the series maintain their continuity with great persistency, their dip is tolerably regular, and altogether there is less evidence of the extraordinary action to which they have been exposed than might have been expected.

The fourth or Vobster series, on the contrary, has been contorted and disturbed to an indescribable extent. Being composed of exceedingly tender shales, when it was rolled back from the Mendips it seems to have been shattered and broken up into fragments.

Speaking generally, I would remark that the mountain limestone itself, although at this point nearly vertical, has not as a rule been folded back. The extreme amount of fold is to be met with in the New Rock series, which has fallen completely over, as already described. A much greater space has consequently been thrown in between the New Rock series and the limestone than is commonly taken up by the

intervening Vobster series and millstone grit, and this unusual space seems to be occupied by fragmentary portions of the Vobster series, the more valuable parts of which are commonly to be found in their natural position closely adjoining the Mendip range.

In the case of the mountain limestone there is a remarkable exception to what I have stated to be the general rule. In looking over geological maps of the neighbourhood, many may have observed near to Upper Vobster, two isolated patches of it which are entirely surrounded by coal measures. In the earlier ordnance maps these were represented as having been faulted up through the coal measures, and comparatively recently the same view has been taken in another quarter; but I am in a position to prove that the workings of at least one colliery have been extended beneath the limestone, and that several wells have been sunk through it, so that the fault theory of the Government geologists must have been a mistake. If, then, the limestone has not been thrust up through coal measures, but on the contrary rests upon them, we are bound to infer that the same disturbance which folded the coal measures back upon themselves carried with them these enormous masses of limestone, which are thus found half a mile from the parent rock.

Before closing I would offer a few remarks on

THE APPROXIMATE DATE AND PROBABLE ORIGIN OF THE FAULTS AND CONTORTIONS

described, and it is necessary that these should be connected, because they have a direct bearing on each other.

According to the testimony of the best authorities, the upheaval of the Mendips must have occurred towards the close of the carboniferous period, and prior to the deposition of the triassic beds, and it is a circumstance worth noting, that with hardly an exception the dislocations which have broken

up the coal measures appear to be of similar date. We have an instance at Paulton of a fault which dates subsequent to the formation of the lias, but the great majority of the disturbances which we have been considering to-night must have had their origin long before even the earliest of the secondary deposits, for the inequalities produced had been removed by denudation before the new red sandstone began to be deposited. If, then, the upheaval of the Mendips and the formation of the faults were contemporaneous, and if, as has already been stated, a large proportion of the faults range parallel with the Mendips, showing their lines of action to have been the same, it seems not improbable that they are to be ascribed to one common origin.

Whether or not this be true of the faults of the district generally, it seems to be the only rational way of accounting for the two more remarkable disturbances, viz., the overlap fault of Radstock and the folded strata of the Vobster Valley. In order to throw as much light as possible on this subject I have constructed a section taking in the different points in question. *(See Section No. 2, which has been reduced from the original.)* It begins with the highly inclined limestone of the Mendips, and taking a line as nearly as possible at right angles with that range, it includes the folded strata of Vobster and Mells and the overlapped strata of Radstock. Its northern and southern ends are strictly in accordance with fact, so far as that is ascertainable, and I have endeavoured to connect them by the only theory which seems adequately to account for the circumstances.

Briefly to embody the conclusions to which it leads :— The existence of volcanic matter in the centre of the Mendips discovered by Mr. Moore having explained beyond doubt the origin of that anticlinal, we are led to infer that the upheaval of the Mendips with the steep inclination prevailing on their northern side has produced that extraordinary folding back

of the strata immediately adjoining ; and to go a step further, we arrive at the conclusion that the folding back of this immense mass of rock and the consequent lateral pressure produced have caused that remarkable overlapping of the strata in the interior of the basin which I have already described.

The view here advanced will be greatly strengthened, and we shall be led to certain useful practical deductions from it, by a consideration of the following circumstances. If we examine Mr. Saunders' geological map of the neighbourhood we shall find that where, as at Ashwick, the angle of inclination in the limestone is not more than from 40 to 50 degrees, the coal measures opposite have their true northern dip ; but that when we proceed a little farther eastward to Stoke Lane, where the inclination of the limestone has increased to 70 or 80 degrees we find simultaneously with it the abnormal southern dip. It will also be observed that if at the point where the contrary dip sets in, a line at right angles with the range of the Mendips is extended into the interior of the coal basin, it will intersect the western termination of the overlap fault so far as at present known. If, then, the western termination of the overlap, the folded coal measures, and the highly inclined limestones so nearly coincide, is it not a strong argument in favour of one common origin, and is it not fair to assume that by observing the inclination of the limestone to the eastward we may ascertain approximately the eastern termination of the overlap and the folded strata of which we are at present in ignorance? High angles prevail in the Mendips until we reach the eastern side of Mells Park, and it is to be expected that to that point the disturbances alluded to will hold good, but after passing the village of Mells the inclination rapidly decreases to 50 degrees. Near that point therefore we may expect the strata to recover their legitimate dip, and at right angles to it in the interior of the basin we may hope to discover the eastern termination of the overlap fault.

If it be granted that the overlap, like the folded strata at Vobster, has been caused by the upheaval of the Mendips, there is another important deduction to be drawn from it. It will be observed that there is a wide difference in the extent to which the veins overlap each other; that while the upper vein of the Radstock series only overlaps itself to the extent of 120 yards, the lower vein of the same series shows an overlap of 330 yards. Now, had the fault been formed after the whole of the upper series had been deposited, no such difference as this could have existed; and the inference to be drawn from it is, that the upheaval of the Mendips must either have been accomplished gradually, or by successive steps with long periods intervening. If we suppose the first movement to have occurred shortly after the three lower veins of the upper series had been deposited, and that the movement was subsequently renewed, it would account for the disparity in the amount of overlap, which it seems difficult otherwise to explain.

S. HAYWARD, PRINTER, "EXPRESS" OFFICE, GREEN STREET, BATH.

CONTENTS.