THE HISTORY

OF THE

GEOLOGICAL SOCIETY OF LONDON

WILLIAM BUCKLAND, D.D., F.R.S.
President 1824-26; 1839-41.

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BY

HORACE B. WOODWARD, F.R.S.

LONDON
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PREFACE

A PROPOSAL was brought before the Council of the Geological Society in November 1904, that a history of the Society be drawn up somewhat after the plan of the 'Record of the Royal Society,' and that it be issued in readiness for the Centenary celebration in 1907.

The project having been approved, a committee comprising the President, Secretaries, and Treasurer, together with Mr. R. S. Herries, and the writer, was appointed to deal with the matter. Mr. H. W. Monckton undertook to contribute notes on some of the manuscript works deposited in the Library, and descriptions of the Medals; Mr. Herries expressed his willingness to verify a copy of the Charter, and to prepare a list of the Benefactors; Professor Garwood promised to deal with the portraits and other illustrations; while the historical portion of the work was undertaken by the writer. The present volume is the result.

The aim of the work has been to set forth the main incidents in the history of the Geological Society, as far as possible in the words of those to whom we are indebted for records, whether in the official Minute Books, in the publications of the Society, or in the several independent biographies of prominent members.

Hitherto no detailed narrative has been published of the circumstances attending the origin of the Society and its founders. Interest has centred in the Great Masters of the Science, notably in Buckland, Conybeare, Sedgwick,

Murchison, and Lyell, who succeeded the actual founders. From the biographies of these distinguished men, and from those of Edward Forbes, Jukes, Ramsay, Falconer, Owen, Huxley, and Prestwich, who belonged to the second generation of geological leaders, much material has been gathered relating to the history of the Geological Society and its individual members.

In the following pages reference has been made to some of the noteworthy achievements of the members, and especially to subjects which have stirred up great debates, but it is obvious that no attempt to present a summary of the contributions to geological progress made during the course of a hundred years would have been possible. The record of the work done by the Society at home and abroad is printed in its *Transactions*, *Proceedings*, and *Quarterly Journal*. Moreover, a history of the Society, though it be the oldest body devoted especially to geology, can have no claim to be a history of the science, the origin of which is a theme of European import, while its growth, fostered betimes in trans-Atlantic regions, soon became world-wide.

Endeavour has been made not merely to trace the birth, the development, and influence of the Geological Society, but to indicate something of the manner of men who laid its foundations, and during the earlier years materially aided its progress. If, however, a study of the work of pioneers tend, even laudably, to develop a kind of hero-worship, this must never be allowed to obscure the important work of the followers.

The growth and success of the Society have been due to the united labour and support of members differing much in education and means, and belonging to all grades of social position; to studious collectors of facts and fossils, as well as to men of genius and conspicuous ability. While it is interesting to find humble observers

like Jonathan Otley giving aid to Sedgwick in his early work in the Lake District, so also is it interesting to read of a former Marquis of Northampton knapping flints in a chalk-pit with such persistent energy as to create astonishment in the mind of a British workman. Other men, of culture, and some of fortune, inspired no doubt by the geological leaders, have rendered much service to the Society by personal devotion to its business and by financial assistance towards its publications.

Brief references have been made to the influence of the Geological Society and of some of its individual members in the establishment of the Geological Survey, and likewise of other Societies devoted to the pursuit of geology in various parts of the British Islands.

No history of the Society could be written without special allusion to the 'Father of English Geology' William Smith, nor without mention of men like Hugh Miller, whose biographies have been published, but whose names, strange as it may seem, were not enrolled among the members of the Geological Society. There are yet others, in a similar position, to whom the Society has owed not a little of its prosperity directly as well as indirectly. The encouragement and active sympathy of Lady Lyell, Lady Murchison, and Lady Prestwich are well known. Women indeed have helped in diverse ways to promote geological research, and, notably in recent years, many have contributed to the publications of the Society.

The greater portion of the present work is occupied with the history of the Geological Society during the first half-century of its existence, and but scant reference could be made to the later more detailed, but none the less important, researches in palæontology, petrology, stratigraphy, and physiography, by many zealous and brilliant workers.

Since the days of Hutton and Werner, whose followers became engaged in keen contests, geologists have been prone to combat, and a history of the workers could not be given without reference to some of their conflicts. That, for instance, relating to the Cambrian and Silurian classification, extending as it did over many years, could not have been passed by; and, in this further discussion of a somewhat thorny subject, advantage has been taken of the Minute Books of the Society. With the aid of extracts, now for the first time made public, it is hoped that some misconceptions may be removed, as it will be manifest that the governing body, though not infallible, strove without fear or favour to promote the best interests of the Society. Nor need the incidents of the dispute lessen our admiration for the work of two illustrious Masters who laid the foundations of our knowledge of the older Palæozoic systems. Great positions are rarely gained without controversy, and although heat will at times be developed, such manifestations amid divergent views are not confined to geologists. They are more apt to find place in the meeting-room or on paper than in the field, where the love of Nature must ever exercise a benign influence. As Huxley once remarked, 'Are you very savage? If so, you must go and take a walk along the sands, and see the slant rays of the sunset tipping the rollers as they break on the beach; that always made even *me* at peace with all the world, and *a fortiori* it will with you' ('Life and Letters,' vol. i. p. 122).

The printed proofs of the work have been read by the President (Sir Archibald Geikie), Professor Watts, Mr Monckton, and Mr. Herries; likewise by Professor Bonney and Dr. Henry Woodward; to all of whom the writer is indebted for valuable additions, emendations, and suggestions. At the same time no one of those who have so kindly rendered help and accorded encouragement is

responsible for any individual statements, unless where expressly acknowledged.

It was the privilege of the writer to serve nearly four years as Assistant in the Library and Museum of the Society, commencing in 1863, when Leonard Horner was still devoting much time to the arrangement of the rock-specimens, when Lyell and Murchison still took an active part in the meetings of the Society, and Bigsby, Robert Chambers, Egerton, Falconer, and Godwin-Austen were members of Council. Recollections of those days created the ambition to write a history of the Society, and the approach of the centenary stirred the effort. No step was taken until the present Assistant Secretary had been consulted, in case he too had nurtured a similar ambition; but Mr. Belinfante, while expressing his cordial sympathy with the project and his willingness to help in any way, at the same time intimated his inability to devote time to its preparation. Substantial aid has, however, been rendered by members of his staff. Mr. William Rupert Jones has at all times placed his stores of bibliographic knowledge at the service of the writer. Mr. C. H. Black and Mr. Alec Field have rendered much assistance in the preparation of the list of members prior to the Incorporation, and of the list of members of Council; and they have cheerfully aided in verifying sundry references. Here acknowledgment should also be made of help afforded by the invaluable 'Dictionary of National Biography.'

With regard to the illustrations, the Society is indebted to Mr. J. Y. W. MacAlister, of the Royal Medical and Chirurgical Society, for a portrait of one of our founders,

Dr. Henry Woodward for that of William Smith; to the Royal Society for permission to copy portraits of Dr. Fitton and John Phillips; and to Messrs. Macmillan for permission to insert those of Edward Forbes and Sir Andrew Ramsay. Professor Garwood has contributed the picture of Dean Buckland, which appropriately forms the frontispiece.

The sources of these and other portraits are recorded in the List of Illustrations.

HORACE B. WOODWARD.

HAMPSTEAD:
June 14, 1907.

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'Geology is the science which investigates the successive changes that have taken place in the organic and inorganic kingdoms of nature; it inquires into the causes of these changes, and the influence which they have exerted in modifying the surface and external structure of our planet.'

Lyell, 'Principles of Geology,' First Edition, 1830, and (without alteration) Twelfth Edition, 1875.

HISTORY

OF THE

GEOLOGICAL SOCIETY

CHAPTER I

INTRODUCTORY

ACADEMIES AND LEARNED SOCIETIES—EARLY GEOLOGICAL RESEARCHES

THE GEOLOGICAL SOCIETY of London was founded on November 13, 1807, about the middle of 'The Heroic Age of Geology,' a period taken by Zittel to extend from 1790 to 1820.[1] The time was appropriate for the binding together in Britain of those naturalists who were interested in the study and progress of the comparatively new science of Geology. This expressive word, indeed, had only been introduced in 1778 by J. A. De Luc, who some years later remarked: 'Of all the sciences the most extensive and the most complex is that which was termed geology, before it was entitled to the name.'[2] Nevertheless, many matters relating to a knowledge of the Earth had attracted attention from the earliest times, and observations

[1] 'Geschichte der Geologie und Paläontologie bis Ende des 19. Jahrhunderts.' Von K. A. von Zittel. Munich and Leipzig, 1899. A condensed English translation of this important work by Maria M. Ogilvie-Gordon, D.Sc., appeared in 1901. See also 'The Founders of Geology,' by Sir Archibald Geikie, 1897 (2nd ed. 1905), where the labours of the chief geologists between 1750 and 1825 are more fully described; and *Proc. Geol. Soc.* iii. p. 96.

[2] 'Treatise on Geology,' 1809, p. 1.

and speculations regarding stones and fossils had been recorded by the philosophers of old in Greece and Rome.

Interest in the subject was renewed during the sixteenth century. Academies were then founded by the learned men of the time: that of Padua (1520) being regarded as the oldest scientific society, though not long-lived. There followed the Academy of Natural Science at Naples (1560), and the Accademia dei Lincei at Rome (1603).

In Britain, 'An Academy for the Studye of Antiquity and History' was founded in the fourteenth year of the reign of Queen Elizabeth (1572). It originated with Archbishop Parker, and the meetings were held, for nearly twenty years, at the house of Sir Robert Cotton. The society remained in existence until 1604, and it included among its members William Camden, Richard Carew, John Dodderidge, and John Stow. Efforts were subsequently made to resuscitate the society, but it 'remained, as it were, in abeyance.' The only mention of it occurs in Mr. Ashmole's Diary, where we have a memorandum that 'July 2, 1659, was the Antiquaries feast.' A revival of the Antiquarian Society took place in 1707, in weekly meetings at the Bear Tavern, in the Strand; it became definitely established in 1717, with William Stukeley as secretary, and it was incorporated as the 'Society of Antiquaries of London' in 1751.[1]

The Royal Society, initiated about the year 1645, was established as a learned society in 1660, and received its charter of incorporation as the 'Royal Society of London' in 1662.[2] It is the earliest chartered scientific society in this country.

During the seventeenth century, interest in subjects pertaining to what is now known as geology was fostered

eighteenth century the structure of the Earth, its minerals, and organised remains, came to be studied more particularly, and from time to time other scientific societies were founded. The Royal Society of Edinburgh (established in 1739 as the Philosophical Society of Edinburgh) received its charter of incorporation in 1783; the Royal Irish Academy, instituted in 1785, was incorporated in 1786; and the Linnean Society, founded in 1788, was incorporated in 1802.

In the publications of these older societies will be found many important papers on subjects connected more or less directly with the history of geology. Among these the following may be mentioned:—

In the *Philosophical Transactions* of the Royal Society for 1684:

An ingenious proposal for a new sort of maps of countries, together with tables of sands and clays, such as are chiefly found in the north parts of England. By Martin Lister, M.D.

In the *Philosophical Transactions* for 1719 and 1725:

Observations on the different Strata of Earths and Minerals, more particularly such as are found in the Coal-mines of Great Britain. By John Strachey.

In the *Philosophical Transactions* for 1760:

On the Cause and Phænomena of Earthquakes. By the Rev. John Michell (afterwards Woodwardian Professor at Cambridge).

Besides the publication of papers in its *Transactions*, the Royal Society contributed greatly to the advance of many branches of science by fostering experimental methods of research and by discourses on the progress of investigation. Robert Hooke (1635–1703), the Society's illustrious 'Curator of Experiments,' deserves to be had in honoured remembrance for the sagacity of the views on geological subjects which he expounded at the meetings. His 'Discourses of Earthquakes,'[1] published after his

[1] 'Discourses of Earthquakes, their Causes and Effects, and Histories of Several; to which are annext, Physical Explications of Several of the Fables

death, contains many acute observations and shrewd inferences.

In the *Transactions of the Linnean Society* for 1798:

Account of some Species of Fossil Anomiæ [Spirifers, &c.] found in Derbyshire. By William Martin (1796).

In the *Transactions of the Royal Society of Edinburgh* for 1788:

Theory of the Earth; or an Investigation of the Laws Observable in the Composition, Dissolution and Restoration of Land upon the Globe. By James Hutton, M.D. (1785).

This 'Theory' amplified in book-form (1795), and illumined by John Playfair in his 'Illustrations of the Huttonian Theory' (1802), exercised a potent influence on the progress of Geology. Hutton first clearly taught that the past history of the earth was to be explained by the present (see p. 233).

In the *Archæologia* for 1800:

Account of Flint-Weapons discovered at Hoxne in Suffolk. By John Frere, F.R.S. (1797).[1]

The Agricultural Surveys of the United Kingdom, of which reports were issued by the old Board of Agriculture, commencing in 1794, stimulated inquiry into the soils and subsoils of the British Isles. The report on Somerset, by John Billingsley (1797), contained much geological information, while 'The General View of the Agriculture and Minerals of Derbyshire,' by John Farey (2 vols. 1811–13), is a geological classic. Farey (1766–1826) had been a disciple of William Smith, although a somewhat older man than his distinguished master.

William Smith (1769–1839) had in the meanwhile been at work for some years, and in 1799 he had coloured geologically the old county survey of Somerset, and a circular map of the country around Bath (the latter preserved in the Library of the Geological Society). In

in Ovid's *Metamorphoses*, very different from other Mythologick Interpreters.' These and other discourses given at the meetings of the Royal Society were collected and published in a folio volume in 1705 by Richard Waller, secretary of the Society.

[1] See Sir John Evans in *Archæologia*, xxxviii. 1860, p. 280.

the same year he communicated to his friends the Rev. Benjamin Richardson (of Farleigh Hungerford) and the Rev. Joseph Townsend (then of Bath), his 'Tabular View of the order of strata in the vicinity of Bath, with their respective organic remains,' of which the original is also in the possession of the Geological Society. At a still earlier date, according to John Farey, Smith had made known some of his views in conversation; but he was deterred from publishing the results of his observations, not only on account of the expense, but partly owing to his business occupations, and his desire to render the work more complete. His leading conclusions were, however, printed by Farey, in August 1807, just prior to the foundation of the Geological Society; and they were also communicated to Townsend, who embodied them, with full acknowledgment, in his quarto work, 'The Character of Moses established for Veracity as an Historian, recording Events from the Creation to the Deluge' (1813). Smith's own publications were subsequently reviewed by Dr. W. H. Fitton,[1] who made clear his title to be regarded as the author of the first geological map of England and Wales, and as the geologist who originally established the sequence of strata in this country, and the fact that they could be identified by their organised fossils.

[1] *Edinburgh Review*, vol. xxix. Feb. 1818, reprinted in 'Notes on the History of English Geology,' *Phil. Mag.* vols. i. and ii. 1832-33; and 'Founders of Geology,' by Sir A. Geikie, 2nd ed. p. 394.

CHAPTER II

Origin, Foundation, and Early History of the Geological Society

THE ASKESIAN SOCIETY—THE BRITISH MINERALOGICAL SOCIETY—THE GEOLOGICAL SOCIETY, ITS FOUNDERS AND THEIR AIMS—PATRON—REGULATIONS, COMMITTEES, AND RESOLUTIONS—EARLY PAPERS AND PRESENTATIONS—NOMENCLATURE—APARTMENTS IN TEMPLE—PROPOSAL TO CONSOLIDATE THE GEOLOGICAL WITH THE ROYAL SOCIETY—MAPS—MUSEUM AND LIBRARY—APARTMENTS IN LINCOLN'S-INN FIELDS—TRUSTEES—THE FIRST COUNCIL

TOWARDS the close of the eighteenth century, several small scientific societies were formed in London, for the purpose of mutual improvement in the different branches of natural philosophy. Of these, the Askesian Society and the British Mineralogical Society are of especial interest, as among their more prominent members were the founders of the Geological Society.

The Askesian Society was formed in March 1796 'by some young men desirous, as its name imports, to improve themselves mutually by philosophical exercises. The objects were to elucidate, by experiment, either facts generally understood, or to examine and repeat any novel discoveries. The meetings were held twice every month, during the winter season. Each member, in turn, was expected to produce a paper for reading and discussion upon some subject of scientific (not literary) inquiry, and many of these papers were afterwards published in Tilloch's *Philosophical Magazine*. Amongst the early members were William Allen, William Phillips, Luke Howard, Joseph Fox, Henry Lawson, Arthur Arch, W. H. Pepys, and Samuel Woods, the last of whom was president. Astley Cooper, Dr. Babington, A. Tilloch, Joseph Woods,

jun., and several others afterwards joined the society, which continued for twenty years.'[1] It is noteworthy that a number of these men were members of the Society of Friends. One of them, Luke Howard, was the distinguished meteorologist, and also chemist, to whom science was indebted in 1803 for the nomenclature of clouds, since generally adopted, and in 1833 for a work on 'The Climate of London.' He was elected F.R.S. in 1821.

Among the books formerly in the Library of the Museum of Practical Geology, and since transferred to the Science Library of the Victoria and Albert Museum, was the MS. Minute Book of the Proceedings of the British Mineralogical Society. From this we learn that at a meeting held in the Askesian Society's room at Plough Court on April 2, 1799—present: William Allen, W. H. Pepys, Alexander Tilloch, Richard Knight, and Wilson Lowry—it was 'Resolved that those present do form themselves into a society under the denomination of the British Mineralogical Society.' Laws and regulations to the extent of twenty-seven were framed at a subsequent meeting held on April 30. The number of members was not to exceed twenty. For the present none were to be admitted members 'but such as are able and willing to undertake a chemical analysis of a mineral substance.' Absentees were required to pay one shilling 'to be applied to the expenses of the society,' and 'members being absent for four nights successively, or neglecting the duties of a member, shall be considered to have resigned.' Mr. W. H. Pepys was chosen as secretary and treasurer. Before the close of the year, Arthur Aikin and C. R. Aikin joined the society: and during 1800 there were added Dr. William

On November 20, 1800, it was resolved: 'To associate as corresponding members such persons competently skilled in mineralogy, and not residing in London, as may be willing to transmit to the society, from time to time, lists of terms made use of by the miners and colliers in their neighbourhood, sketches of the mineralogy of different districts, accounts of strata pierced through in sinking shafts and wells, and such other circumstances as tend to illustrate the subterranean geography of the country.' Among the corresponding members elected in 1800 were Richard Kirwan, David Mushet, and Lewis Weston Dillwyn.

Up to this date the meetings were held once a fortnight during the greater part of the year, and the member whose name appeared first in the secretary's book was the recognised chairman for the evening.

On January 8, 1801, it was 'proposed that a president be annually elected.' W. H. Pepys was then re-elected secretary and treasurer; and on January 22, 1801, Arthur Aikin was elected president for the ensuing year. Apparently he continued as president during the existence of the society, with W. H. Pepys as secretary and treasurer, and C. R. Aikin as corresponding secretary.

Alexander Tilloch was then editor of the first *Philosophical Magazine*,[1] and he published not only reports of the proceedings of both the Askesian and the British Mineralogical Society, but also some of the papers that had been communicated to them. In 1801 he announced that the latter society had lately circulated the following notice [April 16]:—

> *To Farmers and Persons engaged in Experiments on Agriculture.*—The immense importance which, at all times, and particularly at present, is attached to improvements in agriculture, and the liberal encouragement to experiments in the art of cultivating the land offered by the patriotic views of the Board of Agriculture, have rendered it a desirable object to assist the inquiries of the farmer in that part

[1] 'The *Philosophical Magazine*, comprehending the various branches of the Sciences, the Liberal and Fine Arts, Geology, Agriculture, Manufactures, and Commerce.' (1798–1813.)

of experimental chemistry which determines the nature of soils by an analysis of their several contents.

The British Mineralogical Society, having of late increased the number of their members, find themselves enabled to extend the plan of their institution, from the analysis of minerals, in the usual sense of the term, to that of the various soils which are made the base of agricultural operations.

They, therefore, give this public notice that they will examine, free of expense, all specimens of earths or soils, with a view of determining the nature and proportion of their different contents, with as much accuracy as shall seem requisite.[1]

During 1803 the attendance at this society began to be irregular. In January 1804 it was 'Resolved: That the future meetings of the society be held by summons from the secretary, with the concurrence of the president, when business may require the attendance of the members.' On December 18, 1806, it was 'Resolved that the society be incorporated with the Askesian Society.'

The Askesian Society, with the British Mineralogical Society, thus furnished a nucleus of men interested in special studies connected with Geology. They had assembled together mainly for the purpose of mutual improvement in Mineralogy, but 'soon transferred their attention to the more comprehensive master-science of Geology.'[2] They recognised that the science required distinctive treatment, and a selected number agreed together to form an independent society.

Here it may be mentioned that the institution founded by Count Rumford and others in 1799, and chartered in the following year as the 'Royal Institution,' had formed by the year 1804 a museum of more than 3,000 mineral

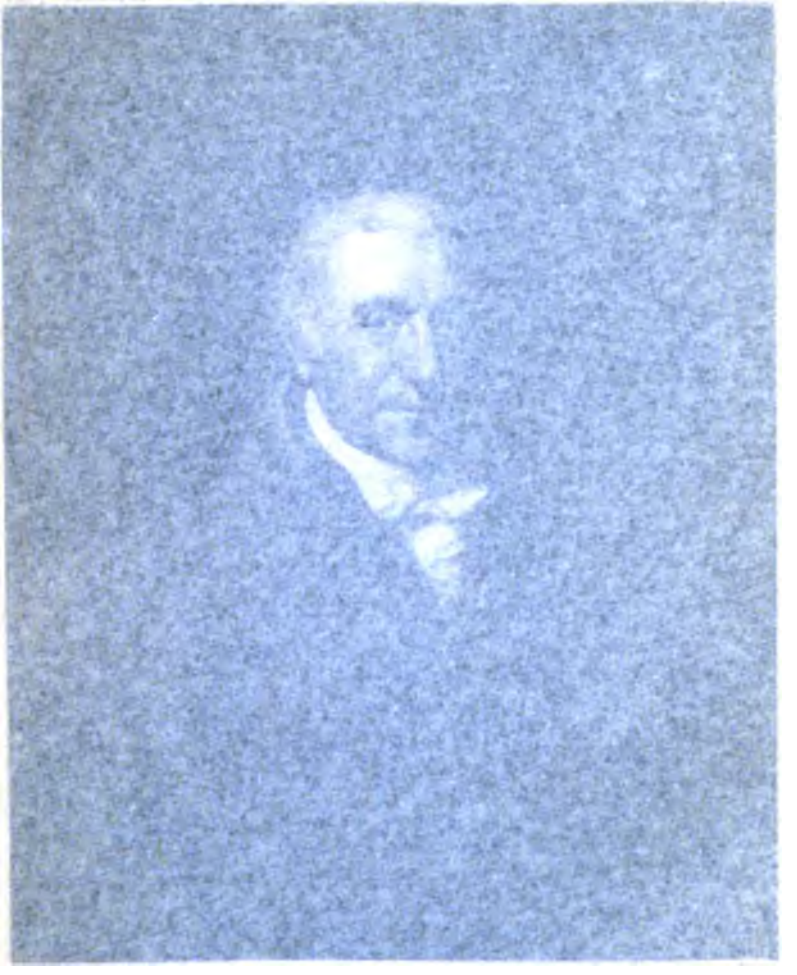
joined the Geological Society. During the years 1805-7, Davy lectured on geology as well as chemistry at the Royal Institution, and the collection there was regarded at the time as forming one of the best geological museums in London.[1]

The following all-important entry occurs in the diary of William Allen: 'On the 13th of the eleventh month, 1807, dined at the Freemasons' Tavern, about five o'clock, with Davy, Dr. Babington, &c., &c., about eleven in all. Instituted a Geological Society.'[2]

As a matter of fact the Geological Society was founded by thirteen gentlemen, two of whom (W. H. Pepys and W. Phillips) were, however, prevented from attending this first meeting. Davy had written to Pepys on the eventful day, November 13, saying, 'We are forming a little talking Geological Dinner Club, of which I hope you will be a member. I shall propose you to-day.'[3] Some account of the founders will here be appropriate.

Of these ARTHUR AIKIN (1773–1854) then of Broad Street Buildings, was a man of wide attainments and sound judgment; a good chemist and mineralogist. He had been a Unitarian minister. At a later date he was secretary of the Society of Arts. He and his brother, C. R. Aikin, prepared a useful 'Dictionary of Chemistry and Mineralogy' (2 vols. 1807 and 1814). Murchison acknowledged that in preparing his work on the Silurian System, he 'derived much assistance from a valuable original MS. on the Structure of Shropshire, by Mr. A. Aikin, the earliest modern geologist, who, with his associate, Mr. T. Webster, worked in this field.'[4]

WILLIAM ALLEN (1770–1843), of Plough Court, a member of the Society of Friends and an analytical chemist, entered



William Babington

M.D. F.R.S.

Founder President 1822-24

of Allen and Hanbury, pharmaceutical chemists. He was elected F.R.S. in 1807. He resigned his fellowship of the Geological Society in 1831.

WILLIAM BABINGTON, M.D. (1756–1833), of Aldermanbury, was born in Antrim, and in 1795 became physician to Guy's Hospital. He attained considerable fame as a medical man. In an obituary notice, Greenough, in 1834, pointed out that in many respects he was a remarkable man. He 'whom we have been accustomed to look to with a respect almost filial, attached himself in early life to a study of chemistry and mineralogy,' and he was author of two works on mineralogy (1795 and 1799). 'With a view to enable Count Bournon, of whom he had been a pupil, to publish his elaborate monograph on carbonate of lime, Dr. Babington, in 1807, invited to his house a number of gentlemen, the most distinguished for their zeal in the prosecution of mineralogical knowledge. A subscription was opened and the necessary sum readily collected. This object having been accomplished, other meetings of the same gentlemen took place for the joint purpose of friendly intercourse and mutual instruction. From such small beginnings sprang the Geological Society; and among the names of those by whose care and watchfulness it was supported during the early and most perilous crisis of its history, that of Dr. Babington must always stand conspicuous.'[1] Some of the meetings were held 'at the hour of seven in the morning, the only time of the day which Dr. Babington's professional engagements allowed him to devote to social enjoyments of this nature.'[2] In 1822 he was elected president, 'an office which he accepted in deference to the earnest wish of the members, and held for two years at great personal sacrifice.' During this period, 'and at his suggestion, was established the practice of submitting to immediate discussion the papers read at the table of the society.' His interest in geology was so enthusiastic that, in order 'to keep up with its rapid progress,' he took private lessons of Thomas Webster, after

the French Revolution, devoted himself to the formation of a fine collection of minerals, and became associated with the leading mineralogists in London. He 'was employed to arrange and describe the mineralogical collections of Sir John St. Aubyn and Mr. Greville, and especially the collection of diamonds of Sir Abraham Hume, of which a description, illustrated with plates, was published in 1816.'[1] The mineral Bournonite was named after him. He returned to France at the Restoration under Louis XVIII. Although essentially a mineralogist, he recognised the value to the geologist of a study of conchology and other branches of zoology in the elucidation of fossil organic remains.

HUMPHRY DAVY, F.R.S. (1778–1829), was professor of Chemistry at the Royal Institution, and secretary of the Royal Society. Early in life he had been apprenticed to a surgeon in his native town, Penzance, but was so attracted to the study of rocks and minerals as well as chemistry, that he 'paid much more attention to Philosophy than to Physic.' He was knighted in 1812, created a baronet in 1818, and elected president of the Royal Society in 1820.

JAMES FRANCK, M.D., of the Temple, was elected F.R.S. in 1821 (died 1843).

GEORGE BELLAS GREENOUGH, F.R.S. (1778–1855), of Parliament Street, was a man of fortune, who had studied mineralogy under Werner at Freiberg, and had travelled much. He formed a large collection of geological specimens, most of which are now in University College, London. He was M.P. for the borough of Gatton 1807–12. He was the first chairman, and in 1811 the first president, of the Society. He issued in 1819 [1820] his Geological Map of England and Wales, in six sheets. His bust by Westmacott is in the apartments of the Society.

RICHARD KNIGHT, of Foster Lane (died 1844).

JAMES LAIRD, M.D., of Basinghall Street, who died in 1840, was an excellent mineralogist, and rendered great service to the Society at its foundation, as the first secretary and afterwards as colleague of Leonard Horner in the secretariat. He was 'the intimate friend of Dr. Babington,

George Bellas Greenough

M.P. F.R.S.

First President 1807-13

Also President 1818-20, 1833-35

Werner, Dr. [J. F.] Berger, of Geneva, were then available, Dr. Laird was very instrumental, together with Dr. Babington, in making the necessary arrangements and [obtaining sufficient] pecuniary subscriptions to engage Dr. Berger to travel, first in Devonshire and Cornwall, and subsequently in the Isle of Man and north of Ireland, and to prepare geological accounts of these districts,' which appear in the first three volumes of the *Transactions* (see p. 51). To Dr. Laird we owe 'the judicious selection of our motto from the "Novum Organum," which still stands on the first page of every volume of our *Transactions*'[1] (see p. 44).

JAMES PARKINSON (died 1824) was in practice as a medical man at Hoxton, was F.R.C.S., and the distinguished author of 'Organic Remains of a Former World,' 3 vols., 1804, 1808, 1811.

WILLIAM HASLEDINE PEPYS (1775–1856), of the Poultry, a member of the Society of Friends, was a chemist and natural philosopher, and a descendant of Sir Richard Pepys, Lord Chief Justice of Ireland. He resigned his fellowship in 1829.

RICHARD PHILLIPS (1778–1851), of the Poultry, son of a printer and bookseller in the City of London, was a member of the Society of Friends. In early life he was the intimate friend of Davy and Wollaston. He became distinguished as a chemist, was elected F.R.S. in 1822, and was chemist and curator to the Museum of Economic Geology from 1839 until the close of his life; during the last two years he was president of the Chemical Society.

WILLIAM PHILLIPS (1773–1828), elder brother of Richard Phillips, also a member of the Society of Friends, carried on the business of printer and bookseller in George Yard, Lombard Street, and became the most distinguished, as a geologist, of the original founders of the Geological Society. He was author of 'A Selection of Facts from the best authorities, arranged so as to form an Outline of the Geology of England and Wales' (1818)—a work subsequently amplified in the classic 'Outlines' by Conybeare and Phillips (1822). His paper entitled 'Remarks on the Chalk Cliffs in the neighbourhood of Dover,' &c. (*Trans. Geol. Soc.* v. 1819), is one of the more celebrated of the early memoirs on English geology. Phillips was author also of important treatises on mineralogy. Of these his

[1] Buckland, Address, 1841, *Proc. Geol. Soc.* iii. p. 526.

'Elementary Introduction to the Knowledge of Mineralogy, published in 1816, reached a third edition in 1823; a fourth edition, augmented by Robert Allan, appeared in 1837; and the book was deemed worthy of a further edition, by H. J. Brooke and W. H. Miller, in 1852.[1]

It will be noted that the founders were men of culture and wide sympathies, although not all of them were geologists in the strict sense.

In the preface to the first volume of the Society's *Transactions* (dated 1811), the following statements were printed:—

'The few individuals who were founders of the Society met, in consequence of a desire of communicating to each other the result of their observations, and of examining how far the opinions maintained by the writers on geology were in conformity with the facts presented by nature.'

They recognised 'the advantages which may be derived from individuals acting in combination for the advancement of particular departments of science,' and 'that there is no object of research in which this co-operation is more necessary than in geology. In this science less, perhaps, has been done, and more that is important remains to be ascertained by future inquirers than in any other branch of natural knowledge; while the variety of attainments, and the degree of leisure requisite for the prosecution of it, can seldom fall to the share of one individual.' They 'felt satisfied that there was a peculiar propriety in making the metropolis of the empire the centre of such an institution, on account of the many mineralogical cabinets that it contains, as well as of the superior opportunities for mutual intercourse.' Attention was also called to the fact that 'a considerable collection has already been formed, which comprises not only many of the mineral productions of the British islands, but likewise several series of foreign rocks.' While thus laying stress on the mineralogical side of the science—no mention being made of the life-history of the

[1] 'A Short Memoir of William Phillips,' by his widow, Christiana Phillips, was published in 1891. For a copy of this we are indebted to their granddaughter, Mrs. George Horton, through the kind influence of a great-nephew, Professor Silvanus Phillips Thompson, F.R.S.]

WILLIAM PHILLIPS, F.R.S.
Founder.

rocks—it was further hoped that the Society might lay 'the foundation of a general geological map of the British territory.'

The concluding remarks are of special interest in showing the conception of geology attained at that early date:—

'It would be superfluous to enumerate the many advantages which may be derived from geology; it is sufficient to observe that it offers to scientific research a field of inquiry, rich in the beautiful and sublime productions of nature; and that, practically considered, its results admit of direct application to purposes of the highest utility. It may also be remarked, that the means of acquiring such information are peculiarly great throughout every part of the British islands. No country contains, within an equal space, a greater variety of mineral substances; while our long and broken line of coast, and our numerous mines, furnish the most ample opportunities of making geological observations.'[1]

The following records are taken from the first Minute Book of the Society:—

At a meeting held at the Freemasons' Tavern, Great Queen Street, November 13, 1807, present: Mr. Arthur Aikin, Mr. William Allen, Dr. [William] Babington, Count de Bournon, Mr. [Humphry] Davy, Dr. [James] Franck, Mr. [G. B.] Greenough, Mr. [Richard] Knight, Dr. [James] Laird, Mr. [James] Parkinson and Mr. Richard Phillips:

Resolved:

That there be forthwith instituted a Geological Society, for the purpose of making geologists acquainted with each

[1] In the library of the Geological Society there is a quarto MS., 'Mémoire par le Comte de Bournon,' of 43 pp. dealing with the work to be done by the Society. According to a Council Minute of January 31, 1811, this was intended as an Introduction to the *Transactions*, and parts of it were no doubt utilised by the Committee of Papers when they prepared the preface (see p. 43). Some account of the early history of the Geological Society was written by W. Stephen Mitchell, then assistant in the Museum of the Society, and published in *The Hour* for Nov. 5, 1873. Reference is made to this article by Sir John Evans in his Address in 1875, and more fully by Sir A. Geikie in his 'Life of Sir Roderick I. Murchison,' vol. i. 1875, pp. 119, &c.; unfortunately the copy that was in the possession of the Society has been lost.

other, of stimulating their zeal, of inducing them to adopt one nomenclature, of facilitating the communication of new facts, and of ascertaining what is known in their science, and what yet remains to be discovered.

That the gentlemen present, with Mr. Pepys and Mr. William Phillips, who have been prevented from attending this meeting, be considered the first members of the Geological Society.

That henceforth members be chosen by ballot. Any person desirous of becoming a member, having communicated his wish through the secretary to the Society, without being proposed or recommended in any other manner, shall be balloted for at the next meeting. The election to be unanimous.

That no person resident in London attend more than two meetings of the Society without becoming a member.

That each member shall be at liberty to introduce a visitor, under the preceding regulation.

That the Society dine together, at the Freemasons' Tavern, on the first Friday of every month, from November to June inclusive, at 15*s.* per head, visitors to pay as members. Dinner to be on the table at five o'clock precisely. Fine for non-attendance, 10*s.* 6*d.* Any member may avoid this fine by sending notice to the secretary of his intention to be absent, three days before the meeting.

That at the last meeting in June a subscription be raised to defray incidental expenses incurred by the treasurer for the purposes of the Society.

That G. B. Greenough, Esq., M.P., be treasurer, and Dr. Laird, secretary, for the ensuing year.

That a book be provided for recording the minutes of the Society, and for the insertion, by members or visitors, of any geological intelligence that may be presented. Every communication must be signed by the person who makes it.

(Signed) G. B. GREENOUGH.

The meetings of the Society and its Committees appear to have been held in a room temporarily engaged at the Freemasons' Tavern. The Society thus began its existence much in the form of a geological dining club, a feature

first institution of the Society to the present time amount to 37*l.* 16*s.*, of which 6*l.* 16*s.* 6*d.* only have hitherto been received.' The system of fines was evidently not a success. In 1824 a separate 'Geological Society Club,' limited to forty members, was established (see p. 65).[1]

At the second meeting of the Geological Society, held on Friday, December 4, 1807, it was resolved that the Right Hon. C. F. Greville be invited to become the patron of this Society; that there be a president of annual election; that G. B. Greenough be president for the ensuing year; and that W. H. Pepys be elected treasurer.

It may be mentioned that Charles Francis Greville (1749–1809) was the second son of the first Earl of Warwick, and had formed one of the finest collections of minerals ever gathered together. He was a Privy Councillor and resided at Paddington Green.

It was decided that forty-two gentlemen be elected honorary members of the Society. These are enumerated in the Appendix. They include distinguished men from all parts of the British Islands: Richard Bright of Bristol, Joseph Carne of Penzance, E. D. Clarke of Cambridge, J. J. Conybeare and John Kidd of Oxford, John Hailstone (Woodwardian Professor) of Cambridge, Robert Jameson and John Playfair of Edinburgh, Richard Kirwan of Dublin, and others.

The one serious defect in the list of honorary members is the omission of the name of William Smith; and yet it included the Rev. Joseph Townsend, whose claim to the gratitude of geologists rests mainly on the knowledge of the strata and their fossils, which, as already stated, he acquired from William Smith (see p. 5). As remarked by John Phillips, Smith was 'almost unnoticed except by

It was further resolved that Mr. Aikin, Dr. Babington, Mr. Greenough, Dr. Laird, and Mr. Pepys be a Committee to draw up rules for the regulation of the Society, and instructions to the honorary members to accompany the notice of their election, to be submitted to the Society at their next meeting.

The following were the first communications brought before the Society :—

Mr. Knight produced to the meeting a piece of Rowley Rag, and an artificial body having the characters of that stone, which he had obtained by the fusion and slow cooling of a portion of the same mass of rock—the result of experiments which he conducted some years since, and analogous to those of Mr. Gregory Watt. [He was the son of James Watt, the engineer, and made observations on basalt (*Phil. Trans.* 1804, p. 279), having melted a mass of Rowley Rag, and noticed the development of spherulitic structure.[1]]

Count de Bournon exhibited several specimens illustrative of the varieties of compact felspar—from its purest and characteristic state, when it has a waxy fracture, is semi-transparent and fusible, to that where it is more or less mixed with argile, or loses its distinctive appearances from decomposition.

On January 1, 1808, it was decided that there be two vice-presidents. The Committee appointed to draw up the regulations of the Society, and instructions to the honorary members to accompany the notice of their election, presented the following statement, which was adopted :—

GEOLOGICAL SOCIETY.

Established November 13, 1807.

SECTION I.—OF ITS OBJECTS.

to the advancement of Geological Science, more particularly as connected with the Mineral History of the British Isles.

Section II.—Of its Constitution.

The Geological Society shall consist of a patron, a president, two vice-presidents, a treasurer, a secretary, ordinary and honorary members.

Section III.—Of its Officers.

The president, vice-presidents, treasurer, and secretary shall be annually elected by ballot.

Section IV.—Of Members.

Art. 1.—Members shall be chosen by ballot; the election to be unanimous.

Art. 2.—Any person desirous of becoming a member may communicate his wish through the secretary to the Society, and without being proposed or recommended in any other manner shall be balloted for at the next meeting.

Art. 3.—Any member desirous of proposing an honorary member shall communicate his wish through the secretary to the Society. The person so proposed shall be balloted for at the next meeting; if elected, the name and recommendation of the member proposing shall be read and noted in the minutes; if rejected, they shall be suppressed.

Section V.—Of its Meetings.

Art. 1.—The Society shall dine together on the first Friday in every month, from November to June inclusive, at five o'clock precisely.

Art. 2.—Business shall commence at seven o'clock, and be conducted in the following order:—

1. The minutes of the preceding meeting read and approved.
2. Notices of new motions, &c., presented.
3. Members proposed.
4. Members balloted for.
5. Motions on the minutes brought forward and determined.
6. Miscellaneous business.
7. Geological communications read and presents acknowledged.

At nine o'clock the president shall leave the chair.

Art. 3.—All questions on which a difference of opinion may arise shall be determined by ballot at the next ordinary meeting.

Art. 4.—If on any occasion the numbers be equal the chairman shall have a second or casting vote.

Art. 5.—At the last meeting in June the officers of the Society shall be elected, the accounts of the late treasurer shall be passed, and a subscription raised to defray incidental expenses incurred by him for the purposes of the Society.

Art. 6.—A special general meeting may at any time be called by the secretary in consequence of instructions received from the president, or a requisition signed by three ordinary members. The object must be stated to the secretary, who shall give each member intimation of it, and of the time and place of meeting, three days previously.

Section VI.—Of Communications.

All communications must be sent to the secretary, and previously to their being read before the Society shall be approved by a committee composed of the officers of the Society, and of three members chosen by ballot. Three to constitute a quorum. This Committee shall be appointed at the June meeting after the election of officers, and shall be Trustees of all presents to the Society.

Section VII.—Of Visitors.

Art. 1.—Each member shall be at liberty to introduce a visitor, besides whom the president, or chairman, for the time being, may admit any person he may think fit with the limitation specified in the succeeding article.

Art. 2.—No person resident in London can attend more than two meetings of the Society without becoming a member.

It was resolved that the preceding statement of the objects and rules of the Society be adopted and distributed among the members; and that the following letter be sent with the plan of the institution to each of the honorary members:—

Sir,—I beg to inform you that you have been elected an Honorary Member of the Geological Society, for an account of which I refer you to the enclosed.

It is upon their Honorary Members that the Society in a great measure rely for the accomplishment of many

of the objects which they have in view, and I am therefore directed to express to you their earnest hope that you will allow them at all times to apply to you for such information as from the place of your residence, or the direction of your studies, they consider you peculiarly qualified to afford. They will also be greatly obliged if without any application on their part you will occasionally communicate to them your discoveries and opinions in Geological subjects.

When you come to London the Society hope to have the pleasure of seeing you at their first meeting 'at the Freemasons' Tavern' after your arrival, that the resident members may have the earliest opportunity of being introduced to you, and of showing you every attention in their power.

I have the honour to be, Sir,
Your obedient servant,
SECRETARY.

The following changes in the regulations were soon afterwards made :—

On March 18, 1808, it was decided :

'That ordinary members shall be elected by two-thirds, and honorary members by a majority of votes.'

On April 1, 1808 :

'That any foreigner may be proposed as an honorary member who has previously intimated a wish to correspond with this Society.'

The contribution to answer the purposes specified in Art. 5, Section V. was fixed at one guinea each member (June 3, 1808).

It is interesting to find that at this early date a Committee was formed 'to examine papers previously to their being read to the Society, and to take charge of all presents that may be received.' On March 4, 1808, Messrs. Aikin, Allen, and Richard Phillips were appointed to complete the number of this Committee. On June 2, 1809, it was 'Resolved : that five ordinary members instead of three be annually elected to complete the number of the Committee of Trustees.'

Soon after its foundation the Geological Society began to accumulate a collection of minerals, rocks, and fossils. Thus:

On January 1, 1808, Dr. Babington offered to the Society a cabinet for the reception of specimens, with free access to the members at all times. This offer was accepted.

During this year there were presented the following documents and specimens:—

Sir Joseph Banks presented plans and section of workings of a coal-mine.

Mr. Vivian presented a collection of rock-specimens formed under Werner at Freyberg.

Mr. Winch sent a series of the strata in which the coal at Coleyhill, Newcastle, is found; with a portion of the Whin dyke which crosses them, and of the coal in contact with it.

Dr. Menish transmitted a specimen of concrete boracic acid found in the Æolian Isles; with a statement of certain experiments by which he determined its nature.

Mr. Greenough presented some varieties of British rocks collected by himself.

Sir Joseph Banks presented specimens of the strata sunk through in digging a well at Lord Spencer's at Wimbledon.

An extensive series of specimens from Leicestershire, Derbyshire, Westmorland, Cumberland, and Scotland, collected by Dr. Berger, was presented.

The first two papers read before the Society (February 5, 1808) were the following:—

A paper on the subject of facilitating the process of Blasting Rocks by the employment of Clay instead of the ordinary Tamping. By John Taylor, Esq., of Holwell House, Devon, *Hon. Mem.*

A paper on the Decomposition of Sulphate of Iron by Animal Matter, and the production of Pyrites. By W. H. Pepys, Esq.

Other papers read on April 1, 1808, were:—

On the Destruction of Rocks. By Count de Bournon.

An Account of the Mineralogy of the Islands of Guernsey, Jersey, &c. By Dr. J. Macculloch (concluded May 6).

Mr. Ryan exhibited a core of solid rock removed from the depth of 65 feet by his patent boring-machine.

It is not surprising that the Regulation Section V., Art. 3, of which the following is a copy of the original draft, was found unworkable :—

That all questions on which there appears any difference of opinion be determined by ballot at the next ordinary meeting, when, if the numbers be equal, the president or chairman shall have a second or casting vote.

This may be judged from another statement quoted from the preface to the first volume of *Transactions* (p. ix), 1811, the principle of which has been maintained, though not without some deviations, throughout the subsequent history of the Society :—

In the present imperfect state of this science, it cannot be supposed that the Society should attempt to decide upon the merits of the different theories of the earth that have been proposed. In the communications, therefore, which are now submitted to the public, every latitude has been allowed to authors, with regard to their theoretical inferences from the observations which they record; it being understood, according to the rule of Literary and Philosophical Societies in general, that the writers alone are responsible for the facts and opinions which their papers may contain.

The steps taken from time to time to promote the study of geology show a laudable desire to attain uniformity in descriptive methods. Thus early in 1808 the Committee laid before the Society a series of geological questions, which, after consideration and emendation, was ordered to be printed and circulated among the members. On May 6 of the same year the following resolutions were adopted :—

That the present state of the Nomenclature of

2. That a Committee shall be appointed, consisting of twelve ordinary members of the Society, three of whom shall form a quorum, which shall be permanent until the object of their appointment is accomplished, and which Committee shall be named 'The Committee of Nomenclature.'

3. That this Committee shall have two principal objects for their attention, viz. the selection of appropriate terms for the uniform description of Geological and Mineralogical facts, and the collection of all provincial terms connected with these branches of science.[1]

The following members were appointed on the Committee of Nomenclature, viz.—Mr. Horner, Mr. Greenough, Mr. Davy, Dr. Babington, Dr. Laird, Dr. Macculloch, Mr. Aikin, Mr. W. Phillips, Dr. Macmichael, Sir James Hall, and Mr. Lowry.

No records appear to have been preserved of the printed geological inquiries that were circulated among the members, of any replies, or of any decisions arrived at by the Committee of Nomenclature; and it is perhaps fair to conclude that the results of the inquiries did not fulfil the expectations of the Committee, and that geologists even in those days were loth to bind themselves to a uniform system of nomenclature.

At a meeting of the Geological Society, held on June 3, 1808, it was resolved:—

That henceforth the names of visitors shall be delivered in writing to the chairman of the meeting, with the names of the members by whom they are introduced.

The first printed list of members bears the above date. At the next meeting, held on November 4, L. A. Necker de Saussure and two others were introduced as visitors. Mr. Necker then presented to the Society 'a map of

On December 2, 1808, it was decided that rooms be engaged by the Society for the reception of its cabinet and for the meetings of the Committees.

On March 3, 1809, it was notified that rooms were engaged, in the name of Mr. Horner, on the ground floor at No. 4, Garden Court, Temple.

> The estimate of the cost of these rooms was as follows: Rent, 50*l.*; window-tax, 1*l.* 4*s.* 6*d.*; house duty, 7*l.* 1*s.* 8*d.*; and Temple dues, 3*l.* (total, 61*l.* 6*s.* 2*d.*). In addition, the cost of attendance 20*l.*, of coals for thirty weeks 11*l.* 5*s.*, and of candles for thirty weeks 5*l.* 5*s.*, made a total altogether of 97*l.* 16*s.* 2*d.* The rooms were on lease for fourteen years, terminable at seven years. The sum of 63*l.* 18*s.* 9*d.* was expended on furniture, and on June 2, 1809, the Committee of Trustees reported that the Society's collection had been removed to Garden Court, where it would be accessible at all hours to any member desirous of visiting it.[1]

In January 1808 the Right Hon. Sir Joseph Banks, Bart., president of the Royal Society, expressed a wish to become an ordinary member of the Geological Society. He resigned, however, in February 1809, because in his opinion the Society had 'deviated from the principles which they entertained at their first establishment.'

It is difficult to understand the reasons for this opinion. The Geological Society had not then determined to publish its Transactions, while among the thirteen founders no less than six were at the time Fellows of the Royal Society, and one of them, Humphry Davy, was secretary of that Society. The only apparent cause of disapprobation was that the Geological Society when it ceased to be a club, and arranged to have a separate habitation, manifested in that way too independent an attitude towards the parent Society.[2]

The following records indicate as far as possible the state of the case, and the 'line of conduct which our then

[1] The sub-treasurer of the Middle Temple, Mr. J. W. Waldron, informs us that the building was pulled down in 1884.

[2] See 'Life of Sir Roderick I. Murchison,' by A. Geikie, i. 1875, p. 121.

president, Mr. Greenough, recommended, and which proved successful.'[1] While he is said to have resisted 'calmly but fearlessly,' the proposals brought before the Society, he at the same time 'endeavoured to conciliate matters by every means in his power. He pointed out to Sir J. Banks the true objects of their intended action; with his own hands he drew up a list of the subjects which it was intended to make the objects of inquiry, and promised that any papers he desired should be freely placed at the disposal of the Royal Society. But all in vain; the hostile feeling could not be overcome. Still Mr. Greenough was unshaken.' It is satisfactory to know that 'although much warmth was elicited in these discussions, Mr. Greenough never lost a friend.'[2]

The following are official records:—

> March 3, 1809. Letter received from Right Hon. Charles Greville.
>
> Resolved that plan proposed by him be printed and copy be sent to every ordinary member.
>
> The secretary communicated to the meeting a letter which he had that day received from Sir Joseph Banks, containing a request that his name should be withdrawn from the list of the Geological Society, and mentioning that he had written to the president on this subject.
>
> Resolved that the secretary be instructed to acquaint Sir Joseph Banks that the Society accept his resignation with deep regret, and that they are not conscious of having deviated from the principles which they entertained at their first establishment.

A special general meeting was held on March 10, 1809, at the Freemasons' Tavern, in order to consider a 'Plan for consolidating the Geological with the Roval

Mr. Garnier, Mr. Horner, Dr. Hue, Sir Abraham Hume, Bart., Mr. Lambert, Mr. Lowry, Mr. Parkinson, Mr. Richard Phillips, Mr. William Phillips, Mr. Shuter, Mr. Tilloch, Mr. Warburton, Mr. Williams, Mr. Woods, and Dr. Laird, secretary.

Plan for Consolidating the Geological with the Royal Society as an Assistant Society.

That the Geological Society do consist of two classes of subscribing members, who shall subscribe two guineas annually or compound for *20l.*

That the subscribing members who are Fellows of the Royal Society shall constitute the first class or Council of the Geological Society, and be invested with the power of electing members, or making bye-laws, and of conducting the intercourse with the Council of the Royal Society, and all the affairs of the Society.

That subscribing members, not being Fellows of the Royal Society, be assistant members, who, with the other class, shall form the Assistant Society to the Royal Society, for the advancement of Geology.

That members may be elected as honorary, and be admitted to the meetings and collection without subscribing to the fund.

That the anniversary be as at present appointed for the election of officers, on which day the president shall be elected from among the subscribing members who are Fellows of the Royal Society, and the other officers from the subscribing members at large.

That the members of the Geological Society, acting as the Committee of Papers, and who are Fellows of the Royal Society, be directed regularly to communicate all papers relative to Geology and Mineralogy, with the drawings, specimens, and illustrations of the same, to the Council of the Royal Society, that the Royal Society may select such papers as it may please to read at its table and to print in the *Philosophical Transactions*; and that such papers as shall not be selected by the Royal Society, and their illustrations, together with any communications which the Royal Society may make to the Geological Society as an Assistant Society, shall be deposited in the collection of the Geological Society, and to be included in any publication which it may think proper to undertake at its own charge; but that on no

pretence whatever shall any paper, selected by the Royal Society for publication in its *Transactions*, be reprinted by the Geological Society in a shorter interval than is at present prescribed by the Royal Society to the Fellows of the Royal Society who are favoured with copies of their papers printed in the *Philosophical Transactions*.

That all existing laws of the Geological Society which, on revision, shall appear inconsistent with this proposed constitution, be considered null and void; and that the first object of the Council be to consolidate the new code; and that the Council be deemed constituted, and its functions do commence, from the time the president of this Society, after communicating these proposals, shall receive the sanction of the present members, or a majority of them.

That the president do forthwith submit to the members individually this proposal of a new constitution, adapted to the original principles of this Society, and do request every member to state in writing whether he inclines to be on the list as a subscribing or as an honorary member; and notwithstanding it is not necessary to consult the honorary members on the constitution of the Society, in forming a new list, it is proper to give an option to the honorary members to continue on that list, or to become subscribing members.

That the president do notify the president of the Royal Society, whenever the proposed Council of Fellows of the Royal Society is established by the majority of the Geological Society, that its co-operation as an Assistant Society may be ratified finally by the Royal Society.

That the ratification of these resolutions by the Councils of the Royal Society and of the Assistant Geological Society shall be permanently binding in honour to both Societies, and shall not be subject to repeal as all other resolutions or bye-laws are declared to be.

The foregoing plan for consolidating the Geological Society with the Royal Society as an Assistant Society, submitted from the Right Hon. Charles Greville, and the state of the Society having been taken into consideration, it was moved, and seconded, agreeably to the words of the first motion of which notice was given :—

'That any proposition tending to render this Society dependent upon, or subservient to, any other Society, does

not correspond with the conception this meeting entertains of the original principles upon which the Geological Society was founded.'

The previous question was put, and negatived.

The following amendment was then put:

'That this Society does not consider itself dependent upon, nor subservient to, any other.'

It was negatived.

The original motion being put, passed in the affirmative.

Resolved—agreeably to the words of the second motion, of which notice was given—

'That the propositions communicated from the Right Hon. Charles Greville having a direct tendency to render this Society dependent upon, and subservient to, the Royal Society are inadmissible.'

The following resolutions were then moved and passed in the affirmative:—

Resolved,—

That it has never entered into the contemplation of this Society to impose upon its members the performance of any duties inconsistent with the obligations of those among them who may be Fellows of the Royal Society.

That this Society, deeply and sincerely regretting that any circumstances should have occurred to implicate in the preceding resolutions the name of the Royal Society, cheerfully embrace the opportunity thus accidentally offered, to declare the high respect and deference they entertain toward that learned and scientific body, and their most earnest wish to contribute, in any degree and in proportion to their limited ability, to the welfare and prosperity of the Royal Society.

That these resolutions be printed, and a copy of them transmitted to the President of the Royal Society, and to each of the ordinary members of the Geological Society.

(Approved and signed), G. B. GREENOUGH.

> The advantage which science has reaped from this independence of action and division of labour is now, indeed, admitted even by those who were opponents and have lived to see our success.

The matter has been recently referred to by a president of the Royal Society, Sir William Huggins, in his Address delivered in 1903 :—

> The scientific world, as well as the Geological Society itself, have good reason to rejoice over the wise and far-seeing policy of its founders and original members, when they decided to leave the young Society free to grow and to develop its powers, untrammelled by any obligations to any other body—a course which the past progress of the Society, the eminent services which it has now for nearly a century rendered to the promotion of natural knowledge, and the scientific distinction and the wide influence which it possesses to-day, in the fullest degree justify and confirm.

Sir William Huggins adds that the question still remained open, of simultaneous duplicate publication of the more important scientific memoirs communicated directly to one or other of the special societies or to the Royal Society.[1]

During the session 1809–10, the evening meetings commenced at half-past seven on the first and third Fridays of every month from November to June inclusive. On March 3, 1809, it was proposed to appoint a committee for the construction of mineralogical maps, models, &c. ; and on April 7 it was resolved :

> 'That the construction of mineralogical maps, and the collection of drawings, models, sections of mines, &c., are well worthy the attention of the Geological Society, and

The Committee was appointed as follows :—

Mr. Atkinson, the Rev. E. J. Burrow, Mr. Davis, Mr. Franck, Mr. Horner, Mr. Lowry, Dr. Macculloch, Dr. Macmichael, Mr. Pepys, Mr. William Phillips, Mr. Parkinson, and Mr. Shuter.

On June 2, 1809, the Committee of Trustees further reported that the expenses incurred by the Society during the past year had amounted to 201*l.* 10*s.* 8*d.*, and the receipts to 43*l.* 1*s.*, and they suggested that the subscription for the year be three guineas each member, which would yield 170*l.* 2*s.* Eventually the subscription for the year was fixed at 4*l.* 4*s.* In February 1810 it was found desirable to have a second secretary, and Mr. Leonard Horner was appointed to this honorary position.

In November 1809 the Committee procured additional cabinets, and resolved that the collections should be arranged by Mr. Greenough and Mr. Leonard Horner.

In the same year the formation of a library was commenced. Thus on March 3 it was notified that 'presents have been made of some works on Geology and Mineralogy;' and at a later date several maps and sections were presented and others were lent. Books also were lent for the use of members at this time, so that the Library was to a certain extent of a temporary nature.

In November 1809 it was announced that the specimens had been arranged geographically: those from the British Islands according to counties; and that Mr. Horner had commenced a catalogue. As elsewhere mentioned, Mr. Horner manifested a life-long devotion to the Museum, and laboured at it on and off for more than fifty years (see p. 35).

On June 14, 1810, the Council resolved that Mr. Horner, Count de Bournon, Mr. Lowry, and Dr. Roget be a committee to arrange the collection of minerals.

principal advantages which they anticipated from such a measure, besides a greater appearance of respectability, were a larger space for the increasing number of cabinets [it was 'cabinet' in 1808], the better accommodation of committees, and of persons visiting the collection, the additional convenience of a clerk, and above all the removal of the business of the general meetings from the place where it was then held to a habitation of their own.

On April 6, 1810, the Committee reported that the house, 3 Lincoln's Inn Fields, was engaged.

> It was agreed that the front room on the ground floor was to be occupied by the Medical and Chirurgical Society exclusively; that the whole of the second floor was to be occupied by the Geological Society exclusively; and that the first floor was to be appropriated to the meetings of the two Societies. The back parlour and the remaining rooms were intended for the residence of a joint-clerk for the two Societies; and the Committee of Trustees were happy to say that they had in view a respectable person who would officiate as such.
>
> On June 1, 1810, the first meeting was held in the new rooms, and Mr. Jones was appointed clerk to the Society.

On April 6, 1810, it was deemed necessary that permanent trustees be appointed, and the following were named:—

William Babington, M.D., F.R.S.	Francis Horner, M.P.
Robert Ferguson, F.R.S.	Sir Abraham Hume, Bart., M.P., F.R.S.
George Bellas Greenough, M.P., F.R.S.	David Ricardo.
	Samuel Woods.

In this year the property of the Society was insured for 400*l.* The printing of a new list of members and code of regulations was ordered on June 1, 1810; and on June 14 it was decided that cards, recording the dates of meetings, be printed and sent to each member prior to the commencement of the session.

Until this date the affairs of the Society had been conducted by committees, and their proposals were submitted to the members at ordinary or special meetings.

It was now decided to form a Council that should meet on the first Friday of every month at eleven o'clock precisely. The following members were selected, and the first meeting of the Council was held on June 14, 1810:—

G. B. Greenough, M.P., F.R.S., *President.*
Arthur Aikin.
Sir John St. Aubyn, Bart., F.R.S., *V.P.*
William Babington, M.D., F.R.S., *V.P.*
J. L. Count de Bournon, F.R.S., *For. Sec.*
Richard Chenevix, F.R.S.
Samuel Davis, F.R.S.
Robert Ferguson, F.R.S., *V.P.*
Leonard Horner, *Sec.*
Sir Abraham Hume, Bart., F.R.S., *V.P.*
James Laird, M.D., *Sec.*
Wilson Lowry.
John Macculloch, M.D.
Alexander Marcet, M.D., F.R.S.
W. H. Pepys, F.R.S., *Treas.*
Richard Phillips.
William Phillips.
Matthew Raine, D.D., F.R.S.
David Ricardo.
Peter Mark Roget, M.D.
Samuel Woods.

It will be apparent from the list of members that the first Council was composed of men representing not merely geology or mineralogy in particular, but many cognate sciences. This policy of selecting representatives of the wider interests of geological science has animated the Council throughout the history of the Society, and has proved of great benefit to the institution.

Some of the active and influential members in the early days of the Society, such as the presidents William Blake and William Babington, published no papers in the *Transactions* of the Society; and the same was the case with numerous members of Council—*e.g.* Sir John St. Aubyn, R. Chenevix, S. Davis, R. Ferguson, Sir A. Hume, Dr. J. Laird, W. Lowry, R. Phillips, Dr. Matthew Raine, David Ricardo, Dr. P. M. Roget, Samuel Woods, and Dr. J. Yelloly.

Of the early members of Council, Sir John St. Aubyn Bart., F.R.S., of Clowance, near Helston, and St. Michael s

Mount (1758–1839), was a distinguished patron of science, and had formed a fine collection of minerals.

The Rev. Edward John Burrow, D.D. (1785–1861), was a man of general culture and scientific tastes. He was author of 'Elements of Conchology' (1815), and of a work on 'The Elgin Marbles' (1817).

Richard Chenevix, F.R.S. (1774–1830), who was born in Ireland, was an able chemist and mineralogist, especially interested in alloys.

John George Children (1777–1852) devoted himself in early life to mineralogy and natural philosophy, and was elected F.R.S. in 1807. His father, a member of the Geological Society, was a banker at Tonbridge, but became bankrupt in 1816. In the same year the son obtained employment in the British Museum, eventually becoming Keeper of the Zoological Department. He was one of the founders of the Entomological Society (1833); and he occupied his later years in the study of astronomy.

Robert Ferguson, F.R.S., of Raith, Lord Lieutenant for the County of Fife, a patron of science, was a vice-president, an active member of Council, and 'on all occasions a most liberal contributor to the wants of the Society.'

Henry Holland, M.D. (1788–1873), of Knutsford, in Cheshire, then a young man of conspicuous ability, had travelled in Iceland with Sir G. Mackenzie, and subsequently made observations on volcanic phenomena in Southern Europe. He discovered 'boracic acid, *in situ*, at the bottom of the crater of the Isle of Volcano.' He wrote on the rock-salt district (1811), and prepared a report on the agriculture of Cheshire for the Board of Agriculture (1813).[1] He was elected an honorary member in 1809, and served on the Council, 1816-20. He became F.R.S. in 1815. He was distinguished in the medical profession, eventually becoming physician in ordinary to Queen Victoria, and a baronet. His son was created Viscount Knutsford.

Francis Horner (1778–1817), elder brother of Leonard

Geological Society. He joined in 1808, and two years later became one of the honorary secretaries. He had studied chemistry and mineralogy at Edinburgh—subjects which afterwards occupied much of the leisure of a busy life. As early as 1810, when secretary, he 'used to spend many evenings arranging the collections, frequently accompanied by his young wife;' and during his last year—more than fifty years later—Horner spent many hours on many days in the Museum of the Society at Somerset House, arranging the foreign collection of rocks. He was especially interested in the German rocks—having resided for two years at Bonn, during the years 1831–33—when he had given much attention to petrology. He was elected F.R.S. in 1813. His eldest daughter was married to Mr. (afterwards Sir Charles) Lyell.[1] In his address to the Society, in 1846, he remarked: 'When we consider the vast extent of the domain of geology—as it is now studied—that its fundamental principles are derived from many, indeed from almost all, departments of natural history and physical science, it is not possible for anyone, although he united the most comprehensive mind and varied attainments with indefatigable industry, to take even a rapid survey of the progress of geology in a single year, using the term in its most enlarged sense.' As remarked by Sir A. Geikie, he was 'ever ready to receive and sympathise with new developments of truth;' and when he read his last address before the Society (1861) 'he pleaded boldly for the high antiquity of the human race, in opposition to popular prejudice on this subject, and claimed for the speculations of Mr. Darwin the thoughtful consideration of all lovers of truth.'[2]

Sir Abraham Hume, Bart. (1749–1838), elected in 1808, was regarded as one of the founders of the Society.[3] He 'was at all times one of its most strenuous friends and most liberal supporters, and especially in its earliest periods, when such aid was of most value.' He was a *virtuoso*, with a famous collection of minerals and precious stones, especially rich in diamonds; and he was one of those who met at Dr. Babington's house, but not in the early hours of the

[1] 'Memoir of Leonard Horner,' edited by his daughter, Katherine M. Lyell. 2 vols. 1890 (privately printed).

[2] Obit. notice of Horner, *Proc. Roy. Soc.* xiv. 1865, p. v.

[3] See Whewell's Address, *Proc. Geol. Soc.*, iii. p. 65.

morning. He was elected F.R.S. in 1775, and was at one time M.P. for Petersfield, and afterwards for Hastings.

Wilson Lowry (1762–1824), was a distinguished engraver, with a remarkable knowledge of geometry and mechanics. He was elected F.R.S. in 1812. He prepared many illustrations for the *Transactions* of our Society, for Tilloch's *Philosophical Magazine*, the *Journal of the Society of Arts*, and the *Encyclopædia Metropolitana*. In the last-named work he was assisted by his son, Joseph Wilson Lowry (1803–79), who likewise followed the art of engraving, and prepared many exquisite geological and natural history illustrations for John Phillips's geological works, for S. P. Woodward's 'Manual of the Mollusca,' and for the Geological Survey of the United Kingdom.

Dr. John Macculloch (1773–1835) contributed the first paper published by the Society, and he subsequently communicated numerous others characterised by 'shrewd, original work, carried on among some of the least accessible tracts of the British islands, and described at times with a vigour of pen which not many of his brethren of the hammer could equal.'[1] As remarked by Lyell, in 1836, the influence exerted by these papers 'on the progress of our science has been powerful and lasting, yet they have been less generally admired and studied than they deserve.' In his later publications, and especially in his 'System of Geology,' there were many imperfections, attributed by Lyell to ill-health acting on a sensitive mind—for Macculloch was labouring under 'the idea that his services in the cause of geology were undervalued.' He resigned his Fellowship of the Society in 1832. Yet Lyell affirmed 'that as an original observer Dr. Macculloch yields to no other geologist of our times;' and he acknowledged that he had 'received more instruction from his labours in geology than from those of any living writer.'[2]

Alexander John Gaspard Marcet (1770–1822), born at Geneva, was educated for the medical profession at Edin-

John Macculloch

M.D. F.R.S.

President 1816-18

He was subsequently appointed lecturer on Chemistry at Guy's Hospital, and in 1808 he was elected F.R.S. In 1819 he resigned his professional appointments and retired to Geneva.

Matthew Raine, D.D., F.R.S. (1760–1811), a distinguished scholar, was head-master of Charterhouse School. He was elected F.R.S. in 1803.

David Ricardo (1772–1823), of Jewish parentage, was much interested in science, and formed a collection of minerals. He was distinguished as a political economist, and in 1819 he was elected M.P. for Portarlington, in Ireland.

Peter Mark Roget, M.D. (1779–1869), the son of the pastor of the French Protestant Church in Threadneedle Street, was educated at Edinburgh University, where he graduated M.D. in 1798. He settled in London in 1808, and was elected F.R.S. in 1815. He was a man of remarkably wide knowledge and ability, and is perhaps best known at the present day as the author of a 'Thesaurus of English Words and Phrases.'

John Yelloly (1774–1842) took the degree of M.D. at Edinburgh in 1799, and settled in London in 1800. He was one of the founders of the Royal Medical and Chirurgical Society, and was also interested in geology. In 1818 he settled in Norwich, and two years later was appointed physician to the Norfolk and Norwich Hospital.

During the year 1810 the Council appointed the following Committees to deal with the work of the Society :—

(1) to superintend management of the accounts;
(2) to arrange collection of minerals;
(3) to conduct, with five members of the Medical and Chirurgical Society, the joint business of the two Societies;
(4) of nomenclature;
(5) of maps and sections;
(6) of chemical analysis;
(7) for the investigation of extraneous fossils;
(8) of papers.

Mr. Lowry, and Dr. Marcet. To these Dr. Roget was subsequently added.

> On February 15, 1811, it was resolved—'That the same member shall not be eligible to fill the office of president beyond the period of two years, and that one year must elapse before he can be again elected to that situation.'
>
> It was further resolved that the same regulation apply to vice-presidents.

Until this date the certificates for new members were in manuscript, and the form varied in different cases. Thus in No. 200 it was as follows:—

> William Conybeare, Esq., of Christ Church, Oxford, being desirous of becoming a member of the Geological Society, we, the undersigned, do, of our personal knowledge, recommend him as a person highly deserving that honour and likely to prove a useful and valuable member.
>
> (Signed) W. Hasledine Pepys.
> Arthur Aikin.
> Saml. Woods.
> S. Solly.
> Wm. Macmichael.
>
> April 19, 1811.

Printed forms of certificate date from 1812.

In that year it was decided that monthly meetings only be held from November to June inclusive, and at 8 P.M.

Up to this date the only important scientific magazines in which geological communications were published were Tilloch's *Philosophical Magazine* (see p. 8); and William Nicholson's *Journal of Natural Philosophy, Chemistry, and the Arts* (1797–1802; ser. 2, 1802–13).

CHAPTER III

THE OLD MASTERS. THE PUBLICATION OF 'TRANSACTIONS'

THE OLD MASTERS—W. D. CONYBEARE AND THE OXFORD GEOLOGISTS—TRANSACTIONS OF THE GEOLOGICAL SOCIETY—SALE OF SPECIMENS—THOMAS WEBSTER—APARTMENTS IN BEDFORD STREET, COVENT GARDEN—COUNCIL, 1817—THE TEACHING OF GEOLOGY—SCIENCE AS A PROFESSION

WE now come to the period, prior to incorporation, when the Society commenced to publish its *Transactions*, and when the more prominent members were most of them geologists actively engaged in the pursuit of the science. Thus in addition to Leonard Horner, Greenough, Thomas Webster, Macculloch, and William Phillips, there now entered upon the scenes Fitton, Wollaston, W. D. Conybeare, and Buckland, followed by Sedgwick, De la Beche, Lyell, Murchison, Scrope, and Lonsdale.

It may be interesting to note that Fitton was, for the first time, introduced as a visitor on December 21, 1810; W. D. Conybeare, on April 19, 1811; Buckland, on May 3, 1811; Von Buch, on March 3, 1815; Sedgwick on April 19, 1816; De la Beche, on May 2, 1817; Dr. Bigsby, on December 6, 1822; Lieut. Portlock, on March 21, 1823; Scrope, on April 23, 1823; Brochant de Villiers and Elie de Beaumont on June 6, 1823; Dufrénoy on June 20, 1823.

Society the names of those old masters who laid the foundations of the science in Britain, on the territory marked out by the small but enthusiastic band of pioneers.

Geology then demanded more pecuniary aid for its study than now, and the members of the Society consisted of men of independent means, such as Greenough, De la Beche, Lyell, and Murchison; of ministers in the Church of England, such as Conybeare, Buckland, and Sedgwick; of medical men like Fitton, Wollaston, and Mantell; or of men in substantial mercantile positions like Horner and William Phillips. Lonsdale, who, like De la Beche and Murchison, had been trained to the military profession, was in less easy circumstances, and, fortunately for the Society, he served for many years in the Museum and Library in succession to Thomas Webster. John Phillips (nephew of William Smith), who commenced early in his career as a lecturer, became one of the most famous of professors.

It is not a little astonishing to find what a sound grasp of geological structure was attained in early years by these old masters; and it may be of interest, therefore, to quote from a recently published autobiography of Conybeare—to whom both Buckland and Sedgwick expressed indebtedness for original instruction—some passages that throw light on the progress of geological study.

There is no need to dwell upon the fact that W. D. Conybeare before the age of twelve 'had written a novel, a play, and sundry poems—the only copies of which, preserved by an old uncle, luckily fell into my hands when I was sixteen,' and were committed to the flames. His father, then rector of St. Botolph, Bishopsgate, had a small country house in the village of Bexley: and there William

Swan Electric Engraving Co Ltd.

William Daniel Conybeare

D.D., F.R.S.

Vice President 1826-28, 1831-33.

which he learnt much about the general course of the Chalk and other strata, and was enabled 'to trace the line of sands underlying the chalk escarpment, and the ranges of calcareous freestone from Bath by the Cotteswolds, through the Midland counties, &c.' Not the least important aid at this time was 'an annual income of 500*l*.,' which a worthy grandmother bequeathed to him.

Christopher Packe's 'Chorographical Chart of East Kent' (1743), a work 'scarcely surpassed by the Ordnance maps of the present day,' aided Conybeare's researches in that county. He now found a deeper interest in tracing the relations between the strata and the scenery, while 'the distinct organic remains of the several ranges became so familiar to me that I was prepared at once to seize the general fact of the successive distribution of these ancient genera when first laid down as an admitted fact in the progress of geology, which was the case about this time, 1809.'[1]

Interest in geological inquiries was likewise stirred at Oxford. The first University lectures on Mineralogy (not then distinguished from Geology) were by Sir Christopher Pegge, F.R.S., then Regius Professor of Physic, who was elected an honorary member of the Geological Society in 1807. Later on, Dr. John Kidd lectured on Mineralogy and Geology, and gathered round him many students who became keen in the pursuit of geology—among them Buckland, and the two brothers Conybeare.[2] They formed a club of Oxford geologists, and were annually visited at Whitsuntide by Greenough, Fitton, and others, who came to study under their guidance the rocks of the neighbourhood. W. D. Conybeare was regarded as the head of this

[1] 'Letters and Exercises of the Elizabethan Schoolmaster, John Conybeare, with fragment of Autobiography, by W. D. Conybeare,' edited by F. C. Conybeare, 1905, pp. 119–21, 136. This autobiography was probably written by W. D. Conybeare (1787–1857) 'shortly before his death.'

assembly, and when Buckland became successor to Kidd, he expressed in the warmest terms his obligations to Conybeare, remarking 'it would not have been fitting for him to offer himself to fill the office of lecturer on that subject had Mr. Conybeare been desirous to occupy it.'[1]

In those days geologists were accustomed to carry on their field-work in tall hats, as we find pictured in early geological works, even until the middle of last century. The portrait of Buckland is characteristic of the costume.[2] Logan, who had worked in the South Wales coal district, continued to wear this style of head-gear for many subsequent years; and Ramsay has told that when he visited Canada in 1857, and had a field-day with him, Logan wore a tall, furry, white hat, which became much more furry in appearance at the end of their day's work, after they had scrambled through many a thicket.

During the period now under consideration the presidential chair was occupied sometimes by active geological workers such as Greenough, Macculloch, and Buckland; and at others by patrons or influential cultivators of science, including Dr. William Babington, F.R.S., the Hon. Henry Grey Bennet (1777–1836), M.P., F.R.S., who was the second son of the fourth Earl of Tankerville, William Blake, F.R.S., and the Right Hon. Spencer Joshua Alwyne, Earl Compton (1790–1851), who succeeded his father as second Marquis of Northampton in 1828. Lord Northampton was earnestly devoted to geological science, he gathered together a fine collection of fossils and minerals at Castle Ashby, and contributed papers on the geology of Mull, and on Chalk foraminifera. He subsequently became president of the Royal Society, but 'he continued frequently to attend our meetings.'

geology was represented by John Taylor, F.R.S., who was for many years treasurer.

The anniversary dinner of the Geological Society was established in 1811. Thus on June 12 of that year:—

> It appearing to the Council desirable that the Society should dine together on June 22, the day succeeding the last meeting for the present session, it was
>
> Resolved, that printed notices be sent to each of the ordinary members requesting their attendance on that occasion. The dinner to be at the Freemasons' Tavern on that day at five o'clock, and to be ordered at 15*s.* for each person, all expenses included.

Early in the previous year the Council took into consideration the question of publishing papers that had been read before the Society.

> On March 16, 1810, at a special general meeting held at twelve o'clock at the Freemasons' Tavern, it was resolved to publish the more important communications made to the Society, but not at stated periods, the title to be the *Memoirs of the Geological Society*; a discretionary power being given to the Committee of Trustees, who would superintend and direct the publication, and insert important geological information from other works in the form of an appendix.
>
> Early in the following year it was resolved, that the term *Transactions* be substituted for *Memoirs*.
>
> The Committee of Papers (see pp. 21, 37) was requested to prepare the memoirs in the possession of the Society for publication; and it was agreed to entrust the printing of the first volume of the *Transactions* to Mr. William Phillips on certain conditions, of which the following were mentioned:—
>
> That the number of copies printed shall be 750.
>
> That the paper, type, and form should be according to certain samples.
>
> That the ink employed shall be of the best character.

This volume was published at the expense and risk of certain of the members of the Society; the ensuing four volumes were published at prices regulated by the Council, and at the cost and risk of the printer and bookseller to

whom the copyright of the first edition of those volumes was transferred gratis (see p. 63).

The first volume of the *Transactions* of the Geological Society was published in quarto in the year 1811. The motto, then adopted by the Council, had been chosen by Dr. Laird from the preface to Bacon's 'Novum Organum,' and was printed on the title-page as follows :—

> Quod si cui mortalium cordi et curæ sit, non tantum inventis hærere, atque iis uti, sed ad ulteriora penetrare; atque non disputando adversarium, sed opere naturam vincere; denique non belle et probabiliter opinari, sed certo et ostensive scire; tales, tanquam veri scientiarum filii, nobis (si videbitur) se adjungant; ut omissis naturæ atriis, quæ infiniti contriverunt, aditus aliquando ad interiora patefiat.[1]

'But if any human being earnestly desire to push on to new discoveries instead of just retaining and using the old; to win victories over Nature as a worker rather than over hostile critics as a disputant; to attain, in fact, to clear and demonstrative knowledge instead of attractive and probable theory; we invite him as a true son of Science to join our ranks, if he will, that, without lingering in the forecourts of Nature's temple, trodden already by the crowd, we may open at last for all the approach to her inner shrine.'[2]

If the contents of the first volume were remarkable for their variety and importance, the illustrations in this and in many subsequent volumes would at the present time alarm any committee of publication and treasurer.

> The volume, illustrated by twenty-five plates, some pictorial, was commenced by Macculloch with a paper on the Channel Islands. The other essays on home geology were

shire coal-field; Leonard Horner on the Malvern Hills; Parkinson on the London area; and Fitton on Dublin. William Phillips wrote on copper ore and the lodes of Cornwall; Marcet on a chalybeate spring at Niton, in the Isle of Wight; and W. H. Pepys, Count de Bournon, and Smithson Tennant dealt with sundry minerals. Papers on foreign geology were communicated by Macculloch on Heligoland; by the Hon. H. G. Bennet on Madeira; and by Dr. Nugent on the pitch lake of Trinidad, and the island of Montserrat.

While in most of these articles structural geology, lithology, and mineralogy were the absorbing topics, it is interesting to find that in the paper by James Parkinson, which was entitled 'Observations on Some of the Strata in the Neighbourhood of London, and on the Fossil Remains contained in them,' the author remarked, in a preliminary statement, that

> 'The study of fossil organised remains has hitherto been directed too exclusively to the consideration of the specimens themselves; and hence has been considered rather as an appendix to botany and zoology than as (what it really is) a very important branch of geological inquiry.' Referring to 'the formation and structure of the earth,' he said, 'To derive any information of consequence from them on these subjects, it is necessary that their examination should be connected with that of the several strata in which they are found.'
>
> In a footnote he stated: 'This mode of conducting our inquiries was long since recommended by Mr. W. Smith, who first noticed that *certain fossils* are *peculiar to, and are only found lodged in, particular strata*; and who first ascertained the constancy in *the order of superposition*, and *the continuity of the strata of this island*.'
>
> Parkinson further mentioned that—'Already have these examinations, thus carried on, taught us the following highly instructive facts. That exactly similar fossils are found in distant parts of the same stratum, not only where it traverses this island, but where it appears again on the opposite coast; that in strata of considerable comparative depth fossils are found, which are not discovered in any of the superincumbent beds;' and he added that—'These general facts lead us to hope that geology may derive considerable assistance from

an examination of fossils, made in connection with that of the strata to which they belong.'

Although relegated to a footnote, it is satisfactory to find acknowledgment of the work of William Smith, whose labours at this time were only beginning to be known and appreciated outside the small circle of his personal friends (see p. 17).

This is not the place to deal generally with the history of geology, but, as remarked by Conybeare, in the early days of systematic inquiry, the three great geological divisions, known then as the Primitive, Secondary, and Tertiary, were treated successively by three schools, in Germany, England, and France. The German school, that of Werner, 'directed its attention principally to the primitive and transition formations, in which the distinctions of mineral character assume the greatest importance.' The English school, that of William Smith, 'distinguished itself by the ardent and successful zeal with which it has developed the whole of the secondary series of formations: in these the zoological features of the organic remains, associated in the several strata, afford characters far more interesting in themselves and important in the conclusions to which they lead than the mineral contents of the primitive series.' The French school, that of Cuvier and Alexandre Brongniart, owed its foundation to their admirable memoir on the Paris Basin, published in 1811: a work which gave inspiration to Webster in his early researches on the Hampshire Basin.[1]

By the end of the year 1811 the Society had accumulated such a considerable collection of fossils and rocks, that there was little or no space for additions. In consequence, on February 12, 1812, it was

Resolved that Mr. Aikin, Mr. Pepys, and Mr. Warburton

catalogue of them, and make such arrangements for their disposal as they may deem expedient.

On May 13, 1812, it was

> Resolved that the duplicate specimens of the collection be exposed for sale at the rooms of the Society, on the 18th, 19th, and 20th inst., and that the prices of each specimen be as follows, to be paid to Mr. Yeoman [the clerk], viz.:—
>
> On the first day. . . one shilling.
> On the second day . . sixpence.
> On the third day . . fourpence.

On June 10, 1812, Mr. Yeoman reported that he had received 3*l.* 17*s.* for the duplicate specimens.

On June 17, 1812, the Council decided that it was absolutely necessary to appoint an officer to take charge of the Library, the collection of minerals, and other property, under the title of 'Keeper of the Museum,' and that the same person should also be appointed draughtsman to the Society; and on June 24 it was resolved

> That the duty of such officer should be to superintend the Library and several collections of the Society, to act as secretary to the Committees, to draw geological plans and sections, to make a fair copy of the minutes and abstracts of the papers read at the meetings, and generally to assist the secretaries in any business which they may have to transact. That he should be required to give his regular and punctual attendance at the rooms of the Society on three alternate days of every week, between the hours of ten and four, and that the salary attached to the situation should be 100*l.* per annum, payable quarterly.

Mr. Horner then stated that Mr. Thomas Webster, member of the Society, appeared to him eminently qualified for this situation, his merits as an artist and his zeal for the interests of the Society having been strikingly evinced. Webster was accordingly appointed, and for many years rendered great service to the Society, not only as keeper of the museum and draughtsman, but also as one of the secretaries (see p. 52).

Thomas Webster (1773–1844), who was born in the Orkneys, studied architecture in London, and when twenty-six years old was engaged as clerk of the works to the Royal Institution, that was founded in 1799. The building in Albemarle Street was designed mainly by him; and the theatre, regarded by Faraday as 'almost perfect as a lecture room,' was pronounced to be the best of its kind in the kingdom.

Turning his attention to geology Webster pursued the subject with great zeal and success. Notable among his careful observations are those on the strata of the Isle of Wight and adjacent parts of Dorsetshire, with pictorial geological views, contributed to Sir Henry Englefield's folio work on those regions published in 1816; and of particular interest is his drawing of the remarkable fault in the Chalk cliffs of Purbeck, between Ballard Point and the Foreland. This disturbance, 'admirably described and figured by Webster,' has since been explained as a faulted monocline structure with considerable overthrust.[1]

In 1841 Webster became the first professor of Geology in the 'London University,' as University College was then called; and he held that post until the close of his life.

The first volume of the Society's *Transactions* had been favourably criticised in the *Edinburgh Review* for November 1811.[2] The writer observed that there was no branch of science in which

> 'the co-operation of numbers is so essential, as that which has for its object the natural history of the globe itself. . . . The field of investigation is of such vast extent, the multitude of the facts so immense, and the difficulty of seizing their characteristic features and describing them with precision so great, that if many hands and many heads are not employed in the work, no progress at all can be expected.'

In the concluding portion of the essay, while 'congratu-

what may be called *geological experiments*.' . . . 'Nothing, for instance, could be more instructive than to know how deep the alluvial ground reaches which we find in the beds of rivers, and especially near their mouths; and in what proportion this depth decreases, as we approach the mountains. This is one of the points on which Nature herself rarely affords full information; which, however, might be obtained by the simple operation of boring in proper situations.'

'The succession of the rocks, as we descend, might be determined in the same manner in those countries where the strata are horizontal and unbroken, and where, of course, Nature seldom affords the means of making such observations. The junction or contact of different kinds of rock is one of the objects most interesting to a geologist; but, how often does he come within a few hundred yards, nay, in some cases, within a few feet, of that junction, and yet is unable to discover the exact line, on account of a quantity of earth or gravel which is not to be removed without more time and expense than he can afford to bestow!'

The second volume of *Transactions*, issued in 1814, three years after the first volume, was illustrated with 39 plates. It contains the classic paper by Thomas Webster, 'On the Freshwater Formations in the Isle of Wight, with some observations on the Strata over the Chalk in the South-east part of England.' In this work the fossils in the main divisions of the Chalk were for the first time indicated, and those of the Tertiary strata were shown to prove alternations of marine and freshwater conditions. The paper was illustrated by geological maps of the London and Hampshire basins, and coloured sections of Headon Hill and Alum Bay. Berger contributed an essay and geological map of the Isle of Man.

The third volume was issued in 1816. Evidently

why it should not. There is some unaccountable negligence in this respect, and it greatly diminishes its usefulness. Although Macculloch may not be so pleasant at the Council Board as Blake, I hope you will not fail to attend as often as you can. You are one of those valuable guardians of liberty, that must not be allowed to slumber, and for God's sake do not allow the Council of the Geological Society to degenerate. If your present Council do their duty there is nothing to fear. Aikin was so kind as to send me a list of the new elected officers; when I read it to Playfair he said they ought to do a great deal, for it was a Council fit to govern the world.[1]

There were, however, other outlets for those who desired a speedier publication of their observations. In 1813, Thomas Thomson, M.D., F.R.S., commenced the publication of the *Annals of Philosophy, or Magazine of Chemistry, Mineralogy, Mechanics and the Arts*;[2] and to this journal, as well as to the *Philosophical Magazine*, many important contributions were made by leading members of the Geological Society.[3]

In 1814 the example set by the Society was, for the first time, followed in the provinces by the institution at Penzance, on February 11, of the Royal Geological Society of Cornwall. The object of its founders was

'The Discovery of New Facts to enrich Science, and the Application of Science to improve Art.' The first volume of *Transactions* was published in 1818, and it was then stated in the preface that 'In the construction of a geological map of Cornwall, the Society has made considerable progress.'

One of the early members of the Geological Society of London, Davies Giddy [afterwards Gilbert] (1767–1839), was chosen president. At the time he was M.P. for Bodmin. He changed his name to Gilbert in 1817, and later on became president of the Royal Society. He was supported in the new Cornish Society by Henry S. Boase (treasurer), Sir John St. Aubyn, William Bolitho, and Joseph Carne.

Reference has already been made to Dr. J. F. Berger, a native of Switzerland and a student of geology, who sought refuge in this country in 1813 from the troubles which then affected his native land. 'In 1816, at the request of some of his friends in this Society, he agreed to devote himself for three years to geological investigations in the British islands; and an annual sum was insured to him during that period by a subscription of some of our members.' These included Dr. Babington, Dr. Marcet, Mr. Francis Horner, Dr. Wollaston, Sir Joseph Banks, and others.[1]

Berger contributed to the third volume of *Transactions* a memoir on the geology of the north-eastern counties of Ireland, to which were added pictorial geological coast-sections drawn by Buckland and Conybeare, in a style which was followed with signal success by De la Beche.

This third volume was illustrated by twenty-six plates, including several geological maps. One of these showed the connection between north-east Ireland and south-west Scotland; there were others of Skye and Glen Tilt by Macculloch, of part of Lincolnshire by E. Bogg, and of west Somerset by Leonard Horner.

At the end of 1815 the Society consisted as follows:—

240	ordinary members
87	honorary „
14	foreign „
341	

The Obligation subscribed by members at this time was in these terms:—

We, whose names are hereunto subscribed, do hereby engage that we will endeavour to promote the honour and interest of the

At a special general meeting on May 6, 1816, it was agreed that they accept the offer of the upper part and basement of the house at a premium of 250 guineas, and at a rent of 150*l.* per annum, free of all taxes for two and a half years, being the remainder of the lease. It was reported that these premises contained a large room fit for a meeting room, and four other rooms well adapted for the collections and other public uses of the Society, besides rooms for the housekeeper and servants. The Society were to have occupation of the house from June.

In 1817, ten years after its foundation, the governing body of the Society consisted as follows:—

J. Macculloch, *president*; the Hon. H. G. Bennet, the Rt. Hon. Sir John Nicholl, Wm. Blake, and Henry Warburton, *vice-presidents*; Charles Stokes and H. J. Brooke, *secretaries*; A. B. Granville, *foreign secretary*; Daniel Moore and John Taylor, *treasurers*; and Arthur Aikin, Capt. T. F. Colby, H. T. Colebrooke, Sir Henry C. Englefield, G. B. Greenough, Henry Holland, A. Majendie, W. H. Pepys, E. W. Rundell, S. Solly, John Whishaw, and W. H. Wollaston, other members of the *Council*.

There were two treasurers during the years 1814–21; while later on, from 1823–26, there were three secretaries, Webster, the keeper of the Museum, acting with the two honorary secretaries.

Fitton, in reviewing the third volume of the Society's *Transactions*, observed:—

It has been remarked by critics that the want of education is sometimes of advantage to a man of genius, who is thus left free to the suggestions of invention, and is neither biassed in favour of erroneous maxims, nor deterred from the trial of his own powers by names of high authority. On this principle it is evident that the members of the Geological Society have derived great benefit from their want of systematical instruction. At the time of its formation there was, in fact, no English school of Mineralogy where they could imbibe either information or prejudice. They were neither Vulcanists nor Neptunists, nor Wernerians nor Huttonians, but plain men, who felt the importance of a subject about which they knew very little in detail; and,

guided only by a sincere desire to learn, they have produced, with a rapidity that is truly surprising, publications of the greatest interest and importance upon the subjects to which they have devoted their attention.[1]

In an earlier review Fitton had remarked that the papers were characterised by 'strict experiment or observation, at the expense of all hypothesis, or even of moderate theoretical speculation.'[2] This was no doubt a right view of the Society's publications at the time; and yet it is interesting to bear in mind the lamentation of William Smith, uttered in 1816, that the theory of geology was in possession of one class of men, the practice in another. Geology had hardly become a profession, unless in the case of mining engineers and surveyors, and it is noteworthy that the three prominent authorities on practical or applied geology, William Smith, John Farey, and Robert Bakewell, were not members of the Society.

As early as 1804, Robert Jameson (1774–1854), who had been 'one of Werner's most zealous pupils,' was appointed professor of Natural History in the University of Edinburgh; and he lectured on Meteorology, Hydrology, Geology, Botany, and Zoology. He introduced the doctrines of the Wernerian school into Britain. For some years much controversy took place at Edinburgh. As remarked by Sir A. Geikie,[3] 'Werner's followers, from the prominence they gave to the sea in their geognosy, were styled Neptunists, while those of Hutton, who dwelt on the potency of the earth's internal fire, were dubbed Plutonists or Vulcanists' (see pp. 4, 46).

Changes, however, were in progress; and in the matter of geological teaching of a practical kind Dublin was in advance, inasmuch as Richard John Griffith (1784–1878) had in 1812 been chosen as professor of Geology and mining engineer to the Royal Dublin Society. Buckland was elected reader in Mineralogy in Oxford in

[1] *Edinburgh Review*, vol. xxix. 1817, pp. 70–94.
[2] *Ibid.* vol. xxviii. 1817, p. 174.
[3] 'The Founders of Geology,' 2nd ed. 1905, pp. 213, 218, &c.

1813, and lecturing also on Geology he 'attracted large classes,' and what perhaps seems more remarkable, he awakened, both in the University and elsewhere, that admiration for, and interest in geology, which led to its public recognition as a science by the endowment, in 1819, of a readership in Geology—and the Treasury allotted to it a stipend of 100*l.* per annum.[1]

If Fitton's remarks on the teaching of mineralogy seem to cast a slur on Cambridge, it may be remarked that the first professor of Mineralogy was not appointed until 1808; and that E. D. Clarke, then chosen, was a man of culture and a distinguished traveller, and if not a profound mineralogist, yet, as Sedgwick remarked, 'he kept us awake.' The Woodwardian professorship, indeed, had been founded as long ago as 1728 by John Woodward, M.D., F.R.S. (1665–1728), professor of Physic in Gresham College, London. It was to be held with a salary of 100*l.* a year, and an obligation to give at least four lectures every year, on one or other of the subjects dealt with in the doctor's published works. Though dating as a lectureship from 1731, geology was not taught in any systematic way until Sedgwick was appointed in 1818. This may be stated with no disrespect to his predecessors, amongst whom the Rev. John Michell has good claims to be regarded as one of the founders of modern geology; while the Rev. John Hailstone, who had just resigned, was a member of the Geological Society, and had published the plan of a course of lectures on Mineralogy, including 'Geognosy, or the Knowledge of the Earth's Internal Structure;' but although he gave demonstrations to residents and strangers who visited the Woodwardian

the laboratory of the Royal Institution in 1813, had in the first instance applied to Sir Humphry Davy, expressing his 'desire to escape from trade, which I thought vicious and selfish, and to enter into the service of Science, which I imagined made its pursuers amiable and liberal.' Davy 'advised me not to give up the prospects I had before me, telling me that Science was a harsh mistress; and, in a pecuniary point of view, but poorly rewarding those who devoted themselves to her service. He smiled at my notion of the superior moral feelings of philosophic men, and said he would leave me to the experience of a few years to set me right on that matter.'[1]

Faraday, who no doubt took interest in the mineralogical side of the science, joined the Geological Society in 1824, and served on the Council during the years 1828–30.

[1] 'Humphry Davy, Poet and Philosopher,' by Dr. T. E. Thorpe, 1896, pp. 173, 174.

CHAPTER IV

GEOLOGICAL MAPS. NEW SERIES OF 'TRANSACTIONS'

WILLIAM SMITH'S AND GREENOUGH'S GEOLOGICAL MAPS—BUCKLAND AND SEDGWICK—MUSEUM—NEW SERIES OF 'TRANSACTIONS'—GEOLOGICAL SOCIETY CLUB

IT was recorded by Buckland, in 1841, that 'A large geologically coloured map and delineation of the strata of England and Wales was published in 1815 by Mr. William Smith, under the encouragement of Sir Joseph Banks and a large number of individual subscribers; and in 1819 [1820] a much more perfect physical and geological map of England was published at the voluntary cost and by the gratuitous exertions of several members of this Society (chiefly those of Mr. Greenough), more complete than any map on a similar scale and extent yet produced by the official labours of any Government in the world.'[1]

There can be no doubt of the supreme importance of William Smith's original map of England and Wales; it was a work of genius, planned and executed single-handed, the product of 'the pursuit of knowledge under difficulties,' and of the application of that knowledge. Above all, it was the first 'true geological map of England and Wales.'[2]

In connection with the history of geological maps, it should not be forgotten that an Ayrshire man, and a

was published in 1835. This was regarded as 'one of the most remarkable geological maps ever produced by a single geologist.' Griffith was long engaged in extensive topographical and mineral surveys in Ireland, and as Commissioner of Valuation. On Griffith's valuation various local and public assessments in that country have been made. He was created a Baronet in 1858.[1]

It is, however, with the map of Greenough that we are specially concerned. In his 'Memoir of a Geological Map of England' (1820) he remarked: 'In obedience to a recommendation circulated by the Geological Society on its first establishment, I began in the year 1808 to sketch upon a common topographical map the extent of the principal strata in England.' He knew as early as 1804 that William Smith had in preparation a similar map, but had regarded its publication as hopeless. In 1812 he presented his map to the Geological Society, but it was not published until May 1, 1820, although dated November 1, 1819.

Meanwhile, in 1815, Smith's map was issued. Greenough had not seen it prior to its publication, but he freely admitted its merits, and that he benefited to some extent by it in the preparation of his own map. He likewise acknowledged assistance received from Buckland, W. D. Conybeare, Warburton, and Webster, and in a less degree from Thos. Buddle, De la Beche, John Farey, the Rev. J. Hailstone, David Mushet, and others.

During the years 1810–15 Buckland had been especially associated with Greenough in collecting materials for his geological map of England; and they made extended journeys together. 'In order to render this work as perfect as possible Mr. Greenough spared no efforts, and was equally willing to avail himself of the information collected by his numerous geological friends as by himself. He ever retained a grateful sense of the pecuniary assistance given him by Mr. Warburton, who had at one time contributed as much as a thousand pounds towards the work,

[1] Obituary by H. C. Sorby, Address to Geol. Soc. 1879.

a great portion of which, if not the whole, was, however, subsequently repaid.'[1]

It is not surprising that the map of Greenough was an improvement on that of William Smith. With the geological aid he received, and the means at his command, it could not have been otherwise. It is only just to add that, while he embodied the information contributed by others, he himself incorporated much original material, and those who had not seen the particulars he had gathered together could 'have little idea of the immense labour which he bestowed upon this object.'[2] To a certain extent it was a Drift map, as there were three separate coloured tablets for 'diluvial beds': namely, sands with or without gravel [as in West Norfolk]; clay with fragments of chalk [the boulder-clay of Finchley and parts of Suffolk], and loam with fragments of chalk [the contorted drift of North-East Norfolk].

The pity of it is that the map of William Smith was not taken up originally and published by the Geological Society.

The following particulars relate to the publication of Greenough's map:—

> On January 7, 1820, a report was read to the Council from the Map Committee as follows:—
>
> At a meeting of the Council held on March 4, 1814, Mr. Greenough having reported that the Geological map of England was ready for the engraver, if the Society should think fit to publish it, a committee, consisting of Mr. Greenough the president, Mr. Aikin, and Mr. Webster, was appointed to inquire respecting the same and report thereon to the Council. The Committee reported on March 18,

proceeds of the map; whereupon it was resolved that the president Mr. Greenough, Mr. Blake, and Dr. Wollaston be appointed a committee with full powers to apply a sum not exceeding 1,000*l.* towards the publication of the map in such manner as they may deem advisable. At a meeting of the Council, held on July 17 of the same year, Mr. Whishaw and Mr. Warburton were added to the Committee.

The Committee found, at the outset, an unforeseen cause of increased expenditure and of delay to the completion of the work. The Geological map, as submitted by the author, was drawn and coloured upon Arrowsmith's four-sheet map of England; but the Committee considered themselves as precluded from adopting the topography of Mr. Arrowsmith's map on their declining to accede to his proposals for engraving the work. It was found necessary therefore to construct a new topographical map of England; for this purpose Mr. Webster was engaged as draughtsman, and to him was entrusted, under the inspection of Mr. Greenough, the compiling of such a map from the most authentic documents, published or unpublished, that could be obtained. It was not until the end of the year 1814 that the topographical map in its first stage, containing the plan work of the coast and rivers, with the names of some of the principal places and districts, was ready for the engraver.

The total cost of the map prior to publication was as follows:—

	£	s.	d.
Mr. Webster's account for drawing .	200	0	0
Mr. Neele's account for copper . .	111	19	9
Mr. Neele's account for engrav ng .	914	10	3
Mr. Neele's account for paper . .	73	10	0
	£1,300	0	0

The map was issued in six sheets, with an accompanying memoir. It was published by Longman, Rees & Co., price 6*l.* 6*s.*, but copies were sold to members at 5*l.* 5*s.*

At the anniversary meeting, held on February 6, 1818 (thirteen members present), it was announced that the Society comprised:—

289 ordinary members
81 honorary ,,
30 foreign ,,
400

In subsequent years the numbers rose, though not without fluctuations, to a total of 459 in 1824, and 471 in 1825 (including honorary and foreign members). Of the ordinary members, those residing during any sixty days or more in any year within twenty miles of London, were resident members, who paid three guineas a year or a composition of thirty guineas. Others were non-resident, and paid an entrance fee of ten guineas, but no other contribution.

On December 3, 1819, the president, G. B. Greenough, laid before the Council a general statement on the wants and resources of the Society. An abstract of this was given in the Minute Book, and referred to as 'the president's Address to the Council.'

He recommended the formation of a committee to report on the Museum; observing that its contents should be divided into two parts—one for beginners, the other for proficients. In the part of the Museum for beginners he would have a set of simple minerals, fossils, &c., also 'a series to show what is meant by substances graduating into one another,' models, a case of geological tools and instruments, &c. In the part for proficients he would arrange the foreign rock specimens, also 'specimens intended to ascertain the correctness of disputed facts in geology.' These latter should not be permanent, but be disposed of by gift, sale, or exchange when no longer required.

In the history of any society periods of comparative dulness are likely to alternate with those of brilliant discovery and animated debate. Such changes may be experienced during a session, and when we come to contrast present with past geological meetings, our verdict need not be wholly unfavourable to present conditions with the increasing dryness of detail: so much depends on the individuals who take part in the proceedings. So early as 1821, it was remarked by Leonard Horner (in a letter dated April 10): 'I went to the Geological Society, which seems to me to have got into very feeble hands,

and to want a great deal of the energy it had in former days.'[1]

The practice of discussing the papers read before the Society commenced a little later, during the presidency of Dr. Babington in 1822–23; to this further reference is made (p. 76).

If the professorial element had invaded the Society, it had for many years in Buckland and Sedgwick vigorous exponents of the science: men who stirred enthusiasm by a knowledge that was tinged with humour and imparted in eloquent terms. The anniversary dinners were enlivened by their presence.

In 1822, as mentioned by Lyell in a letter to Mantell, 'The professors of Cambridge and Oxford were present at our dinner, and Buckland was called upon to explain the vast quantities of bones which he found in the summer, in a cave at Kirkdale in Yorkshire, of which he had a large bagful with him.'[2]

Buckland may be said to have initiated in this country the study of ossiferous caverns and fissures. In these early days the distinction between 'diluvial' and stratified deposits was recognised, but the secret of the drifts had yet to be disclosed. In his 'Reliquiæ Diluvianæ,' published in 1823, he was hampered, as many others were, by the tradition of a Universal Deluge; and this led to the well-known couplet, written by one of his friends:—

> All was darkness once about the Flood,
> Till Buckland rose and made it clear as mud.

Sedgwick, in 1822, commenced his systematic investigations of the older rocks of the Lake District, pursuing his researches during three successive summers. On his second expedition he met the famous geological guide, Jonathan Otley (1766–1856): and he ever cordially acknow-

subdivisions of the rocks, and their geographical distribution. John Phillips, who had visited Keswick in 1821, with his uncle, William Smith, also spoke highly of the services that Otley had rendered to them. In the following year Phillips encountered Sedgwick near the High Force in Teesdale, 'riding, as usual, with saddle-bags for his specimens, and a miner's boy *en croupe*;' and a little later, at Kirkby Lonsdale, Sedgwick met for the first time William Smith, under whose guidance he obtained his 'best fossils from Kirkby Moor.'[1]

John Phillips brought before the Geological Society, in 1827, the results of his observations on the older rocks of West Yorkshire and the borders of the Lake District; Sedgwick presented to a meeting in January 1831 his first account of the general structure of the Lake Mountains.

Meanwhile, the bounds of geological literature were expanding. In 1819, Sedgwick, together with the Rev. John Stevens Henslow (who had succeeded E. D. Clarke as professor of Mineralogy at Cambridge), originated the Cambridge Philosophical Society; and to the quarto *Transactions* of that Society Sedgwick communicated the highly interesting results of observations in Cornwall, while Henslow wrote on the geology of Anglesea.

In 1822 the various collections in the Museum of the Geological Society were enumerated as follows:—

1. A systematic collection of simple minerals.
2. Ditto ditto rocks.
3. Ditto ditto simple shells.
4. Ditto ditto fossil organic remains.
5. A collection of specimens of the strata of England.
6. Ditto ditto rocks of Scotland.
7. Ditto ditto rocks of Ireland.
8. Collections of the rocks of foreign countries.

Adam Sedgwick

D.C.L., F.R.S.

President 1829-31.

from various parts of Europe, India, New Holland, N. America, W. Indies, Iceland, Greenland, Sweden, Russia, France, Switzerland, Italy, Greece, &c., many of them 'collected to elucidate the observations of eminent geologists in different countries.'

Early in the year the Council had under consideration the publication of volume vi. of the *Transactions*, and in connection with this the following estimate had been received:—

Estimate for printing 300 pages; with thirteen lithographic plates and eight copper plates (⅜ of the whole number to be coloured).

	£	s.	d.
Printing	94	12	0
Paper	57	8	0
Lithography	67	18	6
Copper plates	117	12	0
Colouring	31	10	0
	£369	0	6

Volumes ii. to v. had been published by William Phillips. It was now proposed to publish the *Transactions* at the expense and risk of the Society, and the question of commencing a new series had likewise been suggested.

On March 8, 1822, Mr. Aikin, Dr. Fitton, Mr. Stokes, and Mr. Webster were appointed a Committee to deal with the first part of the new volume. It was to contain about 150 pages of letterpress with plates, and such changes were to be made in the form and mode of publishing as the Committee should think proper to introduce. They were further requested to have the work ready for publication, if possible, in the month of May—no light undertaking.

It is not altogether surprising that William Phillips, in a letter addressed to the president and Council [illegible]

been published by him at his own risk, and at a cost of about 4,500*l.* Of these, volume ii. alone had then sold to such an amount as to pay its expenses. He further reminded the Council that he was the only one whom they could find among booksellers to publish the *Transactions*.

The first volume of the *Transactions* had been published by the Society, and of the 750 copies printed, there remained, in June 1822, only 202 copies: no less than 548 copies having been disposed of, including those used by the Society or given away.

From the statement of Wm. Phillips, the following copies of the remaining volumes had been sold up to June 12, 1822:—

Vol. II.	422
„ III.	362
„ IV. Part I.	305
„ „ „ II.	292
„ V. „ I.	215
„ „ „ II.	166

It was mentioned at the Council that, in conversation, William Phillips candidly expressed his opinion that the sale of the next volume would be materially increased by entitling it volume i. of a new series; and the Council, after due deliberation, decided to adopt this course.

At a special general meeting, held on June 21, 1822, the Council communicated to the Society the change which it projected in the form and mode of publishing the *Transactions*; and it was determined that the Society, being relieved from all risk of failure by the generous offer of certain members who undertook to supply whatever sum might be wanted for the purpose, should, instead of employing a publisher as heretofore, itself undertake the publication.

It was estimated that the sale of 300 copies of the first part of vol. i., second series, would defray the expense incurred; and the expectation was realised. In the report of the Council to the general meeting on February 7, 1823, it was stated that the whole cost of printing and publishing

500 copies of the work, containing 174 pages of letterpress and twenty-four plates, had been 345*l.* 2*s.* 7*d.*

Of these copies eighteen were presented or retained for the use of the Society; 229 were sold, realising 286*l.* 18*s.*; and 253 remained on hand.

The price was 1*l.* 5*s.* to members and booksellers; 1*l.* 11*s.* 6*d.* to the public. Thus the Society had received within about 60*l.* of the sum expended, while more than half the copies remained on hand for sale. The success attending the new system of publication was ascribed in great measure to the activity of the secretaries, Dr. Fitton and Mr. Webster. It is satisfactory to learn that in 1826, 383 copies had been sold, producing 478*l.* 15*s.*, or 134*l.* 11*s.* 10*d.* above the cost, as then estimated.

The second part cost 603*l.*, and within the first year 170 copies were sold, producing 289*l.*; while in their report for 1826 the Council announced that 272 copies had been sold, producing 412*l.* 18*s.* It was issued to the members at the price of 1*l.* 14*s.*

These records afford remarkable evidence of the enthusiasm of the members, but they cannot be taken to indicate that a renewed issue of quarto *Transactions* would meet with similar success at the present day. In the first two parts of this second series there were printed the famous memoirs by Buckland and Conybeare on the south-western coal district of England, by Thomas Weaver on parts of Somerset and Gloucestershire, and by De la Beche on the south coast of England.

THE GEOLOGICAL SOCIETY CLUB.

Here it may be interesting to mention that on November 5, 1824, a not inappropriate date for an unofficial assembly, several members of the Geological Society met together and resolved:—

1. That a club be formed of members of the Geological Society to dine together on the days of the Society's meetings (see p. 16).

2. That the number of the Club be limited to forty members.

3. That the place of meeting be the Thatched House Tavern.[1]

4. That the following gentlemen be members of the Club :—

Arthur Aikin.	Rev. A. Irvine.
Fras. Baily.	Thos. Jemmett.
Rev. Prof. Buckland.	A. B. Lambert.
Henry Burton.	Chas. Lyell.
Alexr. Caldcleugh.	Danl. Moore.
Fras. Chantrey.	W. H. Pepys.
Major Colby.	E. W. Rundell.
H. T. Colebrooke.	Jesse Watts Russell.
P. D. Cooke.	Sir G. T. Staunton, Bt.
Sir Alexr. Crichton.	Charles Stokes.
Robt. Ferguson.	John Taylor.
Dr. Fitton.	Henry Tucker.
G. B. Greenough.	J. F. Vandercom.
J. Guillemard.	Jas. Vine.
Dr. Horsfield.	Henry Warburton.

From the MS. Transactions of this Club the following records are extracted :—

November 19, 1824. Mr. Lyell having stated that an experiment had been instituted of enclosing toads in several cavities in rock in the month of September last, with the view of opening the cavities in a succession of years, one in each succeeding year :

The president [the Rev. Prof. Buckland] bets Mr. Warburton two bottles of champagne to one, that at the end of one year from the time of enclosing, one toad will be found alive.

Mr. Warburton also bets the president a bottle of champagne that no toad will be found alive at the end of the second year.

Mr. Taylor bets Mr. Stokes a bottle of champagne that at the end of one year one of the toads will be found alive ; also another bottle that one will be found alive at the end of two years ; and another bottle that one will be found alive at the end of three years.

Mr. Warburton bets Mr. Taylor four bottles to one that none of the toads will be found alive at the end of four years.

[1] This celebrated tavern in St. James's Street stood, from 1711 to about 1843, on the site of the present Conservative Club house. The business was then removed to adjoining premises, and continued there until 1865, when the building was pulled down, and the Civil Service Club (now the Thatched House Club) and Thatched House Chambers were built on the site. Wheatley and Cunningham, 'London Past and Present,' iii. 1891, p. 370.

December 2, 1825. Mr. Lyell stated that the cavities enclosing the toads had been opened on November 15, 1825, and that two toads in them had been found alive.

Resolved that the bets between Dr. Buckland and Mr. Warburton, and Mr. Taylor and Mr. Stokes, referring to the period of one year are decided by this evidence to be lost by Mr. Warburton and Mr. Stokes respectively, one bottle of champagne each.

Among the Officers and Council at this period were the following :—

Philip Barker Webb, F.R.S. (1793–1854), who had been one of the secretaries in 1824–25, was essentially a botanist, but he had become interested in geology through the teachings of Buckland at Oxford, and he was an authority on the topography of the Troad.

Daniel Moore, F.R.S., F.S.A., who was treasurer from 1815–22, was a barrister, of Lincoln's Inn.

Thomas Horsfield, M.D., F.R.S. (1773–1859), was a naturalist, and for some years Keeper of the Museum of the East India Company.

Henry Thomas Colebrooke, F.R.S. (died 1837), had much experience in India, had written papers on the geology of the country, and had been a member of the Supreme Council of Calcutta.

CHAPTER V

THE CHARTER. SOMERSET HOUSE. THE 'PROCEEDINGS'

THE CHARTER—THE FIRST PRESIDENT OF THE INCORPORATED SOCIETY —THE NEW PRESIDENT AND COUNCIL, 1826—APARTMENTS IN SOMERSET HOUSE—ANNIVERSARY ADDRESSES—DISCUSSIONS—COUNCIL, 1827 —MURCHISON AND FITTON—THE 'PROCEEDINGS'

MORE momentous proceedings were at this time engaging the attention of the Council. Early in 1824 they took into consideration the question of obtaining a Charter; and on April 23 the president, secretaries, and treasurer, together with H. T. Colebrooke, H. Warburton, Dr. Fitton, Daniel Moore, and Dr. Babington, were appointed a Special Committee for the purpose of preparing the draft of a petition to the Crown for a Charter of Incorporation. At a subsequent meeting, Mr. J. F. Vandercom was added to the Committee. A draft was accordingly drawn up, and examined by Mr. Butler, a conveyancer.

While this undertaking was in progress, Mr. Warburton reported to the Council, on May 21, that he had been anticipated at the Council of the Royal Society in notifying the intention of the Geological Society to apply for a Charter, the president of the Royal Society [Sir Humphry Davy] having of his own accord mentioned the subject, and expressed his opinion of the propriety of such an application.

thirty-nine members present, including the president (Buckland), Lyell, Warburton, Fitton, Greenough, Webster, and others; and the Council was 'empowered to take such measures as shall appear to them to be most efficient for obtaining a Charter of Incorporation for the Society.' The proceedings connected with this business occupied about a year.

On March 18, 1825, Mr. Warburton informed the Council that he and Mr. Vandercom had had an interview with the Attorney-General on the subject of the Charter. The Attorney-General stated that he saw no objection to any of the clauses, excepting that giving power to the Society to possess real property to the annual amount of 2,000*l.*, other similar societies being limited to 1,000*l.* Mr. Warburton remarked that if the objection were pressed the Society would reduce the sum to 1,000*l.*; but this evidently was not the case (see Appendix, p. 264).

On May 6, 1825, an official communication to the Council was made by Mr. Vandercom, that the Charter of the Geological Society of London had passed the Great Seal, and was in his possession; moreover, it was notified that the fees paid in obtaining the Charter amounted to 385*l.* 14*s.* 6*d.*

The Charter was granted on April 23, 1825,[1] by King George IV., to the Rev. William Buckland, Arthur Aikin, John Bostock, M.D., George Bellas Greenough, and Henry Warburton, who were nominated the first Fellows of the Geological Society. Buckland became the first president of the incorporated Society, and with the four Fellows above mentioned its first Council was formed. They were empowered to remain in office until the third Friday in February of the following year.

The new Council, in accordance with the Charter

five already declared Fellows a total of 372. The honorary members were offered the privilege of being appointed Fellows without ballot on their signifying their desire to be so appointed, and on payment of the usual admission fee. Of the privilege so tendered, only six honorary members availed themselves. The others were retained on the list, with the right of attending ordinary meetings and of access to the Library and Museum (see p. 285).

On February 17, 1826, the full Council and the officers elected were as follows:—

President.

Dr. J. Bostock, F.R.S.

Vice-Presidents.

Sir A. Crichton, F.R.S.
Rev. W. D. Conybeare, F.R.S.
Dr. W. H. Fitton, F.R.S.
Charles Stokes, F.R.S.

Secretaries.

R. I. Murchison.
Thomas Webster.

Foreign Secretary.

Henry Heuland.

Treasurer.

John Taylor, F.R.S.

Other members of Council.

Arthur Aikin.
J. E. Bicheno.
W. J. Broderip.
H. T. Colebrooke, F.R.S.
Sir Charles Henry Colvile.
H. T. De la Beche, F.R.S.
G. B. Greenough, M.P., F.R.S.
Sir Charles Lemon, F.R.S.
Armand Levy.
Charles Lyell, F.R.S.
W. H. Pepys, F.R.S.
G. P. Scrope.
J. F. Vandercom.
Henry Warburton, F.R.S.

It may be mentioned that 'a society that is "incorporated by Royal Charter" is an official body publicly and legally recognised; it has perpetual succession and a common seal; and the statutes or bye-laws, which are framed for the ordinary guidance of the members, must be in perfect accordance with the stipulations or principles of the Charter. Societies of this kind naturally take pre-

cedence of all others; and where several are in other respects (or are assumed to be) of equal importance, priority of incorporation is a reasonable ground of distinction.' Furthermore, 'it must not be supposed that a society is less entitled to the designation "learned" because the researches of its members are occasionally or permanently connected with professional or semi-professional subjects.'[1]

With regard to Fellows or members, the official title depends on the designation in the Charter: thus the original members of the Geological Society were transformed into Fellows, and the title F.G.S. came to be used. In the case of the Royal Irish Academy the term members was retained, with the title M.R.I.A.

The ingenious inventor of the calculating machine made some elaborate researches on the custom of attaching certain letters to the names of those who belong to different societies, and concluded:

> Thus those who are ambitious of scientific distinction may, according to their fancy, render their name a kind of comet, carrying with it a tail of upwards of forty letters, at the average cost of 10*l.* 9*s.* 9¼*d.* per letter.[2]

Of those more immediately associated with the Charter, it should be mentioned that

> Joseph Fitzwilliam Vandercom (of Bush Lane, Cannon Street), whose death was recorded by Wm. Hopkins in 1852, was one whose legal ability and experience were generously placed at the disposal of the Society; and 'it was through his instrumentality that we were enabled to obtain from the Crown a charter of incorporation less complex in its details and more liberal in its provisions than had previously been granted to any other scientific institution.'
>
> John Bostock, M.D. (1773–1846), was educated at Edinburgh, where he graduated M.D. in 1798; he settled as a medical man in his native city, Liverpool, for some years, and came to London in 1817. He then gave up

[1] 'The Learned Societies and Printing Clubs of the United Kingdom,' by the Rev. Dr. Abraham Hume, 1847, with Supp. 1853.

[2] C. Babbage, 'Reflections on the Decline of Science in England,' 1830, p. 43.

practice and took a general interest in science. He was elected F.R.S. in 1818. In an obituary notice by Leonard Horner, in his address of 1847, Dr. Bostock is mentioned as for many years a valuable member of the Society, although not actively engaged in geological inquiries. His name, however, was said to stand 'high in the medical profession as a physiologist, and he devoted much of his time to chemical research.' He was elected president in 1826. His only paper of geological interest was one published in the *Philosophical Transactions* for 1829, on 'The Purification of Thames Water.'

Henry Warburton (1784?–1858), the son of a timber merchant, was educated at Trinity College, Cambridge. He was elected F.R.S. in 1809, and M.P. for Bridport in the Radical interest in 1826. He was a friend of Wollaston, and he assisted in founding the London University. Warburton, although not an original member, was described by Murchison (Address, 1843) as one of the founders of the Society, one of the earliest contributors, and one 'of the best secretaries you ever had—whether as respected the performance of his own duties, or the singleness of mind and integrity of purpose with which, abjuring all personal considerations, he improved the memoirs of various writers which found their way into our *Transactions*.' He, moreover, did much personally and financially to establish the Society on a sound basis.

With regard to the *improvement* of memoirs, the subject is a thorny one, calculated to create diversity of opinion; and there was at any rate a notable exception (see p. 151).

Among other members of the Council at this time, the following may be mentioned:—

Sir Alexander Crichton (1763–1856) was a man of great talents and a distinguished physician; his works were principally medical, but he published an essay, in the Annals of Philosophy, 'On the Climate of the Antediluvian World,' and was author of other geological papers, read before the Society.

Henry Heuland (1777?–1856), who was foreign secretary to the Society, was a great collector of minerals, and likewise

work by A. Levy (1837). The mineral Heulandite (one of the zeolites) was named after him by H. J. Brooke.

Sir Charles Lemon, Bart., of Carclew in Cornwall (1784–1868), did much to further the interests of geological science in his native county; and in 1838 established a mining school, which he continued at his own cost for two or three years, afterwards offering to endow it with 10,000*l.*, if a like sum were contributed by the county. Cornwall unfortunately did not provide the sum.

Charles Stokes (1783–1853) was a member of the Stock Exchange, and a man of remarkably wide and accurate knowledge. 'Careless of fame,' he laboured indefatigably to advance science. Referring to Mr. Stokes, Sir Charles Bunbury recorded that in February 1845 he spent the greater part of the day in Verulam Buildings, Gray's Inn, in 'looking over his splendid collection of fossil woods. It is extremely interesting. He is almost a universal collector, and his knowledge is as multifarious as his collections, and seemingly as deep and solid as it is varied. His rooms exhibit a most picturesque confusion of learned wealth, literary, scientific, and artistical—books, portfolios, fossils, dried plants, stuffed birds, animals preserved in spirits, pictures, busts, casts, coins, grotesque figures from India or Japan, snuff-boxes, and nearly everything that can be conceived; and, strange to say, he seems generally able to find amidst this chaos anything that he wants.' [1]

The Society continued to meet at 20 Bedford Street until 1828, when they obtained apartments in Somerset House, in the block adjoining the inner entrance to King's College. A special meeting was held on May 18, 1828, at which the Fellows were informed of the grant of their new residence from the Lords Commissioners of his Majesty's Treasury, through the mediation of the president and Council of the Royal Society. A subscription was opened for the purpose of repairing and fitting up

the Council were enabled to adapt the apartments to their new purposes. At this time the Library contained rather more than 1,000 volumes, exclusive of pamphlets.

In February of that year the number of the Society was stated to be as follows:—

Fellows having compounded	44
„ contributing	150
„ non-resident	211
Honorary members	55
Foreign members	47
	507

The first meeting of the Society at Somerset House was that of November 7, 1828.[1]

Old Somerset House had been erected by the Duke of Somerset (Lord Protector) about the year 1550. The present buildings, known as Somerset House, were erected from designs by Sir William Chambers, surveyor-general. Commenced in 1776, the Strand front was completed in 1779, but at the time of the architect's death in 1796 the main work was not entirely finished. Indeed, 'as late as 1819 decorative work was still being done upon the internal north façade.' King's College was not built until 1830. It has been remarked that Somerset House 'has remained the chief exemplar in England of the classic style applied to secular needs.'[2]

The buildings were constructed for the purpose of establishing public offices at Somerset House, and for the accommodation of the Royal Academy and Royal Society. The Royal Society was followed by the Society of Antiquaries, the former holding its first meeting in the new rooms on November 30, 1780, the latter on January 11, 1781. Government officials entered into occupation from 1785.

1830. Although in course of time many specimens came to be distributed throughout the suite of rooms, in the hall and along the staircases, the whole of the second floor, and part of the third floor were specially set aside for the Museum. Of these floors the 'Lower Museum' was given up mainly to the collection of British rocks and fossils, the 'Upper Museum' to the foreign collections. The minerals and recent shells were stored in cabinets beneath bookshelves in the comparatively small room assigned to the Library. The arrangement of the English collection was commenced and considerably advanced by Mr. Greenough. The recent shells were named and arranged by John Edward Gray.

The Museum, in addition to its service in preserving specimens that illustrated many papers published by the Society, supplied for a number of years a real educational want. At this period the Library and Museum were open from 11 to 5 P.M.

The meeting-room was on the first floor, the usual entry to which was through the Library. During the evening meetings the Library was often utilised by Fellows for conversation (see pp. 98, 246).

Although the initiation of the custom of delivering an annual address to the Society has been attributed to Fitton, whose address of 1828 was the first printed in the publications of the Society, yet at a special meeting of the Council held on July 10, 1810, the 'address' of the president (G. B. Greenough) was considered, and ordered to be printed and sent to each of the members, ordinary and honorary. No copy of this appears to have been preserved; but it may have been simply a report on

progress of the Society, on its present state and future prospects.

Here it may be noted that the attendance at the annual general meetings was by no means large: on February 5, 1819, it was nineteen; and the same number were present on February 6, 1824.

Dr. Bostock, in the address to which reference has just been made, recommended

> a regular attendance upon our public meetings. This may indeed appear of less moment, provided we are well supplied with papers, yet I am disposed to think that, in its ultimate effects, it will be found to be equally essential to the well-being of the Society. If our meetings be scantily attended, the spirit of the Society must necessarily languish, there will be little inducement for new members to join us, while the old ones will feel disposed to desert, and both our literary and our pecuniary resources will be in danger of becoming deficient. The plan which has been lately adopted of terminating our meetings by conversations on the subject of the papers, or on other topics connected with geology, seems to have fully justified the experiment by the interest which they have excited. Those of you who have been present at the conversations which have been conducted by our late president [Buckland], who have been equally instructed by his knowledge and delighted by his eloquence, must be aware how very much of this success depended upon his talents and personal exertions.

Dr. Fitton, in his address delivered February 15, 1828, referred to 'the self-command that renders both agreeable and instructive the conversations (I will not call them discussions—much less debates) with which it is now our practice to follow up the reading of memoirs at our table.'[1]

Prestwich has recorded that Charles Babbage (1792–

and in a critical volume, published in 1830, he spoke well of the Geological Society, remarking:—

> It possesses all the freshness, the vigour, and the ardour of youth in the pursuit of a youthful science, and has succeeded in a most difficult experiment, that of having an oral discussion on the subject of each paper read at its meetings. To say of these discussions that they are very entertaining is the least part of the praise which is due to them. They are generally very instructive. . . . With regard to the published volumes of their *Transactions*, it may be remarked that if members were in the habit of communicating their papers to the Society in a more finished state, it would be attended with several advantages; amongst others, with that of lightening the heavy duties of the officers, which are perhaps more laborious in this Society than in most others.[1]

At this period the editing of the publications was performed in part only by the permanent officers. As Sedgwick remarked (in his address for 1830) when referring to a lately issued volume of *Transactions*, thanks were due to W. J. Broderip, then retiring from 'the laborious duties' of secretary, 'for the care with which he has superintended every part of it during its passage through the press.' Broderip (1789–1859) was distinguished as a zoologist, and had assisted Buckland in his earliest studies of organic remains in the neighbourhood of Oxford.

It may be mentioned that among the important communications to the Society at this period, Murchison's paper on the Coal-field of Brora was read at two successive meetings in 1827; and Sedgwick's paper on the Magnesian Limestone was brought before four meetings during the years 1826–28.

In 1827 Fitton became president, and from his accession dates the series of printed addresses which illumine the *Proceedings* and *Quarterly Journal* of the Geological Society—a series broken only during the presidency of Warburton, whose remarks were not published.

Those who would follow the history of the progress of

[1] 'Reflections on the Decline of Science in England,' pp. 45, 46.

geology in this country cannot do better than peruse the successive addresses, rich as most of them are in valuable criticism, in original observation, or in historical record.[1]

At this date, 1827, when the Society had been twenty years in existence, Fitton, as *president*, was supported as follows :—

> Aikin, Bostock, W. D. Conybeare, and Sedgwick, *vice-presidents*; Broderip and Murchison, *secretaries*; Henry Heuland, *foreign secretary*; John Taylor, *treasurer*; and De la Beche, J. E. Bicheno, Davies Gilbert, Greenough, John F. W. Herschel, Armand Levy, Lyell, Pepys, Rev. J. H. Randolph, Charles Stokes, J. F. Vandercom, Warburton, Webster, and Thomas Young, other members of *Council*.

Murchison, who now began to take an active part in the work of the Society, had been a keen fox-hunter, but was led, to some extent by Sir Humphry Davy, and largely by Mrs. Murchison, to turn his attention to field-geology. During the years 1824–25 his interest was thus aroused. Buckland gave him his earliest lessons in the field, when 'he accompanied the merry professor and his students, mounted on Oxford hacks, to Shotover Hill.' Webster and Fitton likewise helped to stir his enthusiasm, while Conybeare and Phillips's 'Geology of England and Wales' became his 'scientific bible.' A little later, in a quarry near Bath, he accidentally met 'a tall, grave man, with a huge hammer on his shoulder.' This was William Lonsdale, whose important paper on the Oolitic District of Bath was read in 1829, and under his guidance Murchison spent some days in the field. But 'of all his geological friends none had won his respect and admiration so entirely as Sedgwick,' and for several years their expeditions in this country and abroad were made together. It was during their first expedition abroad that Sedgwick, influenced by his friend's enjoyment of the fragrant weed, himself became a smoker. Together they gave special attention to the older rocks, and Murchison eventually

[1] A brief summary of the contents of each address is given in the Appendix, pp. 286–296.

to face p. 74

Sir Roderick Impey Murchison, Bart.

K.C.B., F.R.S.

Secretary 1826-29, 1229-31 Foreign Secretary 1228-29

President 1831-33, 1851-52

became founder of the Silurian System. Prior to these joint labours he had the satisfaction—much to the amusement of his friends—of finding at Oeningen, between Constance and Schaffhausen, remains of an animal, regarded at the time as a fossil fox. This he described in a paper read before the Society in January 1830.[1]

Like many another fossil it has had its vicissitudes. Cuvier on seeing a drawing thought that the specimen was in all probability that of a fox, and Mantell referred it provisionally to *Vulpes communis*. In 1843, H. von Meyer wrote of it as *Canis Vulpes* (*communis*) *fossilis*, and suggested the name *Canis palustris*, 'the dog of the marsh.' Owen in 1847 thought that it was more nearly related to the civet-cat, but intermediate between *Canis* and *Viverra*; and he named it *Galecynus œningensis*. Huxley, who had no compunction in differing from Owen, saw more of the dog than the cat in the fossil; and on his authority Mr. R. Lydekker restored it to *Canis palustris*. It is now the opinion of Dr. C. W. Andrews that the appropriate name is *Galecynus palustris*, H. v. Meyer, sp. The counterpart of the specimen was presented by Murchison to the Geological Society,[2] the other portion being in the British Museum (Natural History).

Fitton (1780–1861), as remarked by Murchison, was 'truly one of the British worthies who have raised modern geology to its present position.' Born in Dublin in 1780, he graduated B.A. at Trinity College in 1799, and early began to give attention to the rocks and fossils of the neighbourhood. Considering the mistakes that occasionally are made nowadays, it is not surprising that 'in those troublous times' his geological movements created suspicion; on one occasion he was taken to be a rebel, and 'for a short time kept in military durance.' At Edinburgh, where he studied medicine, he came under the influence

[1] See 'Life of Sir Roderick I. Murchison,' by A. Geikie, vol. i. 1875, pp. 125–128, 137, 154, &c.; and Murchison, *Quart. Journ. Geol. Soc.* vol. xviii. p. xxxii.

[2] *Proc. Geol. Soc.* i. 167.

of Jameson, and likewise of the distinguished literary men connected with the *Edinburgh Review*, and thus for many years he was led to contribute to that journal essays on the progress of geological science. Fitton practised medicine for eight years at Northampton, until in 1820 he married 'a most amiable lady, who brought to him the means of a comfortable existence.' The physician now became wholly converted into a geologist. To his special researches on the Cretaceous and other formations further reference will be made; but it should be mentioned that 'he opened his house during his presidency to all the Fellows at evening *soirées*, when his cheerful and joyous countenance and kind manner encouraged many a beginner. . . . Dr. Fitton, as well as his predecessor, Mr. Greenough, held these agreeable scientific *conversazioni* on Sunday evenings.'

It was also remarked by Murchison that 'one of the claims of Dr. Fitton on the gratitude of geologists is, that after having been the secretary of the Society during some years of his life, no sooner did he attain the honour of our chair, than he established the publication of those *Proceedings* which are the true synopsis of our labours, and have been imitated by the Royal Society and most of the scientific societies in the metropolis.'[1]

PROCEEDINGS OF THE GEOLOGICAL SOCIETY.

The publication of the *Proceedings of the Geological Society* was commenced in 1827, and the first number (including accounts of meetings from November 1826) was prefaced by the statement that

'The Council of the Geological Society, being desirous

at the ordinary meetings, with such official documents as it may be thought expedient to publish—which if preserved will furnish a connected history of the Society.

In the Report of the Council read at the annual general meeting on February 15, 1828 (printed in No. 6 of the *Proceedings*), it was announced that

> The circulation of the printed PROCEEDINGS of the Society has given such general satisfaction, that the Council has had no hesitation in recommending the continuance of it; since a record is thus obtained of the progress of the Institution, which may hereafter become an object of reference, with a view to the history of the subject; whilst an opportunity is afforded of circulating with promptitude, notices of transitory interest, or that require immediate attention; and of giving publicity to various papers on geological subjects, too valuable to lose, but not of sufficient importance to occupy a place in the more permanent and costly record of the *Transactions*.

As remarked later on by Leonard Horner, 'In order to avoid an inconvenient, and even injurious, effect upon the sale of our *Transactions*, the *Proceedings* consisted of very brief abstracts of the papers, and, being without illustrations, in many instances they conveyed a very imperfect idea of the nature and value of the memoir. But the great delay in the publication of memoirs in full, robbing authors, in some instances, of the honour of priority in discovery, the uncertainty when a paper that had been read would be published, and even the doubt that was sometimes raised whether it would ever appear, very materially diminished the usefulness of the Society.'

It came to be recognised that, 'In a progressive science like geology, with so many active cultivators of it in every part of the world, rapidity of publication is of the first importance,' and that 'a majority of papers may be

CHAPTER VI

EARLY GEOLOGICAL BOOKS. THE WOLLASTON MEDAL AND THE FATHER OF ENGLISH GEOLOGY. SEDGWICK AND MURCHISON ON CAMBRIAN AND SILURIAN

GEOLOGY OF ENGLAND AND WALES BY CONYBEARE AND WILLIAM PHILLIPS — SCROPE — SOWERBY'S MINERAL CONCHOLOGY — JAMESON — BAKEWELL — BRANDE — GREENOUGH — URE — LYELL — MACCULLOCH — DE LA BECHE — JOHN PHILLIPS — LONDON UNIVERSITY — WOLLASTON MEDAL — SEDGWICK AND WILLIAM SMITH — SEDGWICK AND MURCHISON ON CAMBRIAN AND SILURIAN — DISCUSSIONS — GEOLOGICAL DINNERS — OTHER GEOLOGICAL SOCIETIES

THE progress of geology during the early years had been recorded mainly in the publications of the Geological Society; while the descriptions of English strata had been summarised by William Phillips, in his 'Selection of Facts from the best Authorities, arranged so as to form an Outline of the Geology of England and Wales' (1818). In the second edition of this book, published in 1822 by Conybeare and Phillips, the former author so amplified and enriched the work by his original observations, that it became a standard geological companion, and did more than any other independent work at that date to advance the study of geology in this country.[1]

In 1828 it was proposed by Sedgwick that he should join with Conybeare in the preparation of the second part of the 'Outlines of the Geology of England and Wales,' of

never carried out.[1] At the time he was Rector of Sully, in Glamorganshire; in 1836 he became Vicar of Axminster, and in 1845 Dean of Llandaff; and his clerical duties—to say nothing of a growing family—gradually absorbed more and more of his time. Sedgwick also became engrossed with field-work among the older rocks, and with many and varied occupations in connection with the University of Cambridge, and as Prebendary of Norwich.

The works of George Poulett Scrope (1797–1876), his 'Considerations on Volcanos' (1825), and his 'Memoir on the Geology of Central France' (1827), aided greatly in establishing the true principles of geology, which had been so admirably sketched by Hutton and Playfair.

In Palæontology, the 'Organic Remains' (1804–11) of Parkinson for some years was the chief work of authority; William Smith's 'Strata Identified by Organised Fossils,' begun in 1815, was never completed; but the 'Mineral Conchology of Great Britain,' commenced by James Sowerby (1757–1822) in 1812, at once became the standard work, and with the assistance of his son, James de Carle Sowerby (1787–1871), it remained so, until 1845, after which it was gradually replaced by the publications of the Palæontographical Society.

In the days of the Sowerbys, fossils were not collected with that regard to exact locality and geological position which is at present essential. Their figures, however, were for the most part admirably drawn and reproduced, and although a certain number of the specimens had been obtained from boulder clay or drift gravel, and remain, as regards horizon, a source of doubt, yet those were happy days for the geologist and the local collector, as they could

recorded in papers by Buckland, Sedgwick, Murchison, Fitton, and others, were named and many of them described. Although not a Fellow of the Society, an obituary notice of J. de Carle Sowerby was given by Prestwich, who, referring to the great work on 'Mineral Conchology,' remarked: 'If the species were too multiplied, it was because the connecting links were wanting, rather than from any want of discrimination and information on the part of the authors.'[1] Comment is hardly necessary; suffice it to say that the discovery of 'connecting links' has not tended to diminish the number of species.

A few words may now be said on the early treatises of geology. In referring to the original aims of the Society, Lyell remarked that

> To multiply and record observations, and patiently await the result at some future period, was the object proposed by them; and it was their favourite maxim that the time was not yet come for a general system of geology, but that all must be content for many years to be exclusively engaged in furnishing materials for future generalisations. By acting up to these principles with consistency, they in a few years disarmed all prejudice, and rescued the science from the imputation of being a dangerous, or at best but a visionary, pursuit.[2]

Introductions to geology and manuals were published in the early part of the nineteenth century, some of which, but not all, were written by members of the Geological Society. Robert Jameson issued (1804–1808) a 'System of Mineralogy' in three volumes; of these the third, con-

to Geology, illustrative of the General Structure of the Earth; comprising the Elements of the Science, and an Outline of the Geology and Mineral Geography of England,' and published in 1813. He remarked in his preface that a taste for geological 'inquiries is more prevalent among the intelligent classes of society in this country than at any former period,' and that he had repeatedly heard the want of an introductory treatise on geology 'much regretted by persons who lamented their inability to comprehend the "Geognosy" of Mr. Jameson, and their equal inaptitude of attention to the polemical controversies of M. De Luc.' In a vocabulary of terms at the end of his volume, Bakewell defined Geognosy as synonymous with Geology; and in a footnote explained that 'The term "well-educated geognost," as used by some writers, denotes a perfect disciple of Werner, who has lost the use of his own eyes by constantly looking through the eyes of his master.' This work was gradually improved, until it reached a fifth edition in 1838.

The first text-book by a member of the Society appears to have been that by William Thomas Brande, Sec. R.S., who succeeded H. Davy as professor of Chemistry at the Royal Institution. He had given a course of lectures before that select body in 1816, and in the following year published the substance of them in his 'Outlines of Geology.' He had become a member of the Geological Society in 1814, and served on the Council in 1815–16. He discussed the various theories of the earth propounded by old writers, and then dealt with 'the prevailing theories of the present day,' remarking that 'These are the inventions of Professor Werner, of Freyburgh, and Dr. Hutton, of Edinburgh.' His work showed considerable knowledge of topographical geology, with but a vague idea of geological structure, while the teachings of William Smith were apparently unknown to him.

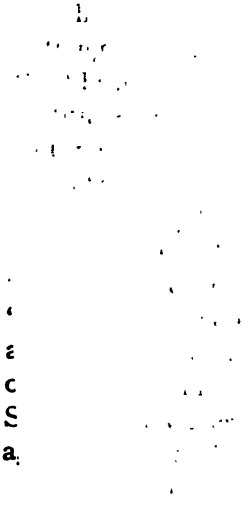
Greenough published in 1819 'A Critical Examination of the First Principles of Geology,' a work remarkable for 'the ingenuity displayed in controverting those geological

theories which he considered injurious to the science;' but the arguments employed were not always sound, and the work was of little value in promoting the advancement of knowledge.

Dr. Andrew Ure, who subsequently became famous as the editor of a 'Dictionary of Arts, Manufactures, and Mines,' issued in 1829 'A New System of Geology.' This work, written 'by one of our own body,' was appropriately dealt with by Sedgwick in his address of 1830. He observed 'The goodly pile, gentlemen, which many of you have helped to rear, after years of labour, has been pulled down and reconstructed; but with such unskilful hands that its inscriptions are turned upside down; its sculptured figures have their heads to the ground, and their heels to the heavens; and the whole fabric, amid the fantastic ornaments by which it is degraded, has lost all the beauty and the harmony of its old proportions.'

In a subsequent passage, Sedgwick observed: 'There is, therefore, one safe rule in all our inquiries, whether they be simple or complicated. Effects similar in kind to those which are produced now, must in all former times have been produced by some corresponding power of nature.'[1]

This was like a prelude to the very different work it was his privilege to deal with in the following year—nothing less than the first volume by Charles Lyell of the 'Principles of Geology' (1830). Sedgwick spoke in gratitude of the instruction and delight with which he had perused every chapter. The volume had already taken 'a distinguished place in the philosophic literature of this country,' and the author (when the work has been completed) will 'have reaped the honour of being the first writer in our country to make known a general system of "geological dynamics"—a new province gained by the advance of modern science.' From Lyell as 'the champion



Sir Charles Lyell, Bart.

D.C.L., F.R.S.

Secretary 1823–26 Foreign Secretary 1829–35

President 1835–37, 1849–51

only the type, but the measure of intensity of the physical powers acting on the earth at all anterior periods.'

Lyell then opposed the doctrine of the progressive development of organic life; and it is interesting to find Sedgwick maintaining that it had many of the elements of truth in it, inasmuch as 'the approach to the present state of things has been gradual, and that there has been a progressive development of organic structure subservient to the purposes of life.' But in expressing this view, Sedgwick had no idea of adopting the doctrines of the 'transmutation of species with all their monstrous consequences.'[1]

At a later date Whewell divided the subject of his presidential address into descriptive geology and geological dynamics, the latter term being 'intended to express generally the science, so far as we can frame a science, of the causes of change by which geological phenomena have been produced.'[2]

'New systems' of geology were evidently in vogue, and occasionally they have been created in later days. In 1831 Macculloch issued in two volumes 'A System of Geology, with a Theory of the Earth;' a production which, temporarily, did much to damage his reputation. Murchison in criticising this work, which was professedly written in 1821, said, 'Gentlemen, if you wish to study geological science "as it is," in the writings of your own countrymen, you will naturally consult the works of Lyell and of De la Beche. But for a knowledge of what "it was," I may request you to peruse these volumes of Dr Macculloch.'[3]

De la Beche's 'Geological Manual' had been published in 1831, and, a few years later, John Phillips brought out the first of his excellent series of text-books. For many years the handbooks of these authors together with the

In most of them, and notably in Lyell's 'Principles,' and in De la Beche's 'Researches in Theoretical Geology' (1834), a great deal of original information was incorporated. It is, however, significant to note a complaint of Lyell, that, on the Continent, he gained no priority for any original views or facts which had only appeared in his 'Principles' and 'Elements.'[1] The due recognition of personal work has ever been a source of anxiety to geologists, but the fact remains that Lyell did more than any other man in his time to advance the progress of geology, not only as the historian of the science, but also as an original observer. As remarked by Professor Bonney: 'The fame of his books causes his numerous papers to be overlooked.'[2]

At this period there was no professorship of Geology in London, and the subject was taught only in occasional courses of lectures, as at the Royal Institution. University College, established in 1828 as the 'University of London,'[3] had no chair of Geology until 1841. Prestwich, who had entered the College during its first year, remarked that 'The only nominal instruction then in geology and mineralogy was to be had in three lectures by Dr. Turner at the end of his course of forty lectures on chemistry.' The organic side of the science was dealt with briefly by Dr. R. E. Grant and John Lindley. Both Turner and Grant had been pupils of Jameson at Edinburgh, and took considerable interest in geology.

Edward Turner (1796–1837) filled the office of secretary to the Geological Society for five years, and was afterwards vice-president. His early death removed a man of exceptional ability and one who was regarded as 'a delightful

THE WOLLASTON MEDAL AND DONATION FUND.

On December 10, 1828, less than a fortnight prior to his decease, the Council received the following communication from Dr. William Hyde Wollaston[1]:—

Dorset Street, December 8, 1828.

I have this day invested one thousand pounds three per cent. reduced Bank annuities in the joint names of myself and the Geological Society of London, in trust, that the said trustees shall during my life pay to me the dividends on the said stock; and after my decease, that the said Society, as surviving trustee, shall apply the said dividends in promoting researches concerning the mineral structure of the earth; or in rewarding those by whom such researches may hereafter be made, or in such other manner as shall appear to the Council of the said Society for the time being, conducive to the interests of the Society in particular, or of the science of Geology in general; such latter application, however, of the dividends to the purposes of science will, in my opinion, be most creditable to the Council. And I hereby empower the Council of the said Society, in furtherance of the above declared objects of this trust, to apply the said dividends in aiding or rewarding the researches of any individual or individuals, of any country; saving only that no member of the Council for the time being shall be entitled to receive or partake of such aid or reward.

And I hereby enjoin the said Society not to hoard the said dividends parsimoniously; but to expend them liberally, and as nearly as may be annually, in furthering the objects of the trust.

And I request the Society to entitle the fund hereby to be created, 'The Donation Fund;' in full confidence that, as there never have been wanting in the Society members who, in case of emergency, have been willing to contribute in aid of the ordinary funds of the Society, so there now are, and

stock, being the remaining part of a subscription entered into some years previously to defray the expenses attending certain geological inquiries in Great Britain and Ireland.'

Wollaston (1766–1828), to quote the words of Dr. Fitton, was 'a Mineralogist of the first order,' and 'it would be difficult to name a man who so well combined the qualities of an English gentleman and a philosopher.' Moreover, 'his penetration and correct judgment upon subjects apparently the most remote from his own immediate pursuits made him during many of the latter years of his life the universal arbiter on questions of scientific difficulty.' His discoveries of Palladium and of Rhodium, together with his inventions of the Camera Lucida, and the Reflecting Goniometer, showed that his love of science was enriched 'by a constant wish and endeavour to be useful to mankind.'[1] It is said that the idea of the Camera Lucida suggested itself 'on his noticing certain phenomena occasioned by a crack in the glass before which he was shaving himself.'[2] He became interim president of the Royal Society in June 1820, on the death of Sir Joseph Banks.

The Council appropriated the first year's income of the Wollaston Fund to the acquisition of a die for a medal, with the impress of the head of the founder. This medal was to be of fine gold, not exceeding the value of ten guineas.

The following is the description of the medal:—

Obverse: Bust to left, 'WOLLASTON.'

Reverse: A space for the name of the recipient and the legend 'THE GEOLOGICAL SOCIETY OF LONDON,' enclosed within branches of laurel and palm, fastened with a ribbon.

For a number of years, from 1846 to 1860, the Wollaston Medal was made of Palladium that had been obtained from

THE WOLLASTON MEDAL

On January 11, 1831, the Council resolved unanimously that the first Wollaston Medal be given to William Smith. To this was added the proceeds of the 'Donation Fund' presented to him at the annual general meeting on February 18.[1]

On this memorable occasion Professor Sedgwick, the president, before delivering his Address, announced from the Chair the adjudication of the 'Wollaston Prize,' and acclaimed the appreciation of William Smith:

> His great and original works are known to you all, and I might well refer to them for our justification, and without any further preface place the prize in his hand, offering him my hearty congratulations. But since his arrival in London, within the last few hours, he has given me a short account of his early discoveries, and has shown me a series of documents of no ordinary interest to this Society and important to the correct history of European geology. I should ill perform my present task were I to withhold this information from you. . . . [Of this the president gave a stirring and interesting account. In his concluding remarks he said:]
>
> I for one can speak with gratitude of the practical lessons I have received from Mr. Smith; it was by tracking his footsteps, with his maps in my hand, through Wiltshire and the neighbouring counties, where he had trodden nearly thirty years before, that I first learnt the subdivisions of our oolitic series, and apprehended the meaning of those arbitrary and somewhat uncouth terms, which we derive from him as our master, which have long become engrafted into the conventional language of English geologists, and, through their influence, have been, in part, also adopted by the naturalists of the Continent.
>
> After such a statement, Gentlemen, I have a right to speak boldly, and to demand your approbation of the Council's award—I could almost dare to wish, that stern lover of truth, to whose bounty we owe the 'Donation Fund'—that

> us to hope that a spirit like that of Wollaston should often be embodied on the earth, I would appeal to those intelligent men who form the strength and ornament of the Society, whether there was any place for doubt or hesitation? whether we were not compelled, by every motive which the judgment can approve, and the heart can sanction, to perform this act of filial duty, before we thought of the claims of any other man, and to place our first honour on the brow of the Father of English Geology.
>
> If in the pride of our present strength we were disposed to forget our origin, our very speech would bewray us; for we use the language which he taught us in the infancy of our science. If we, by our united efforts, are chiselling the ornaments, and slowly raising up the pinnacles of one of the temples of Nature, it was he that gave the plan, and laid the foundations, and erected a portion of the solid walls, by the unassisted labour of his hands. . . .
>
> I think it a high privilege to fill this Chair, on an occasion when we are met not coldly to deliberate on the balance of conflicting claims, in which, after all, we might go wrong, and give the prize to one man by injustice to another; but to perform a sacred duty where there is no room for doubt or error, and to record an act of public gratitude, in which the judgment and the feelings are united.[1]

One who knew Sedgwick has thus spoken of his remarkable personality: 'His fine bronzed face, with its mingled expression of beaming kindness and irresistible wit, his piercing eye, and eager address, gave one the impression of great energy of heart and mind.'[2]

In 1830 the number of Fellows of the Geological Society exceeded 500, and at the annual meeting on February 18, 1831, it was reported that the Society then

Wm Smith L.L.D

to June inclusive, to the alternate Wednesdays. For ten years the session terminated on the first evening meeting in June; but in 1841 it was resolved that the meetings be continued to a second Wednesday in that month.

The year 1831 was a memorable one in the history of Palæozoic geology. Murchison commenced to explore the older rocks on the borders of Shropshire, Herefordshire, and Wales. Sedgwick, who had laboured previously among the ancient rocks of the Lake District, now turned his attention to the western portions of North Wales.

Sedgwick was then forty-six years of age, Murchison was thirty-nine; and they entered with all the enthusiasm of youth into a region that was practically a *terra incognita* —a land of Transition rocks or Grauwacke, of which the divisions, the structure, and life-history had all to be investigated.

Sedgwick rightly enough, as the older and more experienced man, took the more difficult and complicated region; and it is interesting to know that he was accompanied for two or three weeks in Carnarvonshire by Charles Darwin, then a youthful student who desired to learn something of field-geology.[1] Together they hammered the rocks, and sought for fossils, with a vigour that evidently met with no great reward. Thus Lyell records (January 18, 1832): 'Sedgwick is in town, and has been rather, I should say, wasting his giant strength on a barren primary district in Wales, which he owns was like "rubbing himself against a grindstone."'[2]

Meanwhile, Murchison was hard at work on Caer Caradoc and the regions of Ludlow, Aymestry, and Wenlock. He was fortunate in discovering that more was known of the rocks and fossils than had been made public; and he cordially acknowledged help received from local workers, notably from the Rev. T. T. Lewis, Dr. T. Du

[1] 'Life and Letters of Sedgwick,' by J. W. Clark and T. McK. Hughes, vol. i. 1890, p. 379.

[2] 'Life, Letters, and Journals of Lyell,' vol. i. 1881, p. 367.

Gard, and Dr. T. Lloyd. Dr. Du Gard, a busy medical man at Shrewsbury, had helped Buckland on his first geological tour in 1810. To these and other provincial workers, amateurs in the highest sense, who have pursued science for its own sake, the Geological Society has ever been indebted; and Mr. Lewis in particular merits special mention. Of him Murchison remarked: 'The application of his leisure hours to the cultivation of the natural history of his neighbourhood may one day enable Mr. Lewis to confer upon Aymestry the celebrity which White has bequeathed to Selborne.'[1]

> The Rev. Thomas Taylor Lewis, as remarked by Fitton, 'was, we believe, the only person who, previously to the author's inquiries, had determined the relations of any continuous portion of the stratigraphic series beneath the old red sandstone, on the double evidence of superposition and of fossil contents; and . . . the researches of this gentleman deserve a permanent place in the history of the subject.' He had attended Sedgwick's lectures at Cambridge, and on taking up clerical duties at Aymestry in 1826, he laboured zealously at the rocks and fossils, at a time when there were no Ordnance maps of the district; and by the year 1829 he had traced the succession of the great groups of strata afterwards assigned to the Upper Silurian System. Although at one time he thought of publishing an account of the geology, yet when he made acquaintance with Murchison 'he cheerfully resigned the subject, rejoicing that it had fallen into the hands of a geologist whose practical knowledge was much greater than his own.'[2]

Sedgwick having worked through Carnarvonshire extended his labours into Merioneth, Montgomery, and Denbigh, and blocked out his main divisions from Bangor, Tremadoc, and Arenig to Bala. Murchison, working downwards in the succession from the Old Red Sandstone, through Shropshire, Radnor, Brecknock, and Carmarthen, made out his sequence from Ludlow, Wenlock, and Caradoc to Builth and Llandeilo. The two friends met at Bala in

[1] 'Silurian System,' p. 201; *Proc. Geol. Soc.* i. p. 449.

[2] *Edinburgh Review*, lxxiii. 1841, pp. 1–41.

1834; and there parted, 'never to meet again in North Wales.' The results of their respective researches were made known from time to time, but it was not until the year 1835 that the terms Cambrian and Silurian were introduced. In July of that year Murchison introduced the term Silurian for his system of rocks [1]; while Sedgwick, ever given to procrastination in writing, but spurred on perhaps by the energy of his friend, announced the term Cambrian for his system, in a joint paper with Murchison 'On the Silurian and Cambrian Systems,' which was communicated to the British Association, and published in December 1835.[2] In that paper, printed in abstract, each author dealt with his special work; and Sedgwick remarked that his Upper Cambrian 'occupies the greatest part of the chain of the Berwyns, where it is connected with the Llandeilo flags of the Silurian System.' At a later date he admitted that many of the fossils in his Upper Cambrian were identical with those of the lower division of the Silurian System, and that the true distinctive zoological characters of the group had not been well ascertained.[3]

Herein lies the crux of a controversy that should never have arisen, or, at any rate, should never have led to the bitterness which ultimately arose.

The Bala Beds in the Upper Cambrian of Sedgwick were approximately equivalent to the Caradoc Beds (in part) in the Lower Silurian of Murchison; but the latter author had at the time grouped as Caradoc the strata since distinguished as May Hill Sandstone.

Some years elapsed before the true succession was clearly established; inasmuch as both geologists had many new facts to gather, and not a few mistaken notions to

The Upper Silurian then included the Ludlow and Wenlock rocks; the Lower Silurian the Caradoc Sandstone and the Llandeilo Flags, the last named being designated the 'Base of Silurian System.'

The Cambrian as yet had only been broadly divided into two great divisions: the Lower, including the slaty groups around Snowdon that were found to underlie the Bala series of the Upper Cambrian. Murchison, in speaking of the labours of his friend, observed 'that he not only shed an entirely new light on the crystalline arrangement or slaty cleavage of the North Welsh mountains, but also overcame what to most men would have proved insurmountable difficulties, in determining the order and relations of these very ancient strata amid scenes of vast dislocation.'[1] This is eminently just. Sedgwick's great paper on the 'Structure of large Mineral Masses' was read before the Geological Society in March 1835; and no one ever worked harder than he did in the elucidation of the Cambrian System.

In the history of these older formations, the following remarks by Murchison are interesting, whether taken in a prophetic sense or otherwise:—

> But the Silurian, though ancient, are not, as before stated, *the most* ancient fossiliferous strata. They are in truth but the upper portion of a succession of early deposits which it may hereafter be found necessary to describe under one comprehensive name. For this purpose I venture to suggest the term 'Protozoic Rocks,' thereby to imply the first or lowest formations in which animals or vegetables appear.[2]

It may be observed that the term Protozoic is truly appropriate, and has in fact been adopted by Professor Lapworth, for the rocks from the base of the Cambrian to the top of the Silurian.

[1] 'Silurian System,' 1839, p. 6.

[2] 'Silurian System,' p. 11, and *Proc. Geol. Soc.* iii. p. 641. The term Protozoic had originally been suggested by Sedgwick in 1838, for use if any of the Primary rocks, older than the Cambrian, should prove to contain fossils. *Proc. Geol. Soc.* ii. p. 584; see also *Quart. Journ. Geol. Soc.* viii. pp. 154, 155.

Of the two volumes of the 'Silurian System' Fitton spoke in the highest terms, 'as a permanent contribution to our knowledge of the structure of a most interesting portion of our country;' and he remarked that 'No geological book that we know of gives so much information, with such a readable subordination of detail to general principles.' [1]

Of the life of the Geological Society during these years we have glimpses from the records of Lyell:—

> *December* 13 [14], 1831.—Dined at the Geological Society club. . . . A pleasant club. Stokes, Greenough, Buckland, Lord Cole, Broderip, and a few more. Murchison was pheasant-shooting in the country, but cut in for the meeting. A short paper on Springs, and another by Mr. [William] Hutton on the Whin Sill of Yorkshire, drew up Buckland, Greenough, Fitton, Murchison, and De la Beche, and as they seemed much disposed to go on for ever, Buckland speaking five times, but not once too often, I was glad to sit quiet.[2]

Discussions at the present day are perhaps attended with a greater amount of ceremony; but they form an attractive adjunct to most papers, and there are doubtless occasions when certain speakers might profitably address the members more than once, during a debate on an interesting controversial subject.

> 1832. '*February* 3 [1].—Just returned from the Geological Society, having dined at the club, and since taken an active part in a debate, with Sedgwick, Conybeare, De la Beche, Fitton, Greenough, and others—which was prolonged unusually till half-past ten o'clock—"on the Old and New Red Sandstone," and other dryish subjects, which Adam made entertaining. The paper was by him. The attendance was quite splendid, very numerous, and all the best men there.' [The above refers to Sedgwick's paper. 'On the deposits overlying the Carboniferous series in the valley of the Eden, and on the north-western coasts of Cumberland and Lancashire,' read on February 1.]
>
> 1832. 'February 19 [17].—On Friday I went to the General Meeting and the Anniversary Dinner of the

[1] *Edinburgh Review*, vol. lxxiii. 1841, pp. 1–41.

[2] Lyell, 'Life, Letters, and Journals,' vol. i. 1881, p. 357.

Geological Society, at the Crown and Anchor—a splendid meeting. Near the president [Murchison] sat Lords Milton, Morpeth, Cavendish, Sir John Malcolm, Sir J. Herschel, Sir J. Johnstone, M.P., Sir R. Vyvyan, Sir C. Lemon, and other M.P.'s. Literature represented by Hallam, Lockhart, Sotheby, &c. Geologicals—Buckland, Conybeare, Fitton, Greenough, Sedgwick. Then from Cambridge, Whewell, and many other good men. All the best geological residents in town.'[1]

Murchison, when president, following the example of Greenough and Fitton, 'made it the ground for gathering at his house, in a more public and official form than one could do in a private capacity, assemblies in which scientific men mingled freely with representatives from that non-scientific society of rank and fashion to which he had always been so strongly attached. To these gatherings Mrs. [afterwards Lady] Murchison lent her cordial help, giving them a charm which added much to their popularity.'[2] They were continued for many years. The Marquis of Northampton likewise held evening receptions to which the leading geologists were invited.

In 1833 the number of Fellows exceeded 600, and in the following year some additional apartments at Somerset House were made over to the Society. The president (Greenough) in his Address on February 20, 1835, remarked:—

'Gentlemen,—I rejoice to see you assemble in these long-desired apartments. . . . You are well aware that all the accommodation which you now enjoy has not been derived, however, solely from the beneficence of the Government, set in motion by the Royal Society. On our first taking posses-

executed under his direction. . . . [He] has declined to accept any remuneration for his professional services, but I cannot deny myself the pleasure of again recording this new instance of his public spirit and characteristic liberality.'[1]

In 1836 the number of Fellows exceeded 700, and the Council reported that they were proceeding gradually to accomplish the recommendation made by the auditors in 1833, namely, to invest in stock a sum equal to the entire amount of compounded subscriptions. This policy was pursued with tolerable regularity for many years. In 1839 the value of the funded property of the Society was 2,010*l.*, and in 1841 as much as 2,410*l.*

During these years other geological societies were established in Great Britain and Ireland. In 1832 Ireland followed the lead that had been set many years previously by Cornwall, and established the Geological Society of Dublin.

Bartholomew Lloyd, D.D., provost of Trinity College, was president, and he was supported by Sir Charles Giesecke[2] (professor of Mineralogy), Richard Griffith, Captain Portlock, Dr. James Apjohn, the Rev. Humphrey Lloyd, and others. In 1864 the Society was converted into the Royal Geological Society of Ireland, but it ceased to exist after 1889.

The Edinburgh Geological Society was founded in 1834, but did not until some years later occupy a prominent position.

The Yorkshire Geological and Polytechnic Society originated at Wakefield in 1837, from a meeting of coal and iron masters. It was at first called the Geological Society of the West Riding of Yorkshire.

Manchester, in 1838, established a Geological and Mining Society, which was supported by several of our

CHAPTER VII

THE GEOLOGICAL SURVEY. THE DEVONIAN SYSTEM

THE GEOLOGICAL AND ORDNANCE SURVEYS—COLONEL COLBY—COLOURING OF GEOLOGICAL MAPS—DE LA BECHE—GEOLOGICAL MAP OF DEVON—SEDGWICK, MURCHISON, AND LONSDALE—DEVONIAN SYSTEM—GODWIN-AUSTEN—PORTLOCK—SOPWITH—MUSEUM OF PRACTICAL GEOLOGY

IN his Address to the Society in 1861 Leonard Horner remarked: 'The Geological Survey of the United Kingdom claims, however, my first attention; for I think that, without being open to the charge of arrogance, we may say that it is an offspring of this Society. The nation is mainly indebted, for the advantages it has already [derived] and will hereafter derive from that institution, to the genius, activity, and practical judgment of one of the most accomplished geologists of the time in which he lived, and for many years a leading member in this Society, Sir Henry De la Beche.'

The progress of geology in every region must be largely dependent on accurate topographical maps; and the publication of sheets on the scale of one-inch to a mile, by the Ordnance Survey, was of the greatest assistance. This Survey was commenced in 1797, and by the year 1824 the south of England and part of Wales had

these country gentlemen was partly to obtain a hunting-map, and partly to get the drainage of the fens marked out for reclamation purposes.'[1] By the year 1840 the Survey had reached as far north as Preston and Hull, and from experience then gained it was decided to survey the six northern counties on the scale of 6 inches to a mile.

The initiation of the Geological Survey was due in no small measure to the enlightened policy of Colonel (afterwards Major-General) T. F. Colby (1784–1852), director-general of the Ordnance Survey.

Thus, in his Address of 1833, Murchison stated that

> The encouragement which, at the suggestion of Colonel Colby, the Board of Ordnance has afforded to all the surveyors who, during their labours in the field, have kept a register of the mineral changes accompanying variations of outline in the land, is now producing the happiest results.
>
> Mr. [J. R.] Wright has already given us[2] ample proof of this in the geological delineation of a tract of country around Ludlow, which, from repeated personal examination, I can testify to be a model of accuracy.
>
> Mr. [Henry] McLauchlan [1791–1881], another of our Fellows attached to the Ordnance Survey, has, with equal success, illuminated a much larger surface of the Ordnance maps, comprehending the Forest of Dean and the central parts of Herefordshire.[3] . . . .
>
> Our Society has further been most advantageously connected with the Ordnance Survey, by the appointment of Mr. De la Beche to affix geological colours to the maps of Devonshire, and portions of Somerset, Dorset, and Cornwall. . . .
>
> The adoption of a fixed scale of colours by all English geologists is still an essential desideratum in this department; and I am happy to have it in my power to state that a systematic arrangement will shortly be submitted to you, after it has undergone the supervision of our Council and

such colours only as are fixed and distinct from each other, has been suggested by our valued member Mr. [afterwards Sir Francis] Chantrey.[1]

In the Library of the Geological Survey and Museum of Practical Geology there is a copy of the original Index of Colours, sent to Murchison from the Ordnance Survey, and dated May 16, 1832.

Here it is of interest to refer back to a paper (read before the Wernerian Society on April 9, 1808) 'On Colouring Geognostical Maps,' by Robert Jameson. He gave the following advice:—

> In constructing geognostic maps, after having delineated the aspect of the surface of the country we have examined, our next business is to exhibit, as far as possible, by means of colouring, a true and harmonious representation of the alternation, extent, and relative position of the different rocks that appear at its surface. Various methods have been adopted for accomplishing this object. In some maps the boundaries of the different rocks are marked by a continuous or dotted line, and the enclosed space representing the rock by a particular symbol; in others, the enclosed spaces are distinguished by lines running in different directions, or by dots of various magnitudes; lastly, in others the enclosed spaces are coloured. Of all these this last is the preferable method, and is, besides, that which has been most generally followed.

In his rules to be observed in colouring maps, he stated that

> The colours must agree as nearly as possible with nature—that is, they must correspond with the most common colour of the rock.[2]

Carboniferous Limestone *blue*, the Coal-measures *dark-grey*, the New Red Sandstone *light red*, the Lias *yellowish-brown*, the Oolites various shades of *yellow*, the Greensands shades of *green*, and the Tertiary strata shades of *brown*.

De la Beche (1796–1855), who, in his youth, resided for several years at Charmouth, had already published admirable descriptions of the strata exhibited in the coast sections of Dorset and parts of South Devon; and therefore had no difficulty in extending his detailed work northwards across the Blackdown Hills to the Vale of Taunton. The case was different when he passed west of the Exe Valley, and carried his field-work through West Devon into Cornwall. There he had to deal with perhaps the most difficult tract in Britain.

Other independent labourers were also at work in the field. William Lonsdale had made a map of the country near Bath, Chippenham, and Calne, in illustration of his memoir 'On the Oolitic District of Bath' (1829), which had been prepared at the suggestion of Fitton and De la Beche. In January 1832 the Council directed that one year's dividend of the Wollaston Fund should be paid to Lonsdale, for continuing, during the summer then ensuing, a survey of the Oolitic series; and in his Address of 1833, Murchison reported that

> Mr. Lonsdale has presented us with the result of his labours, having laid down upon maps of the Ordnance Survey the range of different members of the oolite, from the neighbourhood of Bath, where he had previously developed their relations, to the southern limits of Warwickshire and Oxfordshire.[1]

At a later period Lonsdale made an 'elaborate survey of a long range of the oolitic escarpments from the south-western country, with which he had been long familiar, to the Humber.'[2] These maps, which are in the possession of the Geological Society, are crude when compared with the earliest published maps of Devon and Somerset by

[1] *Proc. Geol. Soc.* i. pp. 52, 413, 423, 446. [2] *Ibid.* iv. p. 67.

De la Beche; but they were evidently intended only as sketch-maps to show the general range and relations of the Oolites. Lonsdale rendered effective aid to the Geological Survey when, later on, they commenced to map the region north of Bath. As yet, however, the Geological Survey had no independent existence.

In 1834 Greenough announced that De la Beche, acting under the direction of the Board of Ordnance, had produced 'a geological map of the county of Devon, which, for extent and minuteness of information and beauty of execution, has a very high claim to regard.'[1] This appears somewhat scant praise for the first-fruits of De la Beche's enthusiastic and disinterested labour; but he had evidently not had sufficient time to do justice to the older rocks, as both Sedgwick and Murchison found fault with the map in regard to the classification and absence of details in the 'Grauwacke' group.[2]

It is an unfortunate circumstance that the early Geological Survey maps of Devon and Cornwall were not dated; but, as noted further on, there is no doubt that some of them were revised prior to 1839.

Thus we learn from Greenough (Address of 1835) that the researches of De la Beche

> 'in the counties of Devon and Somerset have been carried on this year with increased energy. Of the eight sheets of the Ordnance Map upon which he has been engaged, four were published last spring, three others are complete, the eighth is nearly complete, and an explanatory memoir, with sheets of sections applying to the whole, are to be published before our next anniversary.'[3]

During the year 1835, quarter-sheet 63 NE of the

Grauwacke, New Red Sandstone, and Lias. Other MS. maps, prepared by officers of the Ordnance Survey, and to which reference has been made, were also deposited in the Library. In the copy of sheet 53 SW which includes Edgehill, by J. Robison Wright, 1836, MS. sections were affixed to the map, in a style similar to that recently introduced by the Geological Survey on their one-inch colour-printed maps.

It was during the first presidency of Lyell that steps were taken to place the Geological Survey on a permanent footing, and he recorded the circumstances in his Address of 1836:—

'Early in the spring of last year an application was made by the Master-General and Board of Ordnance to Dr. Buckland and Mr. Sedgwick, as professors of Geology in the Universities of Oxford and Cambridge, and to myself, as president of this Society, to offer our opinion as to the expediency of combining a geological examination of the English counties with the geographical survey now in progress. In compliance with this requisition we drew up a joint report, in which we endeavoured to state fully our opinion as to the great advantages which must accrue from such an undertaking, not only as calculated to promote geological science, which would alone be a sufficient object, but also as a work of great practical utility, bearing on agriculture, mining, road-making, the formation of canals and railroads, and other branches of national industry. The enlightened views of the Board of Ordnance were warmly seconded by the present Chancellor of the Exchequer, and a grant was obtained from the Treasury to defray the additional expenses which will be incurred in colouring geologically the Ordnance county maps. This arrangement may justly be regarded as an economical one, as those surveyors who have cultivated geology can with small increase of labour, when exploring the minute topography of the ground, trace out the boundaries of the principal mineral groups. This end, however, could only be fully accomplished by securing

the co-operation of an experienced and able geologist, who might organise and direct the operations; and I congratulate the Society that our Foreign Secretary, Mr. De la Beche, has been chosen to discharge an office for which he is so eminently qualified.'[1]

We have a picture of De la Beche in the 'Memories of Old Friends,'[2] by Caroline Fox, daughter of Robert Were Fox, of Penjerrick. Thus she recorded in 1836:—

> Falmouth, April 7.—Sir Charles Lemon, John Enys, and Henry de la Beche came to luncheon. The last-named is a very entertaining person, his manners rather French, his conversation spirited and full of illustrative anecdote. He looks about forty—a handsome but care-worn face, brown eyes and hair, and gold spectacles. He exhibited and explained the geological maps of Devon and Cornwall, which he is now perfecting for the Ordnance. Accordingly he is constantly shifting his residence that he may survey accurately in these parts.

At the close of 1835, De la Beche was in doubt as to how far the divisions of the Grauwacke in Western Somerset, Devon, and Cornwall might coincide with Sedgwick's Cambrian; but he was of opinion that the rocks were older than the Silurian of Murchison.[3]

In 1836 Sedgwick and Murchison together commenced their detailed researches on Devonshire, whereby they rescued the Culm-measures from the chaos of Grauwacke; and eventually (in 1839) showed, with inspiration from Lonsdale, that the older rocks of the county formed a great group between Carboniferous and Silurian, and the Devonian system was founded.

Some controversy naturally arose with reference to the

if he finds reason to modify any of them, he shall not hesitate to announce the change of opinion.'[1]

The history of the founding of the Devonian System was thus told by Lonsdale:—

> It was immediately after the reading of Mr. Austen's paper 'On the Geology of the South-east of Devonshire' [December 1837], 'and partly from an examination of Mr. Austen's specimens, that I formed the opinion relative to the limestones of Devonshire being of the age of the old red sandstone; and which I afterwards suggested, first to Mr. Murchison and then to Professor Sedgwick, and at a later period (in 1838), to Mr. de la Beche and other Fellows of the Society.'

This view was not published until March 1840.[2] Thus Lonsdale's 'important and original suggestion of the existence of an intermediary type of Palæozoic fossils, since called Devonian,' led to a change which was then 'the greatest ever made at one time in the classification of our English formations.'[3]

At a later date Sedgwick explained how it came to pass that the Devonian system was not established by Murchison and himself in 1836, when they determined the great culm-trough of North Devon to be Carboniferous. 'The reason is well known. We sent a good series of the fossils of the Petherwin and Barnstaple Groups to London. They were examined and named, and every species was called Silurian. . . . On re-examining the fossils in 1838, it turned out that all the species of the Barnstaple Group had been wrongly named; and that so far from being Silurian, the only doubt respecting them was, whether they might not be called Carboniferous rather than Devonian. Thus the physical and fossil evidence were

or of subordinate formations, ever can be attempted without a previous determination of the physical groups.'[1]

Austen (afterwards Godwin-Austen, 1808–84), of Chilworth Manor House and Shalford, near Guildford, became a Fellow of the Society in 1830. Soon afterwards he resided for some time at Ogwell House, near Newton Abbot, and worked so zealously at the geology of the neighbourhood that De la Beche, ever ready to seize upon and bring forward younger workers of ability, was principally indebted to him for the geological lines on that part of the map of Devon.[2] Austen also accompanied Sedgwick through parts of Devonshire in 1837. His first paper on the Raised Beach near Hope's Nose, Torquay, was read in November 1834, and severely criticised by Greenough, who (as told in conversation by Godwin-Austen) remarked: 'This young man thinks he has seen a Raised Beach; I don't believe a word of it' (see p. 131). His great paper on the Geology of the South-east of Devonshire (published in the *Transactions*) embodied a series of communications made during 1834–40. In later years he published other notable papers, to some of which reference will be made; but although he attained the front rank, and was in 1862 awarded the Wollaston Medal as 'pre-eminently the physical geographer of bygone periods,' he could never be induced to take the presidential chair.

That De la Beche issued a revised edition of his Devonshire maps may be judged from the following remarks made by Buckland in 1840:—

> Mr. De la Beche, in his map of Devon and Cornwall, published in 1839, has adopted divisions of the strata

[*to face p. 108*

Of the several sheets of the map, Buckland observed that 'they are more beautiful in their execution, more accurate in their details, and more instructive in the economical and scientific information they give respecting mines, than any maps yet published by any government in the world.'[1]

De la Beche's classic 'Report on the Geology of Cornwall, Devon, and West Somerset' was published also in 1839, before the term Devonian had been introduced; but this term he adopted in a later publication, remarking that 'in Cornwall and Devon there may be equivalents both of the Carboniferous limestone above, and of the higher parts of the Silurian rocks beneath, also included in this system.'[2]

De la Beche knew in 1839 of the discovery made by C. W. Peach[3] of *Orthis* and other fossils in the quartzites of Gorran Haven in Cornwall. Some years elapsed, however, before the specimens were recognised to be of Bala or Caradoc age; but this determination did not modify the belief that the greater part of the slaty series in West Cornwall was Devonian, although no boundary line could then be drawn between that series and the older rocks.[4]

The Devonian system had no definite base, while its upper limits were as yet but ill-defined; facts which allowed room for considerable controversy at later periods.

While arrangements were in progress for the establishment of the Geological Survey in England and Wales, Joseph Elliston Portlock (1794–1864), captain of Royal Engineers, was conducting the Geological Branch of the Ordnance Survey in Ireland. He has told how Colonel Colby, at the commencement of the Trigonometrical Survey, expressed his opinion 'that the Topo-

[1] *Proc. Geol. Soc.* iii. pp. 221, 227.
[2] *Mem. Geol. Survey*, vol. i. 1846, p. 50.

graphical Survey should be considered a foundation for Statistical, Antiquarian, and Geological Surveys.' About the year 1832 Portlock commenced the formation of a geological department in Ireland, and this ultimately led to the preparation of his famous 'Report on the Geology of the county of Londonderry, and of parts of Tyrone and Fermanagh,'[1] published, in 1843, as a companion volume to De la Beche's Report on Cornwall, &c. (see p. 133). Meanwhile in 1835 a second and much improved edition of Griffith's Geological Map of Ireland was published.

It should not be forgotten that Macculloch had in 1814 been appointed 'Geologist to the Trigonometrical Survey of Great Britain,' and that after collecting a great mass of information on the geology of Scotland, he received a commission from the Lords of the Treasury to construct a geological map of that country. His field-work was finished in 1832, and his map, based on that of Arrowsmith, was ready in 1834, but it was not published until 1836, after the decease of the author.[2]

The progress of the Geological Survey in the west of England was aided, as De la Beche records, by several Fellows of the Geological Society. H. McLauchlan and H. Still, in Cornwall, and later on in Pembrokeshire,[3] diligently recorded observations in the field, while engaged on the Ordnance Survey. S. R. Pattison (then of Launceston) and the Rev. Richard Hennah (of Plymouth) aided by their collections of fossils. The Rev. David Williams (of Cross, near Bleadon, Somerset: died 1850) and Thomas Weaver (1773–1855) had indicated some of the main stratigraphical divisions among the older rocks of Devon and Cornwall. Weaver, who had been a pupil of Werner, was an active member of the Society, and also

It was not until about 1840 that De la Beche had the benefit of assistants who gave their whole attention to the work of the Geological Survey. W. T. Aveline joined in that year, A. C. Ramsay in 1841, and H. W. Bristow in 1842.[1]

At a later date William Sanders in the Bristol area, and William E. Logan in the great South Wales Coal-field around Swansea, gave most effectual help in the work of the Geological Survey, placing their information freely at the service of that institution. Logan had commenced work in 1831, and his maps had been exhibited in 1837 at the meeting of the British Association in Liverpool, where they attracted the attention of De la Beche.

Mention may here be made of an eminent practical geologist, Thomas Sopwith, land and mine surveyor, who published in 1833 an account of the mining districts of Alston Moor.[2] Two years later, by order of H.M. Commissioners of Woods and Forests, he prepared a plan on a scale of ten inches to a mile, of the coal and iron mine districts in the Forest of Dean, and in 1842 he constructed a model of the area. He became well known also for his twelve hand-models, shaped from thin slabs of differently coloured wood, to illustrate geological phenomena: such as stratification, dip, strike, coal seams, faults, mineral veins, denudation, &c. These models were issued in 1840, and an account of them was brought before the Geological Society in the following year.

De la Beche has told how in 1835, while conducting the Geological Survey in Cornwall, he was forcibly impressed with the idea that the Survey presented an opportunity, not likely to recur, of illustrating the useful applications of geology; and he then suggested to the Chancellor of the Exchequer, Mr. Spring-Rice (afterwards Lord Monteagle),

that a collection should be formed of economic minerals, building-stones, and other rocks employed for useful purposes. The proposal was favourably received by the Secretary of the Treasury, and by other influential persons, including Sir Robert Peel. A house belonging to the Crown, in Craig's Court, Charing Cross, was placed at the disposal of the Geological Survey, and the Museum of Economic Geology, as it was then called, was established in 1837, although not opened to the public until 1841. A laboratory was added; and Richard Phillips, F.R.S., was appointed chemist and curator (see p. 13). Two years later the Treasury gave their sanction to lectures being delivered on the practical applications of geology; but arrangements for these could not be made until the present Museum of Practical Geology was opened on November 6, 1851, when at the same time the 'School of Mines and of Science applied to the Arts' was founded.

In the meantime, in 1840, De la Beche had further established a Mining Record Office, for the purpose of collecting information respecting the distribution and produce of our mines, and for procuring plans and sections not only of modern workings, but also of abandoned mines. It was placed under the charge of T. B. Jordan, who was succeeded in 1845 by Robert Hunt.[1]

At the opening of the Museum and School of Mines in 1851, the following were the professors: Lyon Playfair, *Chemistry*; Edward Forbes, *Natural History*; Robert Hunt, *Mechanical Science*; John Percy, *Metallurgy*; A. C. Ramsay, *Geology*; and Warington W. Smyth, *Mining and Mineralogy*.

Among the earliest students were Hilary Bauerman and H. F. Blanford, 1851–53, and W. T. Blanford, 1852–54.

Four years later (1855), on receiving the Wollaston

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CHAPTER VIII

CATALOGUES OF FOSSILS. EARLY DISCOVERIES OF VERTEBRATA

CATALOGUES OF FOSSILS—EARLY COLLECTORS—MARY ANNING—STONESFIELD SLATE—EXTINCT MONSTERS—BUCKLAND AND HIS HOME—ETHELDRED BENETT—W. C. WILLIAMSON—ZONES—CHARLESWORTH—MANTELL—ANNIVERSARY DINNERS—FITTON'S 'STRATA BELOW THE CHALK'—LIBRARY AND MUSEUM—DARWIN—COUNCIL, 1837—FALCONER AND CAUTLEY—OWEN—GREENOUGH'S GEOLOGICAL MAP (SECOND EDITION)—COAL-MEASURES—HUGH MILLER AND THE OLD RED SANDSTONE

DURING the years referred to as initiating the field-work of the Geological Survey, the indoor-work of the palæontologist was steadily increasing, for even at this date the multiplicity of names for the same fossil was lamented as a great hindrance to the acquisition of knowledge.

Richard Cowling Taylor (1789–1851), who had worked at the Crag and Chalk of Norfolk, published in 1829 a list of the fossil shells then recorded from British strata.[1]

In 1831, at the first meeting of the British Association, the Geological and Geographical Committee recommended that John Phillips 'be requested to draw up, with such co-operation as he may procure, a *systematic catalogue of all the organised fossils of Great Britain and Ireland*, hitherto described, with such new species as he may have an opportunity of accurately examining, with notices of their localities and geological relations.' This work was not

by Murchison, through whose influence he had received on loan a number of geological books, an invaluable aid to a provincial worker in those days. When published the work contained a record of 2,008 species. Some years elapsed before any further list of British fossils was compiled.

Fossils had been collected at sundry localities for sale to visitors in the latter part of the eighteenth century, especially at Lyme Regis and Charmouth. The most notable collector during the early part of the nineteenth century was Mary Anning (1799–1847), daughter of a cabinet-maker of Lyme Regis, who had supplemented the profits of carpentry with those derived from the sale of fossils. Losing her father in 1810, when she was little over ten years of age, Mary Anning began collecting specimens and achieved remarkable success. Moreover, as De la Beche remarked, 'she exhibited great talent in developing the fossils. In 1811 she discovered remains that proved to belong to *Ichthyosaurus*, a fossil reptile not previously recorded from this country.' Ten years later she obtained remains of an entirely new Saurian which was described by Conybeare as *Plesiosaurus*; and in 1828 she discovered the remains of a Pterodactyl, described by Buckland, and now known as *Dimorphodon macronyx*. She also found numerous Cephalopods (*Belemnosepia*) with their fossil ink-bags. The ink appeared to be so well preserved that Buckland induced Sir Francis Chantrey to make a drawing with it, and the material proved to be of excellent quality. The drawing (head of an *Ichthyosaurus*) is now deposited in the Society's Museum. A stained-glass window was erected to the memory of Mary Anning in the parish church of Lyme Regis, by Fellows of the Geological Society; and an oil painting of her is suspended in the Museum.

They were first recognised by Cuvier, and referred to the genus *Didelphys* in 1818, from a specimen obtained by W. J. Broderip, and given to Buckland. The discovery, however, created some consternation, and a long controversy arose. The geological age of the stratum was at first questioned, and when that was settled, the zoological affinities of the fossil were disputed by Agassiz, De Blainville, and R. E. Grant. De Blainville, who proposed the name *Amphitherium* on account of the 'ambiguous nature' of the remains, thought they most likely belonged to a Saurian; but although Cuvier's opinion was supported by Buckland, it was not until 1838, when Owen described the original specimen together with a second fossil that had been found by Broderip, and others afterwards obtained, that the matter was set at rest. The genus *Amphitherium* was retained (although in place of it the name *Botheratiotherium* had been suggested by Charlesworth); and other genera were established. John Phillips also called attention to the fact that a specimen, now named *Amphilestes Broderipi*, had been obtained about the year 1764 by Joshua Platt, and had been deposited in the York Museum.

Among other specially noteworthy discoveries at this period was that of the *Megalosaurus*, found in the Stonesfield Slate, near Oxford, and described by Buckland in 1824. Many years later, restorations of this, and of other extinct monsters, were made by B. Waterhouse Hawkins, for the geological garden at the Crystal Palace; the *Megalosaurus* being represented to be thirty-seven feet in length, including five feet of head, and fifteen feet of tail, while the girth was twenty-two feet six inches.[1] In 1853, Owen and twenty others dined in the interior of the *Iguanodon* to celebrate the completion of the restorations. Such models, as well as pictorial representations, have proved attractive to many writers since Thomas Hawkins (1810–89), a somewhat eccentric Fellow of the Society, in

[1] Owen, 'Geology and Inhabitants of the Ancient World,' 1854; 'Life of Owen,' vol. i. p. 399; and Geikie, 'Life of Edward Forbes,' p. 531.

1840 published his 'Book of the Great Sea-Dragons, Ichthyosauri and Plesiosauri.' The animals, like the geologists, seemed generally to have been engaged in combat.

Buckland was always an enthusiastic collector, and it is recorded that on one occasion, obtaining a large form of *Ammonites Bucklandi* without the inner whorls, he thrust his head through the stony ring and rode home, dubbed by his friends the 'Ammon Knight.'[1] He habitually carried a large blue bag for his fossils, and has told that the greatest honour which the bag ever had was when Lord Grenville insisted on carrying it; and the greatest disgrace it ever had was when he called on Sir Humphry Davy three or four times one day, and always found him out. At last Sir Humphry asked his servant, 'Has Dr. Buckland not called to-day?' 'No, sir, there has been nobody here to-day but a man with a bag, who has been here three or four times, and I always told him you were out' (see Frontispiece).

Buckland's home at Oxford, as described by Sopwith in 1839, was 'truly characteristic as the residence of a geologist and scholar. The exterior is a plain, low, rustic, time-worn Gothic wall, being part of the large quadrangle of Christ Church College. A low and very plain-looking door opens, and you behold a very wide and short staircase, almost covered with fragments of rock, specimens of fossil remains, an immense tortoise, and a stuffed wolf. In the breakfast-room are a series of piles of books, boxes, papers; in short, such a combination of book-stands, chairs, sideboards, boxes, all blended together in one mass of confusion, which, I was informed, had not been invaded by the dust-cloth for the last five years.'[2]

From another writer, in October 1839, we learn that:—

rubbish held sacred to geology, which she once ventured to have cleared, but found it so disturbed the doctor that she determined never again to risk her matrimonial felicity in such a cause.'[1]

That women have been interested in one way or another in geology has already been indicated. As early as 1823 the Geological Society received a communication from Mrs. Maria Graham, being 'an account of some effects of the late earthquakes in Chili;' and this was published in the *Transactions*.[2] Nearly forty years, however, elapsed before any other paper by a lady was printed in the Society's publications.[3]

In the diary of Lyell for May 1832, when he was professor of Geology at King's College, it is mentioned that there were 'grand disputes at the Geological Society about the propriety of admitting ladies to my lectures.' The fact was that the Council of King's College had decided that, in future, ladies should not be admitted to Lyell's lectures, because their presence 'diverted the attention of the young students.' A great falling-off in attendance was the result of this resolution.[4] Sedgwick, however, lectured in 1847 at Cambridge to a very large class, including many ladies.[5] In an amusing letter to Dr. William Somerville, in 1834, he offered a warm welcome at Cambridge to Mary Somerville (1780–1872), whose researches on physical geography should be mentioned in this volume, and whose husband took interest in mineralogy, and had in early years joined the Geological Society.[6]

In this country the most distinguished of early women-

the daughter of a Wiltshire squire, who resided for many years at Norton House, near Warminster. There she formed a collection of local fossils, especially those of the Upper Greensand and Chalk. In the possession of the Society is a MS. quarto volume by Miss Benett, dated 1816, and entitled 'Sketches of Fossil Alcyonia from the Greensand Formation at Warminster Common, and in the immediate vicinity of Warminster, in Wiltshire.' She contributed to Sir Richard Colt Hoare's County History 'A Catalogue of the Organic Remains of the County of Wilts,' which was reprinted and privately issued in 1831. In that work she described and figured several species of Upper Greensand sponges. Among the specimens in her collection was one regarded by members of the family as Aunt Etheldred's heart; but that this had not suffered petrifaction may be inferred from her reply to a request for a silhouette. She wrote from Norton House, May 15, 1837, enclosing a profile of herself taken a short time previously at Bath, and remarked:

> 'Such as he has made me in bonnet, cap, and velvet spencer, you have me; or rather, I should say, you have me not, for I do not think it will give you the least idea of me. The dress I am never seen in but in my pony carriage, and it makes me look at least ten years older than I am; I could not alter my dress when I found the man, for I had not a moment to spare.'[1]

The value of fossils, as William Smith taught, was in the identification of geological formations; and for many years geologists collected specimens from the main stratigraphical divisions, with little or no regard to the particular layers in which they occurred.

William Crawford Williamson (1816–95), in later years

curator of the Scarborough Museum, in whose house William Smith and his wife resided in 1826 and for a considerable time afterwards. Smith's costume was thus depicted by W. C. Williamson:

> 'The drab knee-breeches and grey worsted stockings, the deep waistcoat, with its pockets well furnished with snuff . . . . and the dark coat, with its rounded outline and somewhat Quakerish cut, are all clearly present to my memory.'[1]

He has told also how Murchison and his wife paid a visit to Scarborough in 1826 and were conducted along the Yorkshire coast as far as Saltburn by William Smith and John Williamson: a good preparation for Murchison in regard to his subsequent work at Brora in Sutherland, to which region he afterwards proceeded.

W. C. Williamson's early interest in geology was greatly stirred by the 'Illustrations of the Geology of Yorkshire. Part 1. The Yorkshire Coast' by John Phillips, published in 1829; and this led him to study the distribution of the organic remains. In memoirs read before the Geological Society in May 1834 and November 1836,[2] he drew attention to the horizons and ranges of many of the Liassic and Lower Oolitic fossils in Yorkshire. In the first paper he sought to show that the subdivisions in the Lias were characterised by certain species of Ammonites and other distinguishing fossils. In the second paper he dealt with the organic remains in the Oolitic series, and especially with the fossil plants of the Estuarine strata, thereby laying the foundations of the palæo-botanical knowledge for which he was subsequently distinguished. In his 'Reminiscences'[3] he has mentioned that 'almost simultaneously with the receipt of my second memoir, a short but carefully prepared paper by Mr. Louis Hunton, a hitherto unknown author, was forwarded to the Society and shortly

[1] 'Reminiscences of a Yorkshire Naturalist,' by W. C. Williamson, edited by his wife, 1896, pp. 13, &c.

[2] *Trans. Geol. Soc.* ser. 2, v. p. 223.

[3] Williamson, *op. cit.* p. 37.

afterwards read . . . The author was evidently ignorant of my memoir, but he had arrived at conclusions identical with those which I had announced in May 1834.' The fact was that although a short summary of the first paper had been printed in the *Proceedings* of the Society, it was not uncommon to amalgamate two or more papers by one author in the *Transactions*, which were then published at irregular intervals.

Hunton, in describing the Upper Lias and Marlstone near Whitby, drew attention to the limited vertical range of many species, and remarked 'But of all organic remains, the Ammonites afford the most beautiful illustration of the subdivision of strata, for they appear to have been the least able, of all the Lias genera, to conform to a change of external circumstances.'[1]

Hugh Edwin Strickland in 1840 came to somewhat similar conclusions with regard to the Lias on the borders of Worcestershire and Gloucestershire. Thus early we find indications of the zonal grouping which in Germany was established by Quenstedt in 1843 and subsequently developed by Oppel.

About this period Edward Charlesworth (1813–93) appeared upon the scenes. The son of a clergyman, who for some years was rector of Flowton near Ipswich, he had been educated for the medical profession, but became so interested in Geology and especially in the Crag deposits of East Anglia, that he determined to devote himself to natural science. In May 1835 he read before the Society a paper 'On the Crag of part of Essex and Suffolk.' This was published only in abstract. It appeared elsewhere in full with the title: 'Observations on the Crag-formation and its Organic Remains; with a View to establish a Division of the Tertiary Strata overlying the London Clay in Suffolk.'[2] It is difficult to understand

[1] *Trans. Geol. Soc.* ser. 2, v. p. 215. Mr. C. Fox Strangways informs us that Louis Hunton was probably son of William Hunton, at that time manager of the Lofthouse Alum Works.

[2] *Phil. Mag.* ser. 3, vii. August 1835, p. 81.

why the Geological Society did not publish this paper. So far as the Crag is concerned it became a classic; and the author lived on the reputation of the paper until the end of his days. To him we owe the designations Red and Coralline Crags and the first clear account of their relations, life-history, and method of formation. He acknowledged help received from Searles V. Wood, then of Hasketon, near Woodbridge, who had already gathered together an extensive series of Crag fossils. Recognised as a man of great ability and promise, Charlesworth lacked what is usually known as ballast, and his subsequent career was a disappointment. He edited a new series of the 'Magazine of Natural History,'[1] 1837–40; and a few years later succeeded John Phillips, as curator of the Museum of the Yorkshire Philosophical Society at York, resigning that post in 1858.

Vertebrate palæontology had for some time occupied the attention of Gideon Algernon Mantell (1790–1852). He was engaged for many years in extensive practice as a surgeon at Lewes and afterwards at Brighton, and was the author of works on the Geology of Sussex (1822 and 1827), and of the Geology of the south-east of England (1833). He was a great collector of fossils, and his museum, of which he published descriptive catalogues, was open at stated times to visitors. To Mantell we owe the demonstration of the freshwater origin of the Wealden Beds. As early as 1825 he described the *Iguanodon*, the first specimens of which were found by Mrs. Mantell in 1822; and in 1833 the *Hylæosaurus* or forest-lizard, so named from the rather indefinite locality of the Forest of Tilgate,

Gideon Algernon Mantell
LL.D. F.R.S.
Vice President 1848 - 50

of his audience, and invariably left them imbued with a love for the science he had taught them.'[1]

Agassiz (1807–73), who in 1836 had been awarded the Wollaston Medal for his researches on fossil fishes, had encouraged two of our Fellows, Sir Philip de Malpas Grey Egerton (1806–81) and Lord Cole, afterwards third Earl of Enniskillen (1807–86), to undertake the collection and study of these organic remains. In a communication read before the Society in 1833, Egerton had drawn attention to the Carboniferous fossils collected by Lord Cole and himself in County Fermanagh. Two years later he announced the discovery of Ichthyolites in the North Staffordshire Coal-field. He devoted himself to the scientific study of fossil fishes; Lord Cole mainly to the collection of specimens. Until the close of their lives these enthusiastic workers continued their labours, and for many years both took an active part in the management of the Society.

In February 1835 the Wollaston Medal was awarded to Dr. Mantell, and the presentation was made at the anniversary dinner, Lyell speaking on behalf of Mantell, who was unable to be present. Lyell mentioned that[2]—

> 'The dinner went off famously, more than a hundred present. . . . . Lord Lansdowne [proposed the toast of] Oxford and Buckland; Fitton gave Cambridge, answered by Sedgwick; Sedgwick, the Royal Society, answered by Lubbock; Buckland, the Linnæan; I, the Astronomical, answered by Baily; Greenough, the Geographical, answered by Murchison.' After other toasts, 'we adjourned late to hear Greenough's address.'

This method of procedure doubtless had its drawbacks: at any rate in later years the dinner followed the address. On one occasion, 1859, the Council arranged that the annual dinner take place on the day following the anniversary, but this could not have proved satisfactory, least of all to Fellows living away from London.

[1] Wm. Hopkins, Address to Geol. Soc. 1853.

[2] 'Life, Letters, and Journals,' vol. i. 1881, p. 447.

The annual general meetings were held for many years at 1 P.M., and the dinner at 6 P.M.

The years and places of dining were as follows:

1835–46: Crown and Anchor, Strand (see p. 133).
1847–50: Willis's Rooms, 26 King Street, St. James's Square.
1851–52: Thatched House Tavern, St. James's Street.
1853–60: Freemasons' Tavern, Great Queen Street.

During subsequent years the dinners have been held at Willis's Rooms, at the Criterion, &c. Buckland, when he journeyed to London to attend the meetings of the Society, was accustomed to stay at the Salopian Coffee House and Tavern, Charing Cross—a house noted for good dinners and wines.

The delays that arose in the publication of papers were referred to by Lyell in his address of 1836. They were due to 'a desire to print all papers containing original and valuable matter in the order in which they were presented; but many have been sent to us in so unfinished a state as to retard the printing of the rest, and, as the science advances rapidly, and new facts pour in daily, the authors even of the most finished memoirs soon require to make additions and corrections, and thus the evil is continually augmenting. The Council have, therefore, resolved, for the future, to print at once those memoirs which are in the most complete state, without waiting for others which are imperfect.'

Writing on June 1 of the same year, Lyell remarked that:

> 'Fitton is at last, we believe, at the point of being delivered of the Green Sand paper, on which occasion we trust that the shock of an earthquake may not throw down

This great memoir, 'Observations on some of the Strata between the Chalk and the Oxford Oolite, in the South-east of England,' was published before the close of 1836.[1] It filled nearly three hundred pages and was accompanied by seventeen plates. It embodied observations dating in publication from 1824, and it had been read on June 15, 1827. To all subsequent workers it has proved to be a mine of carefully recorded facts on the stratigraphy and palæontology of the Upper Secondary formations.

Attention was given by the Council in 1835 to the indexing of geological literature, and in 1836 they reported that Mr. Lonsdale had

> 'prepared a catalogue of Papers or Memoirs on Geology, alphabetically arranged according to the names of places, with a similar catalogue arranged according to the names of fossils, and a third catalogue of Memoirs on Theoretical Geology, arranged according to the names of the authors; and that these catalogues are accompanied by references so as to form a complete index to all the volumes of *Transactions*, *Journals*, and other works—Geological or Miscellaneous—contained in the Library.'

In 1837 it was reported that 'Since the last anniversary alphabetical catalogues of every geological map, section, plan, diagram, and view, scattered through the works in the Library, have been prepared, the value of which, as affording increased facilities of reference, is too obvious to be insisted upon.'

Lonsdale during his term of office as curator 'performed nearly the whole of the scientific duties which were formerly discharged in great measure by our honorary secretaries'; he also devoted himself with 'unwearied zeal and discriminating skill' to arranging and naming the specimens.[2] Precision and neatness were among his characteristics, and these were exhibited in his handwriting on the tablets to which the fossils were affixed. It is not,

[1] *Trans. Geol. Soc.*, ser. 2, vol. iv. p. 103.
[2] See Murchison, Address, 1843.

however, surprising to learn from the Council's Report in 1837, that owing to the uninterrupted pressure of other business, no progress had been made during the previous year in the arrangement of the collections. In the following year they reported that the number of duplicate specimens was 'enormous.'

For these reasons assistance in the Museum had been asked for; and it is interesting and pathetic to learn that William Smith, LL.D., writing from Scarborough, February 3, 1838, offered himself as a candidate for the office of curator to the Museum. He was then in his sixty-ninth year.

On February 16, 1838, the Council expressed their opinion 'that the laborious and difficult duty of arranging and cataloguing the collections should devolve upon an officer whose time should be given to that single object; but the qualifications required in such an officer are so many and so rare, that though numerous candidates have presented themselves, no one has yet been appointed.'

In May of that year Searles V. Wood, then forty years of age, was appointed curator, but in consequence of ill-health he was compelled to retire in less than twelve months, much to the regret of the Council. In June of 1839, S. P. Woodward, then a youth not quite eighteen years of age, was appointed sub-curator, under Lonsdale; a position he owed to the recommendation of Sedgwick.

Observations made by Charles Darwin along the coasts of South America during the years 1832–35, had been communicated by him in letters addressed to Professor Henslow; and the main facts were brought before the Society in November 1835 by Sedgwick. Darwin was elected a Fellow on November 30, 1836; in the following year he was chosen a member of Council, and before the close of 1837 he was sounded by Henslow with regard to the secretaryship. In his reply Darwin raised sundry objections:

> 'First, my entire ignorance of English Geology—a knowledge of which would be almost necessary in order to

shorten many of the papers before reading them before the Society, or rather to know what parts to skip. Again, my ignorance of all languages, and not knowing how to pronounce even a *single* word of French—a language so perpetually quoted. It would be disgraceful to the Society to have a secretary who could not read French. Secondly, the loss of time. . . . . I cannot look forward, with even tolerable comfort, to undertaking an office without entering on it heart and soul.'[1]

Ultimately, to the honour of the Society, Darwin accepted, and held office during the years 1838–41.

For many years it was customary for one of the secretaries to read the papers, or selected portions of them, at the evening meetings of the Society; although exceptions were occasionally made on request of an author who desired personally to state the main points of his paper. The practice of calling upon an author, whenever present, to read his paper, or to discourse generally on his subject, was not adopted until the Society had settled at Burlington House.

In 1837, thirty years after the foundation of the Society, the officers and council were as follows:—

The Rev. William Whewell was *president*, with Buckland, Fitton, Greenough, and Murchison as *vice-presidents*; Robert Hutton and J. F. Royle, *secretaries*; De la Beche, *foreign secretary*; John Taylor, *treasurer*; and F. Baily, Broderip, W. Clift, Viscount Cole, Darwin, Daubeny, Egerton, H. Hallam, L. Horner, Lyell, Marquis of Northampton, Sir Woodbine Parish, Sedgwick, and Warburton, other members of *Council*.

Whewell (1794–1862) was a man of encyclopædic knowledge, whose career at Cambridge was most distinguished. He held for five years the professorship of Mineralogy, and was in 1841 appointed Master of Trinity College. He became President of the Geological Society at the urgent request of Sedgwick, Lyell, and Murchison.

[1] 'Life and Letters of Charles Darwin,' vol. i. 1887, p. 285.

He was frequently consulted by Lyell, Owen, and others for advice in the construction of new geological names.[1]

Robert Hutton (1784–1870), M.R.I.A., and M.P. for Dublin, had formed a large collection of Irish minerals and fossils.

John Forbes Royle (1799–1858) was professor of Materia Medica and Therapeutics in King's College, London. He was essentially a botanist, and had been superintendent of the Botanic Garden at Saharunpore, where he was succeeded by Hugh Falconer.

Francis Baily (1774–1844), an astronomer, was one of the founders of the Astronomical Society, and treasurer of the Royal Society.

William Clift (1775–1849) was curator of the Hunterian Museum and an osteologist, interested in fossil as well as recent bones.

Charles Giles Bridle Daubeny (1795–1867) was a man of extraordinary breadth of knowledge. He studied Chemistry under Kidd at Oxford, Natural History under Jameson at Edinburgh. He took the degree of M.D. at Oxford, and was for a long period professor of Chemistry, and during part of the time professor of Botany and also of Rural Economy. Inspired by Jameson, he early studied the volcanic regions of Auvergne and Southern Europe, and was the author of a volume on 'Active and Extinct Volcanos' (1826; 2nd ed. 1848), of papers on Mineral Waters, as well as of many other publications.

Henry Hallam (1777–1859) was the well-known historian and antiquary: author of 'Europe in the Middle Ages,' and other works.

Sir Woodbine Parish, K.C.H. (1796–1882), had been Consul General at Buenos Ayres, and had been instrumental in obtaining remains of *Megatherium*.

The Wollaston Medal in 1837 was awarded in

Hugh Falconer

M.D., F.R.S.

Foreign Secretary 1863-64

Hugh Falconer (1808–1865), who was educated for the medical profession, was a naturalist of the old school: a good botanist, zoologist, and geologist. As early as 1831, when exploring the geology of the Sewalik Hills, he concluded that the strata were mainly of Tertiary age; not long afterwards the remarkable vertebrate fauna was discovered by him and his colleague, Captain (afterwards Sir Proby T.) Cautley (1802–71). This discovery, as observed by Dr. Charles Murchison, was not fortuitous, but a result suggested by study and followed with definite aim. When the fossil bones were found, including mammals, birds, reptiles, and fishes, 'the ordinary means resorted to by men of science for determining them by comparison were wanting. Of palæontological works or osteological collections in that remote quarter of India there were none. But Falconer was not the man to be baffled by such discouragements. He appealed to the living forms abounding in the surrounding forests, rivers, and swamps to supply the want. Skeletons of all kinds were prepared.'[1] Eventually a series of memoirs was written by Falconer and Cautley; and the two Wollaston Medals were awarded to them by the Council, who thus recognised the extraordinary energy and perseverance, the talent and judgment, which had attended their labours. It is noteworthy that the one recipient was not quite twenty-nine years of age, the other about thirty-five.

Richard Owen (1804–92) first came prominently before the Society in 1837 when he described the *Toxodon*, one of the fossil mammals obtained from South America by Darwin. In the following year the Wollaston Gold Medal was awarded to him for his services to Fossil

a series of investigations, but was certainly well justified by subsequent researches.

Owen, who was elected a Fellow in 1837, and was introduced at the meeting on June 14, has told that

> 'After a very interesting evening with Buckland, Whewell, Sedgwick, Murchison, De la Beche, Stokes, &c., they all adjourned to Lord Cole's to supper. After supper, they proceeded to play "high jinks," as immortalised by Sir Walter Scott in "Rob Roy." Mr. Stokes took the chair as king, and was excellent as the arbitrary monarch. . . . . All kind of scientific discourse was prohibited on pain of forfeit.'[1]

Thus, from time to time, were the heavier proceedings of science enlivened; and we learn from Lyell that in 1838,

> 'After the anniversary evening, Lord Cole pressed me so hard to go and eat *pterodactyl* (alias woodcock) pie at his rooms, that I went, with Whewell, Buckland, Owen, Clift, Egerton, Broderip, Hamilton, Major Clerk, Lord Adair; and there we were till two o'clock, fines inflicted of bumpers of cognac on all who talked any "ology." Cigar smoke so strong as half to turn one's stomach. I lost the enjoyment of Murchison's dinner next day, and for five days only did half a day's work, or less.'[2]

Sir Charles Bunbury gave the following account of a meeting of the Geological Society held on March 8, 1837, when the first paper was by the Rev. W. B. Clarke 'On the Geological Structure and Phenomena of Suffolk, and its Physical Relations with Norfolk and Essex;' and the second paper was by the Rev. David Williams 'On the raised beaches of Saunton Downend and Baggy Point':—

> 'The papers that were read were very dull, and it was not till after they were finished that there was some fun in the shape of an animated debate between Sedgwick and Greenough; the former was in his glory, and very entertain-

of wit or humour. Greenough still sticks to his notion of the sea having sunk instead of the land being raised'[1] (see p. 108).

Greenough would have found support for his views at the present day in Suess's 'Antlitz der Erde.'

The second edition of Greenough's Geological Map of England and Wales was published on September 12, 1840. The price to the Fellows was 4*l.*; and to the public 5*l.*

A Memoir to accompany this edition was read before the Society on February 5, 1840, and issued as a pamphlet in the same year. Therein Greenough alluded to topographical and geological revisions, and observed that, in addition to his own personal experience, he had received most valuable communications from Mr. De la Beche, Mr. Jukes, Mr. Logan, Mr. McLauchlan, Mr. Milne [Mylne], Mr. Murchison, Professor Sedgwick, Mr. Sopwith, Mr. Strickland, Mr. J. Taylor, Mr. N. Wood, Mr. Lonsdale, Dr. Fitton, and Mr. J. Phillips. The principal additions were 'the introduction of the Silurian divisions made in the slate rocks, by Mr. Murchison, in the border districts of England and Wales; and the new distribution very recently assigned to the slate rocks of Devonshire and Cornwall.'

At the annual meeting on Feb. 21, 1840, the Council reported that 'Mr. Greenough has generously transferred to the Society the copperplates of the second edition of his "Geological Map of England," on certain conditions. The principal conditions were, that the Map shall be published by the Society, and that, after they had been reimbursed for their expenses, "the surplus received from such sales shall be paid over annually to Mr. Greenough until he shall have been repaid the sum of 718*l.* 2*s.* 5*d.*, the cost of drawing and engraving, incurred by him in the [illegible] for the second edition of the said Map; after

Mr. Pendarves, Dr. Robert Hodgson (Dean of Carlisle) Professor Sedgwick, Dr. Fitton, Mr. John Taylor, Mr. Lyell, Mr. Austen, Mr. Hamilton, the Marquis of Northampton, Dr. Horsfield, Dr. Pye Smith, Mr. Murchison, Mr. Greenough, Mr. Hallam, Mr. Lonsdale, Mr. De la Beche, Dr. Daubeny, Mr. Solly, and Viscount Cole.

The detailed study of Coal-fields, that had been commenced in the south-west of England and South Wales by Buckland and Conybeare, had now been carried on in other areas. The Ashby Coal-field of Leicestershire was illustrated in a volume by Edward Mammatt in 1834; the Coalbrookdale Coal-field was investigated by Prestwich, whose observations (communicated in 1834 and 1836) were embodied in his classic memoir published in the *Transactions* in 1838, when the author was twenty-six years of age; and in 1840 W. E. Logan[1] brought forward his famous observations on the occurrence of *Stigmaria* (roots) in underclay beneath the seams of coal in South Wales. The plant-remains referred to, *Stigmaria*, are now considered to belong to *Sigillaria* and other tree-like forms.

The Old Red Sandstone at this time attracted much attention, through the researches and writings of Hugh Miller (1802–1856). It is to be regretted that one who did so much to promote an interest in Geology, and to bring it within the domain of literature, was never a Fellow of the Society; but he was accorded an obituary notice in the *Quarterly Journal*. His discoveries of fossil fishes in the Old Red Sandstone of Cromarty were made known in 1840, and described in picturesque language in 'The Old Red Sandstone' (1841), a work referred to by Sir A. Geikie as 'the first and, in some respects, the freshest and most delightful of all his volumes.'[2] He attained fame and comparative comfort; whereas Robert Dick, of Thurso

[1] William Edmond Logan (1798–1875) was appointed in 1842 to direct

(1811–66), an equally ardent observer of nature, and a keen collector of Old Red Sandstone fishes, never educated himself to occupy a position above that of baker, but his 'was one of the largest, most impressive, and remarkable funerals that had ever been seen in Thurso,' and a fine monument was erected to his memory.[1]

A. C. Ramsay, who had published in 1841 an admirable account of 'The Geology of the Island of Arran, from original Survey,' and had just joined the Geological Survey, was introduced in the same year to the Geological Club, which then met at the Crown and Anchor in the Strand. He observed:—

> 'It has a most shabby outside, but is one of those old-fashioned splendid inns inside, which, I suppose, are not to be found out of London.'[2] Murchison was in the chair, and Buckland, Lyell, Featherstonhaugh, Captain Pringle, and about twenty others were present.
>
> Captain J. W. Pringle, R.E., had been engaged in establishing a geological branch of the Trigonometrical Survey in Ireland during the years 1826–29, prior to the time when Portlock took up the work. G. W. Featherstonhaugh, F.R.S. (1780–1866), had carried on researches on the geology of North America; in 1844 he was appointed British Consul at Havre.

Among the members of Council in 1840–41 was Philip Pusey, M.P., F.R.S. (1799–1855), a distinguished agriculturist, and one of the founders of the Royal Agricultural Society. He was elder brother of Edward Bouverie Pusey, Canon of Christ Church, and resided on the family estate at Pusey in Berkshire.

[1] 'Robert Dick, Baker of Thurso, Geologist and Botanist,' by S. Smiles, 1878, p. 414.

[2] 'Memoir of Sir A. C. Ramsay,' by Sir A. Geikie, 1895, p. 30. The Crown and Anchor Tavern was closed in 1847, when the club removed to

CHAPTER IX

THE GLACIAL PERIOD. THE CAMBRO-SILURIAN CONTROVERSY

GLACIAL DRIFT—JAMES MITCHELL—AGASSIZ, BUCKLAND, AND LYELL ON THE ANCIENT GLACIERS OF BRITAIN—DISCUSSIONS—WILLIAM HOPKINS—MOXON'S 'GEOLOGIST'—W. J. HAMILTON—PHOTOGRAPHY—RETIREMENT OF LONSDALE—SEDGWICK AND MURCHISON ON CAMBRIAN AND SILURIAN—H. WARBURTON—J. W. SALTER—THE RAY SOCIETY—H. E. STRICKLAND—ROBERT CHAMBERS—D. T. ANSTED

THE various superficial deposits, more especially those now grouped as Glacial Drift, were known in early days by the uncomplimentary term of 'Extraneous Rubbish.'

Several observers were engaged from about 1830 and onwards in studying the local deposits. Thus, H. E. Strickland dealt with the gravel yielding freshwater shells at Cropthorne in Worcestershire; and Joshua Trimmer with that containing marine shells near Shrewsbury, and with the still more remarkable shelly 'diluvium' on Moel Tryfaen near Carnarvon. At this locality the drift was more than 1,000 feet above sea-level, and the slaty rocks beneath the sand and gravel were observed by Trimmer to be covered with scratches and furrows. James Mitchell, in a memoir read before the Society on November 7, 1838, described the Drift deposits that occur over the Eastern counties from Finchley to Cromer, and remarked that

> 'The current by which the drift was accumulated, the author conceives, came from a point to the east of north, and he is of opinion that the materials have been derived in part from Scandinavia and in part from the destruction of strata which once occupied the site of the German Ocean.'[1]

[1] *Proc. Geol. Soc.* iii. p. 5.

Lyell in a later paper, regarded this conjecture as 'by no means improbable,' and it is interesting to find it supported by modern Glacialists, although the view of an 'East British Ice-sheet' over the area of the North Sea is not held without strenuous opposition.[1]

James Mitchell, LL.D. (1785–1844) had made extensive and methodical observations on the Tertiary and superficial strata of the London area; and he helped and influenced Prestwich in his later and more elaborate researches. In 1889 Prestwich deposited in the Library five MS. folio volumes of 'Geological Researches round London,' containing records of wells, and observations by Mitchell on the geology and botany of the neighbourhood of the metropolis.[2] Mitchell has recorded that, at a meeting of the Geological Society on April 9, 1834, he denied the existence of the London Basin. He added that 'The attempt at a defence of the term Basin was exceedingly feeble. In fact it was all but abandoned.' He was evidently somewhat of a Geological Radical, to judge by the following extract from a letter to a friend:

> 'I assure you it is not sufficient to be a Fellow; if you be not also high in office you do not get justice. There is a certain set of elder brethren, members of the Council and ex-members, who monopolise as much as they can, both in the *Transactions* and in the speaking at the Society; and a new man has to fight his way through them.'[3]

One of the more interesting and important of the papers by Lyell was that on 'The Boulder Formation, or Drift, and Associated Freshwater Deposits Composing the Mud Cliffs of Eastern Norfolk.' It was read before the Geological Society on January 22, 1840, but only an

[1] See remarks, on opposite sides of the question, by G. W. Lamplugh, and T. G. Bonney, *Geol. Mag.* 1901, pp. 142, 187, &c.

[2] *Quart. Journ. Geol. Soc.* xlvi. p. 12 (Proc.) Many of Dr. Mitchell's notes were published by W. Whitaker in his 'Geology of London,' 2 vols. *Mem. Geol. Survey*, 1889.

[3] Letters dated April 30 and May 2, 1834; in possession of Dr. Henry Woodward.

abridged account was printed.[1] Nevertheless, the paper was mentioned by Buckland, in his Address for that year, as 'full of elaborate detail of facts, and of ingenious speculations respecting the Boulder formation.' Perhaps the speculations were regarded as too ingenious: the only record in the Council Minute Book of February 5, 1840, is to the effect that a letter was read from Mr. Lyell, requesting to withdraw his paper on the Mud Cliffs of Norfolk. In describing the Drift he remarked that it was strictly analogous in character with that which has been called in Denmark and Sweden the Boulder Formation. He believed that the boulder fragments or erratics were accumulated on ground permanently submerged, and not by one or many transient rushes of water over land previously emerged. Therefore he preferred the term Drift to that of Diluvium.

In a previous paper Lyell had described the disturbed Chalk in the Danish island of Möen, and compared the dislocations with those seen near Trimmingham, in Norfolk.[2] He had referred the disturbances at Möen to subterranean movements; but in his later paper he noticed the possible effects of landslips, and of the lateral pressure of drift ice. History repeats itself; and the relations of Chalk and Drift in these regions remain a topic of animated discussion.

The year 1840 is memorable in the history of the Geological Society, inasmuch as it was marked by the inception of the Glacial Period as a chapter in the geological record.

On November 4, Agassiz (1807–73) read a paper on

greater altitude of mountains would not account for the dispersion of erratic boulders over the temperate and northern regions of Europe, Asia, and America. He argued

> 'that great sheets of ice, resembling those now existing in Greenland, once covered all the countries in which unstratified gravel is found; that this gravel was in general produced by the trituration of the sheets of ice upon the subjacent surface; that moraines, as before stated, are the effects of the retreat of glaciers; that the angular blocks found on the surface of the rounded materials were left in their present position at the melting of the ice; and that the disappearance of great bodies of ice produced enormous débâcles and considerable currents, by which masses of ice were set afloat, and conveyed, in diverging directions, the blocks with which they were charged. He believes that the Norwegian blocks found on the coast of England have been correctly assigned by Mr. Lyell to a similar origin.'
>
> 'Another class of phenomena connected with glaciers is the forming of lakes by the extension of glaciers from lateral valleys into a main valley;' and he instanced the parallel roads of Glen Roy.

Perhaps the most remarkable statement is the following:—

> 'If the analogy of the facts which he has observed in Scotland, Ireland, and the north of England, with those in Switzerland, be correct, then it must be admitted,' M. Agassiz says, 'that not only glaciers once existed in the British Islands, but that large sheets (*nappes*) of ice covered all the surface.'

At the same meeting (November 4, 1840) the reading of a Memoir on the Evidences of Glaciers in Scotland and the North of England, by Dr. Buckland, was commenced; it was resumed and concluded on November 18.[1]

> Dr. Buckland's attention was first directed by Professor Agassiz, in October 1838, to the phenomena of polished, striated, and furrowed surfaces on the south-east slope of the Jura, near Neuchâtel, as well as to the transport of the erratic boulders on the Jura, as the effects of ice; but it was

[1] *Proc. Geol. Soc.* iii. p. 332.

not until he had devoted some days to the examination of actual glaciers in the Alps that he acquiesced in the correctness of Professor Agassiz's theory relative to Switzerland. On his return to Neuchâtel from the glaciers of Rosenlaui and Grindelwald, he informed M. Agassiz that he had noticed in Scotland and England phenomena similar to those he had just examined, but had hitherto attributed them to diluvial action: thus in 1811 he had observed on the head rocks on the left side of the gorge of the Tay, near Dunkeld, rounded and polished surfaces; and in 1824, in company with Mr. Lyell, grooves and striæ on granite rocks near the eastern base of Ben Nevis. About the same time Sir George Mackenzie pointed out to Buckland in a valley near the base of Ben Wyvis, a high ridge of gravel, laid obliquely across in a manner inexplicable by any action of water, but in which, after his examination of the effects of glaciers in Switzerland, he recognised the form and condition of a moraine.

After these general remarks, Dr. Buckland proceeded to describe the evidence of glaciers observed by him in Scotland during the previous autumn, partly before and partly after an excursion, in company with Professor Agassiz; but he forbore to dwell on the phenomena of parallel terraces, though he was convinced that they were the effects of lakes produced by glaciers.

The following discussion then took place [1]:—

Mr. MURCHISON called upon the mathematicians and physical geographers present to speak of the objections to Dr. Buckland's glacial hypothesis, he himself should attend only to the facts of the case. Of the scratches and polish on the surface of certain rocks there is no doubt, and 'Are glaciers the cause?' is the question. Could they be done by ice alone? If we apply it to any as the necessary cause, the day will come when we shall apply it to all. Highgate Hill will be regarded as the seat of a glacier, and Hyde Park and Belgrave Square will be the scene of its influence. Dr. Buckland has in his paper

Schiehallion had been covered with glaciers there ought to be some [indications]. If the height be great the result should be proportionate. There ought to be a co-ordinate relation in the phenomena. But in the Highland mountains, not one-third the elevation of the Alps, we have moraines two or three times the magnitude of any known in Switzerland. Formerly, when we found traces of fragmented rocks disposed around a mountain, we attributed them to the successive periods of elevation in that mountain. The parallel roads of Glen Roy were compared to sea-beaches; now all are attributed to the action of ice. And not only these, but Edinburgh and Stirling, and other places equally out of the reach of such actions, did glaciers ever exist in the higher chains, are to be covered with a mass of ice! These grooved and striated surfaces and heaps of boulders are also to be found in Scandinavia, on the east of the Gulf of Bothnia, all proceeding from the north and north-west. Have these crossed the gulf on ice? In Russia, too, we shall find them where there are no mountains. And if we look to the remains of marine shells found in beds elevated, differing in no respect from those in our present seas, except that they are called 'Pleistocene' (by James Smith and Lyell), we have proof of a lower elevation at the very time (the period following upon the more tropical epochs), when these glaciers should be introduced. On these accounts I am still contented to retain our old ideas, that when a mountain was elevated, or a body of water passed over a series of elevations, the diluvium would descend with the [streams] and be disposed in mounds and terraces according to the direction of currents, &c.

Professor AGASSIZ.—Mr. Murchison has objected to the glacial theory in the only way in which it could be objected to. He allows that the whole is granted as soon as you grant a little bit. For here, as in other cases, we argue from what is proved, to what is to be proved. In Switzerland the action of glaciers is yearly seen by thousands of foreigners, and of these facts there can be no doubt, [nor as to the former] extent of glaciers. In the Glacier de l'Aar, grooves, &c. are to be found in the valley seven leagues (twenty-two miles) from the end of the present glaciers. Did we find these surfaces only on the hard rocks, we might suppose they were merely uncovered by the action of the glaciers; but on the soft limestone rocks these grooves are only to be seen on the surfaces from which the glacier has just retreated. Many glaciers traverse such rocks only (equivalents of our Lias), and there the grooves are annually renewed in winter, and removed by the atmospheric action in summer. I have been many hundred feet under the glacier of Monte Rosa, and found the quartzose sand forming a bed beneath, and acting like emery upon the rocks. A moraine may be distinguished by certain characters from any other accumulation of fragmented rocks. From the sides of the glaciers moving faster than the middle, there is a continual tendency to throw the fragments into lines at the sides (lateral moraines), and when two glaciers descending from different gorges unite, a medial moraine is formed. The lateral [moraines] are exposed to constant friction with the rocks with which they are brought in contact, and their terminations are passed over by the whole mass of the glacier, so that they become rounded and striated, whilst the medial moraines

remaining on the surface continue angular. When the glacier retreats in the summer, the medial moraine, composed of angular fragments, is spread out over the surface of the lateral and terminal moraines, composed of rounded fragments; and it is by these characters that we have proved the existence of moraines in Scotland, Ireland, and the north of England. There are moraines in the Alps 200 feet wide, composed of boulders several feet in diameter.

Mr. LYELL spoke of the size of moraines, and the way in which they might, under certain circumstances, attain any magnitude. A glacier has been known to retire half a mile in a single summer, [a number of] moraines have been in succession left, and in severe winters all these might be driven successively into one by the downward motion of a glacier.

Mr. GREENOUGH spoke of the arguments derivable from analogy, &c., and objected to the mode in which the Geological Society was in the habit of accounting for phenomena. Instances of accumulations of travelled rocks [occur in] North Germany; from a careful comparison some of these must have crossed the Baltic. In the valleys of Switzerland some deposits must have crossed Lake Geneva, and ascended very high mountains. Does Professor Agassiz suppose that the Lake of Geneva was occupied by a glacier 3,000 feet thick? (AGASSIZ.—'At least!') [Mr. Greenough then referred to the] changes of climate necessary to account for these phenomena [and to the] objection from the tropical nature of remains in recent deposits. [He considered it to be the] climax of absurdity in geological opinions. In one period, the Crag, we have three opposite conditions blended: corals, tropical; peat, temperate; shells, pronounced by Dr. Beck, arctic!

Mr. LYELL.—Mr. Greenough confuses four distinct epochs under the name of Crag. The first comparatively tropical (Coralline Crag), the others temperate (Red and Norwich Crag), and the period of the peat bogs (Lacustrine deposits) more recent than any.

Mr. JOHN EDWARD GRAY.—The corals of the Crag appear to me as arctic as the shells. I know no reason for making them tropical.

Mr. GREENOUGH [remarked] on the size of the blocks on mountains, the agency of floating ice, and on mountains as the physical boundaries of different kinds of diluvium.

Dr. MITCHELL inquired if Dr. Buckland confined the glaciers to the Highlands or whether he made them descend to the Lowlands.

Dr. BUCKLAND expressed himself ready to answer any question on the subject under discussion, or any involved in his paper, but considered the present question irrelevant.

Dr. MITCHELL considered his question relevant to the subject.

Dr. BUCKLAND rose to reply, but Mr. WHEWELL rose. (Cheers, and 'Mr. Whewell!')

Mr. WHEWELL.—At this late hour it is impossible to go into the question of the physical changes necessary to allow of the existence of

glaciers in this country. I shall, therefore, confine my remarks to the subject as discussed this evening, and it does appear to me that the way in which Mr. Lyell has treated it is not the most fair and legitimate. He says: 'If we do not allow the action of glaciers, how shall we account for these appearances?' This is not the way in which we should be called upon to receive a theory. Now, it is not within our reach at present to refer each set of phenomena in geology to its adequate cause, but that is no reason why we should receive any theory that is offered to account for it. This glacial theory is brought forward to explain what has hitherto, to a great extent, been found inexplicable—the nature and position of diluvial detritus over considerable areas and in widely different climates. So far as it is founded on strict comparison and analogy it is to be received, but we must not overrate its influence; and it appears to me *incomplete* in three important particulars:—*Firstly*, in accounting for such an extent of diluvium over such wide areas, in countries of such opposite physical structure, surface, climate, &c. *Secondly* [from the] marine remains of the glacial period, showing the continents to be submerged. Mr. Darwin has described an island capped with snow in the equivalent latitude of Yorkshire, and by supposing an equal extent of water in our Polar regions, we might induce a degree of cold sufficient for that; but these glacial phenomena are found over too wide an extent to allow of that. (Mr. LYELL—'I have attempted to account for that in my paper'—here interrupted. Dr. BUCKLAND—'So have I in a paper which is not yet written!') Mr. WHEWELL, continuing—Our attention to-night is limited to Dr. Buckland's paper. *Thirdly*, the physical conditions under which glaciers now exist. We find them universally stretching out from lofty mountain-chains, which take their rise in *warm* climates, so as to allow of the downward motion and the retiring in summer. Mr. Lyell speaks of the prodigiously *rapid* retreat of a glacier which amounted to half a mile in a single summer. But where shall we obtain mountains as *fulcra* for glaciers, stretching many leagues into the plains, producing such results as are ascribed to their action in Scotland?

Dr. BUCKLAND resigned the chair to Mr. Greenough, and argued the *à priori* credit to be attached to his 'narrative,' from the circumstance of his having been a 'sturdy' opponent of Professor Agassiz when he first broached the glacial theory, and having set out from Neuchâtel with the determination of confounding and ridiculing the professor. But he went and saw all these things, and returned converted. And he considered the testimony of four such competent observers as himself, Agassiz, Renouard, and [De Charpentier] who, next to Saussure, had spent more time in the Alps than any other geologist, sufficient to prove to all the truth of their observations and the correctness of their inferences. He referred to Professor Agassiz's book, and condemned the tone in which Mr. Murchison had spoken of the 'beautiful' terms employed by the professor to designate the glacial phenomena. That highly expressive phrase *roches moutonnées*, which he had done so well to revive, and that other 'beautiful designation' the glacier *remanié! remanié! remanié!* continued the doctor most impressively, amidst the cheers of the delighted assembly, who were, by this time, elevated

by the hopes of soon getting some tea (it was a quarter to twelve P.M.), and excited by the critical acumen and antiquarian allusions and philological lore poured forth by the learned doctor, who, after a lengthened and fearful exposition of the doctrines and discipline of the glacial theory, concluded—not, as we expected, by lowering his voice to a well-bred whisper, 'Now to,' &c.—but with a look and tone of triumph he pronounced upon his opponents who dared to question the orthodoxy of the scratches, and grooves, and polished surfaces of the glacial mountains (when they should come to be d——d) the pains of eternal itch, without the privilege of scratching!

On November 18, 1840, a paper 'On the Geological Evidence of the Former Existence of Glaciers in Forfarshire,' by Charles Lyell, was commenced, and concluded on December 2. Then the second part of Dr. Buckland's 'Memoir on the Evidence of Glaciers in Scotland and the North of England' was read.[1]

In the former part of his paper Dr. Buckland mentioned that Maclaren[2] had found a polished surface of rock near the south-west base of Arthur's Seat; and he referred also to early observations of furrows that had been sketched by Sir James Hall.[3] He now discussed the distribution of Shap Fell boulders eastward across Stainmoor Forest into the Tees Valley, and maintained that the difficulties of transport were entirely removed by the application of the glacial theory.

Lyell similarly found that many of his difficulties were removed, and he was convinced that glaciers existed for a long time in the Grampians, and extended to the low country. The conditions differed from those of Switzerland, and he looked to Kerguelen's Land, and other tracts on the borders of Antarctic regions, for the nearest

[1] *Proc. Geol. Soc.* iii. pp. 337, 345, &c.

[2] Charles Maclaren (1782–1866) was for many years editor of the *Scotsman*, and he was author of 'A Sketch of the Geology of Fife and the Lothians,' 1839.

[3] Sir James Hall (1761–1832) was the first to observe and describe the striated rock-surfaces which are now recognised as the work of ice. He attributed them to gigantic bodies of water, sweeping over the face of the country. *Trans. Roy. Soc. Edin.* vii. 1815, p. 139. He initiated investigations in experimental geology, relating to the fusion, crystallisation, and contortion of rocks. Some of his apparatus and specimens are in the Museum of the Society (see p. 250).

approach to the physical conditions of Scotland during the glacial epoch.

After the reading of these papers the following discussion took place [1]:—

Mr. JAMES SMITH [2] referred to the evidence of the upper and lower marine beds along the coast of Scotland, and to the arctic character of the marine shells.

Mr. WHEWELL felt in a dilemma owing to the difficulties in accounting for the glaciers. Either a decrease of central heat, which has since returned—a supposition at variance with all the known laws of physics—or a different distribution of land and water in the northern hemisphere [must be supposed]. Granting the change of climate, where would be the Alps from which to suspend the glaciers of Scotland? They could not have descended from such isolated peaks as Schiehallion or Ben Nevis.

Mr. DE LA BECHE spoke of the changes of conditions necessary for the existence of glaciers in Scotland, and of the recent date of elevatory movements.

Mr. LYELL explained the distribution of superficial *débris* in a portion of Scotland. Three distinct covers: (1) *universal*, composed of fragments of the subjacent rocks with a slight admixture of foreign matter; (2) *Till*, unstratified drift clay, with boulders, covered by (3) stratified gravel. The first, supposed to have been distributed by sheets of ice spreading all over the country; the second by glaciers; and the third *remanié*, by melting of glaciers &c.

Mr. JOHN PHILLIPS examined the question of the Shap Fell granite boulders and their distribution over Stainmoor, across a valley twelve or fourteen miles wide, to Darlington &c.

M. AGASSIZ advocated the origin of gravel from glacial action and not from marine currents, from the fact of the numerous lakes of Scotland in which there was no gravel. Had marine currents formed the Till it would have filled all these hollows. On the glacial hypothesis they would be filled with ice and thus preserved. Recommended the same caution to his opponents in making objections as had been so strongly urged upon himself in generalising.

Dr. DAUBENY referred to the wide extent over which the grooved surfaces are found in America &c., and to the difficulties attending the degree of cold necessary.

Mr. GREENOUGH argued against the recent elevatory movements. The decreasing level of the Baltic he attributed to the clearing of the forests and consequent smaller supply of water, and to the widening of the entrance which promoted its escape (see p. 131).

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[1] As noted in MS. by S. P. Woodward.

[2] James Smith, of Jordanhill, near Glasgow, F.R.S. (1782–1867), was author of 'Researches in Newer Pliocene and Post-Tertiary Geology,' 1862.

Mr. MURCHISON spoke of the universality of the cause which produced the Till &c. of Scotland, its operation over Russia &c., and referred to the agency of drift and floating ice.

Dr. BUCKLAND did not explain all diluvial phenomena by the operation of glaciers; he allowed the existence of raised bars and beaches, of currents, of floating and drift-ice, but contended that glaciers alone would account for many phenomena observable in Scotland, &c. He discussed the possibility of a glacier descending from Shap Fell, crossing the valley of the Eden, and passing over Stainmoor; and of repeated *débâcles* spreading the detritus still further.

William Hopkins, who 'led the way in applying mathematical and mechanical knowledge to geology,' did not at first appreciate the new views on glaciation. In a paper read in June 1842, he remarked that the glacial theory, 'in its application to the transport of blocks across Stainmoor, involves such obvious mechanical absurdities that the author considers it totally unworthy of the attention of the Society.' He added, however: 'He is quite prepared to believe in the possible extension of glaciers beyond the boundaries to which they now extend, wherever such greater extension can be accounted for consistently with the conclusions of collateral branches of physical science.' [1]

In the following year he made 'some new experiments on the movements of ice, which have considerably modified his former views, and seem to prove that glaciers *may* act as a transporting power on planes of very small inclination.' [2] At a later period, when president of the Society, Hopkins gave a clear view of the state of the glacial theory, admitting that he had considerably modified his views, and that almost all geologists 'now agree in the opinion that both floating and terrestrial ice have played their part to a greater or less extent in the transport of erratic blocks.' [3]

researches on glaciers of the Alps and Norway, but took no active part in the work of the Society.

The evidences of glacial action in North Wales were recognised by Darwin in 1842, and, as he somewhat pathetically remarked, 'it was the last time I was ever strong enough to climb mountains, or to take long walks such as are necessary for geological work.'

It was about this time that Lyell, in conversation, reminded Darwin that some years previously, when discussing the opposition of the old school of geologists to the new 'Principles of Geology,' the latter had exclaimed, 'What a good thing it would be if every scientific man was to die when sixty years old, as afterwards he would be sure to oppose all new doctrines.' But Lyell hoped that he might be allowed to live longer.[1]

In January 1842 there appeared the first number of a monthly magazine devoted to geology. It was entitled *The Geologist, being a Record of Investigations in Geology, Mineralogy, &c.*, and was edited by Charles Moxon. It continued for two years only.

The Geological Society came in for a certain amount of criticism in some of the monthly notices in that magazine. It was remarked that the Museum was 'not visited by a dozen students in the twelvemonth,' and that but little was 'said at the meetings except by the members of the Council.' Further, 'A confidential friend, who has attended the meetings of this Society for the last eighteen years, states to us distinctly, that the difference between the meetings held during the "youth" and "maturity" of the Society is striking—that meetings which attracted in former times, on their individual merits, have long since fallen off, except casually, when the *bonhomie* of a Sedgwick enlivens the audience, or the novelties of a Murchison astound the ear—and that now it is a great difficulty to find any assemblage beyond the president, curator, secretary, Messrs. Fitton, De la Beche, and one or two

[1] 'Life and Letters of C. Darwin,' edited by Francis Darwin, vol. i. 'Autobiography,' pp. 71, 72.

others, and their friends.' It was contended that 'if the Society proposes to *encourage* geology, and discriminate upon subjects brought under its notice, it should not virtually sanction the publication of communications, to the merits of which they do not give their entire assent, by presenting them to the public without comment.'[1]

'On the suggestion of many of our correspondents' the editor addressed a letter to the Council of the Geological Society, in which was advocated 'the adoption of the method practised among many societies abroad, of printing, appended to the papers read, a summary of the discussions which ensued.'

In reply the following letter was received[2]:—

> Sir,—I am directed by the Council of the Geological Society of London to acknowledge the receipt of your letter, dated the —— day of ——, and to inform you that it is contrary to the long-established and approved practice of the Geological Society to permit, or in any way sanction, the publication of the discussions which take place at their evening meetings, or any comment thereupon; and the Council have seen, with extreme regret, in the numbers of *The Geologist* to which you have referred them, that you have allowed allusions to those discussions to be inserted in those publications.
>
> I have the honour to be, Sir,
> Your obedient servant,
> (Signed) Wm. J. Hamilton, Sec.

William John Hamilton (1805–67) in early life entered the diplomatic service, and was M.P. from 1841 to 1847. He was author of 'Researches in Asia Minor, Pontus. and Armenia.' two vols., 1842. He devoted much

discussions was admitted into the *Abstracts of Proceedings* and *Quarterly Journal.*

The printed reports of the proceedings of the Society had been from an early date supplied for publication to certain journals, such as the *Annals of Philosophy*, *Philosophical Magazine*, &c. On November 29, 1843, the Council ordered that the abstracts furnished to the *Athenæum* and other papers be in a more condensed form, stating the formal proceedings of the meeting, the titles of the papers read, and their general object only.

The advantages of photography were recognised in 1841. Then Buckland in his address observed that 'A valuable application has been made by Captain Ibbetson of a Photogenic process for rapidly producing perfect drawings of fossil shells on metallic plates, from which, when fixt by the engraver's tool, lithographic transfers may be rapidly multiplied to an almost indefinite extent. This process promises to be applicable to organic remains of every kind, and consequently of great utility in Palæontology. From a beautiful fossil starfish I sent by one day's mail to Captain Ibbetson, in London, I received, by the next mail, a parcel of most exact impressions, taken from a photographic drawing, transferred to stone by the process above mentioned.' [1]

In their Report of 1842 the Council gave a detailed statement of the contents of the Society's Museum, and this was supplemented in the following year with a table of the estimated number of named species. The retirement of William Lonsdale was then announced, and the Museum Committee stated that

> During the bearing Mr. Lonsdale's connection with this Society of fossil organic remains on many points of

its investigations; it was towards this, and especially in the vast subject of fossil conchology, that he rendered most valuable services to this Society.

The president, Murchison, in the course of his address in 1843, remarked :—

> Fourteen years, gentlemen, have elapsed since his appointment was made, during which time your collections and your volumes attest the arduous and successful labours of your curator and librarian. . . . . Our *Transactions*, *Proceedings*, and collections of the last fourteen years are the real monuments of Mr. Lonsdale's labours. . . . From the moment of his appointment to the day of his retirement Mr. Lonsdale infused a truly generous and highly philosophic spirit into every act and every proceeding with which he was connected.[1]

On the retirement of Lonsdale in 1842, Edward Charlesworth, among others, had applied for the vacant post, but the Council decided that he was disqualified from holding office in the Society's establishment. This stirred up some of Charlesworth's East Anglian friends, and a requisition for a special meeting to consider the subject was sent in, signed by Robert Wilson, J. W. Robberds, William Stark, Robert Fitch, and J. W. Wigham.

What took place at the meeting is not recorded, but it was known that 'An angry dispute had arisen in the Society as to the claims of the new candidates, a dispute so serious, indeed, that some of the foremost leaders had intimated their intention of quitting the Society if a certain one of the candidates was elected.'[2] In these circumstances Edward Forbes (1815–54) was invited to apply for the curatorship; and supported by Fitton, Murchison, Lyell, and others, he agreed to become a candidate, was duly elected and held office for two years. In his brief career

Edward Forbes,

President 1853 - 54.

of naturalists. He was chosen president in 1853, when only thirty-eight years of age; but died in the following year (see p. 178).

Lonsdale had named and described many of the corals that were deposited in the Museum in illustration of papers; and subsequently when Forbes became curator the Museum Committee recommended 'That all the new species [in the British collection] be described and named by Mr. Forbes, and the account published in the Society's *Proceedings*.' Needless to say, this task was not completed, although a commencement was made.[1] After the retirement both of Forbes and the sub-curator, S. P. Woodward, in 1845, but little continuous systematic work was given to the Museum, although an officer was now and again appointed to discharge the duties of curator.

The Dudley and Midland Geological Society was instituted on January 17, 1842, when Murchison delivered the inaugural address. Among the active local workers were Henry Beckett, S. H. Blackwell, William Mathews, and James Yates. The Society was not long in existence; but it was re-established in 1862 as the Dudley and Midland Geological and Scientific Society and Field Club.

During the years 1843–45 some controversy arose on the unsettled limits of the Cambrian and Silurian systems. Murchison had noted that the Bala Limestone, placed by Sedgwick in the Upper Cambrian group, contained several species of fossils that occurred, some of them very abundantly, in his Lower Silurian rocks;[2] and this fact was admitted by Sedgwick,[3] and later on confirmed by Daniel Sharpe, whose work bears evidence of great care and accuracy.

to the Society had not other avocations prevented his visiting London. He stated, however, that Sedgwick's memoir would shortly be read, and in the meanwhile he remarked :—

> The base of the palæozoic deposits, as founded on the distinction of organic remains, may now, therefore, be considered to be firmly established; for the Lower Silurian type is thus shown by Professor Sedgwick himself to be the oldest which can be detected in North Wales.[1]

This challenge roused Sedgwick to defend his Cambrian system, and the geological combat might have been carried on without the acrimony which was developed later, had not Warburton, by injudicious efforts to obtain peace at any price, thought fit to modify some of Sedgwick's statements.

In June 1843 Sedgwick brought before the Society his 'Outline of Geological Structure of North Wales,' and he was aided in his work by James de Carle Sowerby and J. W. Salter, the latter a youthful and cheerful companion who accompanied him during part of the time in the field. The paper was printed in abridged form; and all the older fossiliferous strata of North and South Wales, beneath the Upper Silurian rocks of Murchison, were classed as the 'Great Protozoic group'[2] (see p. 96). Later on in the same year Sedgwick was again in North Wales with Salter, and the results were published in a paper read November 29, and entitled 'On the Older Palæozoic (*Protozoic*) Rocks of North Wales.'[3]

It was at this period, as remarked by Sedgwick, that Mr. Warburton, who was chosen president of the Geological Society in 1843, 'most kindly, as I thought, offered to reduce the successive communications of Mr. Salter and myself, embracing the labours of the two preceding summers, into a state fit for publication.'[4]

[1] *Proc. Geol. Soc.* iv. pp. 73, 74. [2] *Ibid.* iv. pp. 212, 223, 224.
[3] *Ibid.* p. 251, and *Quart. Journ. Geol. Soc.* i. p. 1.
[4] Preface to 'A Catalogue of the Collection of Cambrian and Silurian Fossils,' by J. W. Salter, 1873, p. xxvi. Salter's name was attached to the

Sedgwick frankly admitted the need of revision, remarking that his paper had been written in a slovenly and hasty manner, and that he had willingly and without reserve placed the MS. in the hands of the president. Unfortunately Warburton, in seeking to 'improve' the paper and produce harmony, made unjustifiable changes in nomenclature, and refused to allow Sedgwick to see proofs.

Sedgwick had adopted the term Protozoic for Lower Silurian and Cambrian; and Warburton altered the MS. so as to make Protozoic equivalent to Lower Silurian.

The refusal to send proofs to Sedgwick, and the publication of his papers and illustrations in unauthorised form, naturally caused grievous offence. It is inconceivable that such a proceeding could take place nowadays.

Sedgwick was a member of Council, in 1843, during the first year of Warburton's presidency, and during the second year Austen (afterwards Godwin-Austen), Buckland, De la Beche, Egerton, Falconer, Fitton, Horner, and Lyell—not to mention others—were on the Council, and it is impossible to believe that they would permit intentional injustice to be done to Sedgwick. Indeed, Sedgwick later on admitted that, 'With all the faults of the Reduction, it was obvious that Mr. Warburton had laboured hard at my Papers and Sections, and perhaps done his best to put them into a systematic form; and on that account I was willing, after I got over my first sorrow (and it was a *very great* sorrow, to endure the loss of perhaps the best two years' labours of my geological life), to excuse some of his blunders, and to overlook the overbearing manner in which he had treated me.'[1] Unfortunately the printed grouping misled De la Beche, who remarked in 1846, 'Sedgwick, you have given up a very good nomenclature!'[2] In that same year, in De la Beche's 'Index to the Colours and Signs Employed on the Geological Survey of Great

lists of fossils in Sedgwick's papers above noted, but does not appear as par author.

[1] Preface to Catalogue (*op. cit.*), p. xxviii.

[2] 'Life and Letters of Sedgwick,' by J. W. Clark and T. McK. Hughes, vol. ii. 1890, p. 252.

Britain for South-Western England and South Wales,' there was one tablet for 'Upper Silurian Rocks,' and another for 'Lower Silurian and Cambrian Rocks.'

That Murchison felt no animus towards his old friend may be judged by one of the closing portions of his address, before mentioned, wherein he stated:—

> I have, indeed, deeply felt the honour of presiding over men who, in the course of a quarter of a century, have demonstrated that there is no such thing as '*odium geologicum*,' and whose members, rivals as they must be, have only sought to excel each other in their ardent search after truth.

Of Sedgwick's fellow-labourer, John William Salter (1820–69), it may be mentioned that he had in early life been apprenticed as a natural history draughtsman to James de Carle Sowerby, whom he assisted with the plates for the 'Mineral Conchology.' From 1842 to 1846 he worked a good deal for Sedgwick at the Woodwardian Museum, and accompanied the professor on some of his field expeditions. In 1846 he was appointed to a post on the Geological Survey under De la Beche, with Edward Forbes as his immediate chief, and eight years later he became palæontologist. He was distinguished for his knowledge of palæozoic invertebrata, and especially for his researches on trilobites.

The Ray Society, soon after its establishment in 1844, requested permission to use the rooms of the Geological Society for occasional meetings, the objects of the new Society being the promotion of natural history by the printing of original works on zoology and botany, &c. It is interesting to know that up to the present time the members have continued to hold their meetings in the Society's rooms. Although nearly all the published

and Geology,' by Louis Agassiz, corrected, enlarged, and edited by H. E. Strickland. This elaborate work was more complete than anything of the kind previously attempted, and it owed a very great deal to the care and labour expended upon it by Strickland.

Hugh Edwin Strickland (1811–53), distinguished as a naturalist, was an enthusiastic worker at geology, more especially in Worcestershire and Gloucestershire.[1] With James Buckman (1814–84) he augmented and revised in 1845 a new edition of Murchison's 'Outline of the Geology of the Neighbourhood of Cheltenham,' originally published in 1834. With W. J. Hamilton he explored the geology of the eastern shores of the Mediterranean and parts of Asia Minor. In 1850 he was appointed Deputy Reader in Geology at Oxford, during the illness of Buckland, and at the same time the mineralogical duties were separated and Mr. Nevil Story Maskelyne was appointed Reader in Mineralogy. After attending the Hull meeting of the British Association in 1853, Strickland went alone to examine cuttings on the Manchester, Sheffield, and Lincolnshire Railway between Retford and Gainsborough, where he was unfortunately struck down and killed by a train: a mournful ending to a promising career.

In 1844 Robert Chambers became a Fellow of the Society. During the same year there was published an anonymous work on the 'Vestiges of the Natural History of Creation;' a work in which the sincere desire of the author (to use his own words) 'was to give the true view of the history of nature, with as little vexatious collision as possible with existing beliefs, whether philosophical or religious.' Needless to say, it not only created a sensation, and went through four editions in seven months, but it

inorganic, world was developed under the operation of similar laws.'[1] It was a work of great literary merit, but the author lacked the intimate biological knowledge necessary for the proper exposition of his evolutionary notions. The authorship, long surmised to be that of Robert Chambers (1802–71), was not publicly announced until 1884. Chambers took much interest in geology, and was author in 1848 of a work entitled 'Ancient Sea-margins, as Memorials of Changes in the Relative Level of Sea and Land.' In later years he became a member of the Council of the Society.

When the office of curator and librarian to the Society became vacant on the retirement in 1844 of Edward Forbes, the Council, 'out of the considerable number of deserving candidates,' resolved to appoint as chief of the permanent staff D. T. Ansted, Fellow of Jesus College, Cambridge, and professor of Geology in King's College, London. At the same time they made considerable changes in the nature of the duties. Ansted was to be vice-secretary, and to edit the publications of the Society. In the course of the year 1845 his duties were further defined: he was to have custody of all MS. papers, and to attend the apartments of the Society every Monday, Wednesday, and Friday, from two to five o'clock, from November 1 to June 30, and during the other four months of the year at such times as the Council should determine, but not exceeding three days a week, or three hours a day.

A librarian and curator of the Museum was to be separately appointed, and James de Carle Sowerby was chosen in 1846 to occupy this post, also on partial duty;

CHAPTER X

THE 'QUARTERLY JOURNAL'

THE 'QUARTERLY JOURNAL'—CATALOGUES OF FOSSILS—JOHN MORRIS—CHARLESWORTH'S 'LONDON GEOLOGICAL JOURNAL'—COUNCIL, 1847—DR. BOWERBANK—THE PALÆONTOGRAPHICAL SOCIETY—LONDON CLAY CLUB—GREAT COLLECTORS OF FOSSILS—S. P. PRATT—P. B. BRODIE—PALÆOBOTANY—PRINCE ALBERT—THE KING OF SILURIA

THE great expense attending the publication of the *Transactions* gave anxiety to the Council in 1843, and in the following year they reported more fully on their difficulties. They estimated that a sum varying from 250*l.* to 300*l.* per annum was all that could be expended on the publications without anticipating future income or encroaching on capital.

While the number of papers increased, the sale of the *Transactions* did not justify further expenditure, and the Council essayed to effect a compromise by publishing in the *Proceedings* a 'very full abstract' of the papers read, accompanied by the necessary illustrations.[1] A few illustrations had indeed been issued in 1843 with certain papers in No. 95 of the *Proceedings* (vol. iv.), but a more comprehensive scheme was now suggested.

The Council decided that those Fellows who wished to receive the new form of *Proceedings* were to be charged five shillings, and the public seven shillings and sixpence, for the entire session (postage extra): 1,500 copies were

February 21, 1845, the Council notified that the new mode of publishing the *Proceedings* of the Society in an illustrated form had not met with the sale anticipated, and that other arrangements had meanwhile been put in hand.

In a circular issued on December 23, 1844, it was stated that the president and Council had entered into an agreement for one year with Messrs. Longman & Co. for the regular publication of the proceedings of the Society in a periodical, to be entitled '*The Quarterly Journal of the Geological Society of London.*' The cost of the work was to be defrayed by the publishers, who took upon themselves the risk and profits, while the option was reserved to the Fellows of receiving either the *Proceedings* gratuitously or the entire journal at the trade price.[1] The sum of 160*l.* per annum was to be allowed by the publishers for illustrations.

It was arranged that the work was to consist of two parts; the first was to comprise the papers read before the Society and selected for publication, while

> 'The second, or miscellaneous part' was to consist of 'Translations or Abstracts of Geological papers published in the Transactions of Foreign Societies or in foreign journals, and of analyses of the contents of works expressly Geological, both English and Foreign;' but the Articles in this division of the *Journal* were also to extend 'to such publications in the departments of Natural Philosophy, Chemistry, and Natural History as may be judged to have a more immediate bearing on Geology, strictly so called.'

The work was to be edited by the vice-secretary; and

that no analysis of an English work be given, but simply an announcement of its contents.'[1]

It was not intended that the publication of the *Transactions* should cease on the institution of the *Journal*, but 'that when a paper could only be advantageously given in quarto, that form should be adopted.'

The *Journal* was to appear quarterly on the first day of February, May, August, and November.

> In the first volume of the *Journal*, in addition to abstracts of foreign papers, there were notices of Brodie's 'Fossil Insects,' Darwin's 'Structure and Distribution of Coral Reefs,' Humboldt's 'Kosmos,' Lyell's 'Travels in North America,' Mantell's 'Medals of Creation,' Nicol's 'Geology of Scotland,' &c. Most of the notices were written by Ansted.

In 1846 a circular was issued by the Council to inform the Fellows that Messrs. Longman, who undertook, on terms very favourable to the Society, the publication of the first four numbers of the *Journal* at their own risk, had 'been disappointed in the sale in consequence of so small a number of the Fellows taking the *Journal*, and having thereby sustained a loss, they have declined continuing to run any further risk.'

There is no doubt that with the increased number of Fellows the proportion of the 'well-to-do' was less than in earlier days; it may also be inferred that a certain number of Fellows were more concerned in appending F.G.S. to their names than in adding the *Quarterly Journal* to their bookshelves.

The Council then determined to continue the publication on the Society's account and to discontinue the

manent publication. In December 1858 they resolved that it be circulated *gratis* among all the compounders and resident contributing Fellows, commencing, in 1859, with the February number.

In May 1861 they decided to present the *Journal* to the foreign members; and in 1870 they arranged to print an edition of 1,500 and to present copies to the foreign correspondents.

By some Fellows of the Society the publication of the miscellaneous part of the *Journal* was regarded as 'a great innovation upon established custom, a departure from a sound principle for a Society to publish, under its authority, anything beyond that which properly belongs to it as an integral part of its own proceedings.'[1] The Council, however, did not take this view. The notices of new books published in this country were soon discontinued; but the publication of the miscellaneous part of the *Journal* was not abandoned until the close of 1873. During the later years many abstracts of foreign Memoirs were contributed by Count A. F. Marschall (1805–87), who was elected a foreign correspondent in 1863.

The Council announced in 1845 that they had decided, by way of trial and in accordance with the wish expressed by several Fellows, to break up ten copies of the last five volumes of the *Transactions*, so that the papers might be sold separately. A catalogue of these was printed, and the prices to Fellows may be judged from the following:—

Buckland and De la Beche, 'On Weymouth,' 5*s*.
Fitton, 'Strata between the Chalk and Oxford Oolite,' 25*s*.
Murchison, 'Coal Field of Brora,' 8*s*. 6*d*.
Sedgwick, 'Magnesian Limestone,' 10*s*. 6*d*.
Owen, 'On *Thylacotherium*,' 5*s*.

On April 2, 1845, the Council decided that a referee be appointed for every paper on the day on which it was to be read.

An extraordinary mistake was made about this time, as on November 5, 1845, it was brought to the notice of

[1] Horner, Address to Geol. Soc. 1846.

the Council that during the previous year Professor H. D. Rogers[1] had been elected a foreign member, being already an ordinary Fellow and it was resolved that his name must be retained on both lists. In 1858, after Professor Rogers had become resident in this country, the Council, at his request, removed his name from the list of foreign members.

In 1846 the Society published a Catalogue of the Books and Maps in the Library, edited by Professor Ansted; in 1856 they issued a Supplemental Catalogue of the Books, Maps, Sections, and Drawings; and in 1860 an Alphabetical Supplement of Books and Maps. These later volumes were edited by Mr. (afterwards Professor) T. Rupert Jones.

Leonard Horner made special mention of the Museum in his address of 1846, and stated that he was preparing, with the assistance of Mr. (afterwards Professor) Morris, an illustrated copy of his 'Catalogue of British Fossils,' for the use of those who came to study the collections.

In 1845 John Morris issued the first edition of his celebrated 'Catalogue of British Fossils.' The second edition of that work was published in 1854, and in it 8,359 species were recorded. It was 'the first really important *critical list* of British fossils,' and it has continued to be of the highest value for reference. Meanwhile, in 1848–49, H. G. Bronn issued, in three volumes, his 'Index Palæontologicus'—relating to all countries—a contribution to nomenclature that gave 'the most complete and accurate census of past life-forms ever attempted.' At later dates the 'Thesaurus Siluricus,' 1868, and 'Thesaurus Devonico-Carboniferus,' 1878, by Dr. J. J. Bigsby, gave us records of the flora and fauna of the Silurian, Devonian, and Carboniferous periods; while, in 1888, Robert Etheridge published the first

[1] Henry Darwin Rogers (1808–66), born in Philadelphia, was distinguished for his researches on the geology of Pennsylvania. In 1857 he was appointed professor of Natural History and Geology in the University of Glasgow (*see* p. 204).

volume of 'Fossils of the British Islands,' stratigraphically and zoologically arranged, but only the Palæozoic species were recorded. In 1886 Etheridge had estimated the number of known species of British fossils at 19,022.[1] What the number now is no man can tell.

John Morris (1810–86) had been brought up as a pharmaceutical chemist, in High Street, Kensington; but his disposition early led him to stray from the paths of business in pursuit of natural science, and of geology in particular. In this respect he manifested no indecision, although a remarkable trait of his character was hesitation when action was required. Fortunately for him, and for science, he was, in 1855, appointed professor of Geology in University College, and he retained this post until 1877. As remarked by his successor, Professor Bonney, 'Morris was a born teacher; to a memory of extraordinary retentiveness he united a remarkable power of lucid exposition. He was able, even at the shortest notice, to express his ideas simply but clearly, clothing a train of well-connected reasoning in language often chosen with unusual felicity.'[2] His knowledge was exceptionally wide and accurate, and the influence he exerted on the progress of geology, great through his publications, was perhaps greater through his personal influence, and the information and aid he ever generously imparted to others.

After the death of Morris efforts were made to produce a third edition of his 'Catalogue of British Fossils;' but the difficulties proved insuperable. Not everyone qualified to aid in such a critical task is also able or willing to devote the time; moreover, a new edition of the original work would have needed many volumes. Two, however, were published—'The British Fossil Vertebrata,' by Dr. A. Smith Woodward and Mr. C. D. Sherborn, 1890; and 'The British Jurassic Gasteropoda,' by Mr. W. H. Hudleston and Mr. Edward Wilson, 1892. Owing to the

[1] *Geol. Mag.* 1889, p. 82.
[2] *Quart. Journ. Geol. Soc.* xlii. p. 45 (Proc.).

vast amount of new material these were independent works. The former volume was practically the same size as Morris's full Catalogue of 1854, and the latter was about two-fifths the size.

In the year following the establishment of the *Quarterly Journal*, Charlesworth commenced 'The London Geological Journal, and Record of Discoveries in British and Foreign Palæontology.' It was proposed to issue six numbers each year, but only three were published in September 1846, and in February and May 1847. In the first number the editor claimed the right of giving 'the unfettered expression of independent opinions,' and proceeded severely to criticise some of the identifications of fossils by Professor Owen. Although Charlesworth received considerable support, and Thomas Davidson promised to contribute to his journal a monograph of English Silurian brachiopoda, yet, being no respecter of persons, he made enemies by his injudicious methods of redressing what he conceived to be wrongs. In later years he appeared at the annual general meetings of the Society—notably from 1863 to 1865—and harangued the Fellows for an hour or so, with a fluency of language in which he excelled, on the general management of the Society—much to the annoyance of many who were anxious to hear the presidential address.

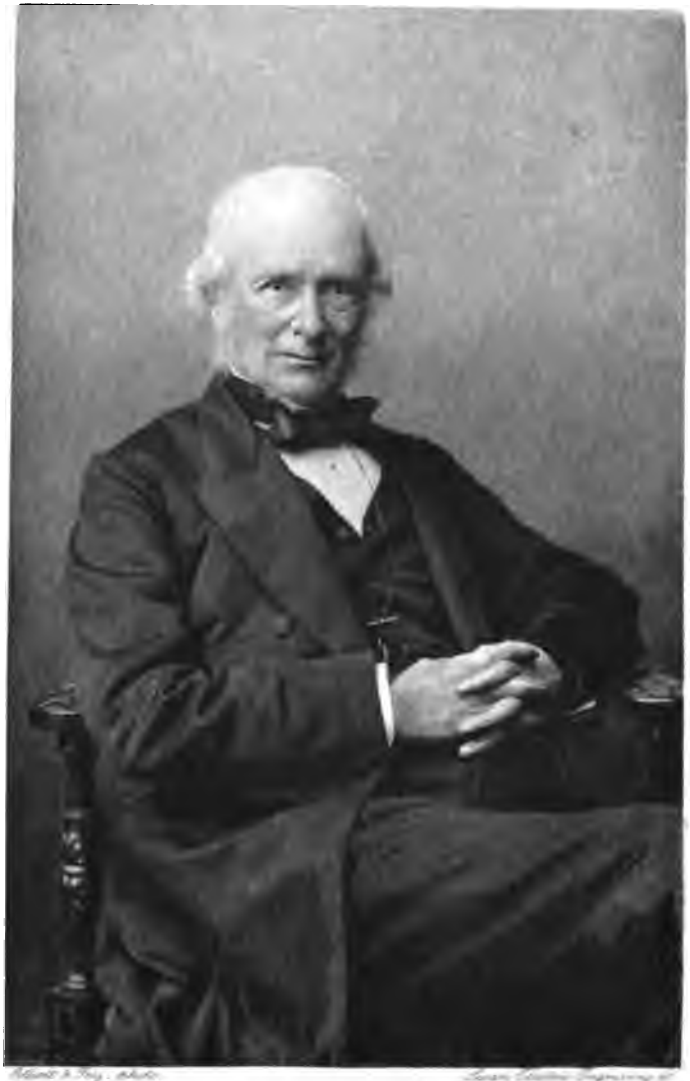
In the year 1847, forty years after its foundation, De la Beche was *president* of the Society, supported by Egerton, Lyell, Owen, and Sedgwick, *vice-presidents*; by W. J. Hamilton and John Carrick Moore, *secretaries*; by Charles J. F. Bunbury as *foreign secretary*; J. L. Prevost, *treasurer*; and by Bowerbank, Darwin, Falconer, Edward Forbes, Greenough, Wm. Hopkins, Robert Hutton, L. Horner, Mantell, Murchison, S. P. Pratt, Daniel Sharpe, Strickland, and S. V. Wood, other members of the *Council*.

One of the more active of the younger members of the Geological Society at this period was Prestwich, who was devoting special attention to that division of the

Tertiary strata to which the name Eocene had been given by Lyell.

On February 3, 1847, after the reading of Prestwich's paper 'On the probable Age of the London Clay, and its relations to the Hampshire and Paris Tertiary Systems,' Edward Forbes, in the course of the discussion, 'remarked with regret how much information on this subject lay scattered in different books and periodicals. Mr. Bowerbank followed, and, on the spur of the moment, suggested the establishment of a Tertiary Publishing Society. The idea immediately found favour, and afterwards, at tea downstairs, it was expanded into a proposition to found a society for publishing plates of fossils, not from the Tertiary deposits only, but from all the British formations. This was the origin of the Palæontographical Society.'[1]

James Scott Bowerbank (1797–1877), author of a 'History of the Fossil Fruits and Seeds of the London Clay,' 1840, was distinguished as a microscopist, and in later years for his researches on British sponges. During his residence in the north of London Dr. Bowerbank kept open house on Monday evenings for any geological students, at whose disposal were placed the 'treasures of his museum, the use of his microscopes, and his personal assistance.'[2] Not a few distinguished geologists attended these receptions. Sir Charles Bunbury, in 1856, 'went with Lyell to Mr. Bowerbank's, at Highbury, near Islington, to see his collection of fossils, which is really splendid—a wonderful collection to be made by one individual of no extraordinary wealth. He showed us a great variety of curious specimens in illustration of his theory of the origin of flint from sponges.'[3]



Treasurer 1856-68. *President 1870-72.*

which had been formed about the year 1836, included among its members J. S. Bowerbank, Searles V. Wood, Frederick E. Edwards, John Morris, and Nathaniel T. Wetherell (of Highgate). They experienced the want of figures of British Tertiary fossils, as the illustrations in Sowerby's 'Mineral Conchology' were arranged in no systematic order, and during recent years that publication had come out at long and irregular intervals; the last number, in fact, was issued in 1845. Hence the establishment of the Palæontographical Society was heartily welcomed. The first volume issued was 'The Monograph of the Crag Mollusca,' by S. V. Wood (1798–1880); a work commenced in 1848, completed in 1856, and crowned in 1860 by the award of the Wollaston medal.

It would be beyond our limits to refer in detail to the work of the Palæontographical Society, but it is a satisfaction to know that its council and annual meetings have always been held in the rooms of the Geological Society.

Mention may, however, be made of Thomas Davidson (1817–85), who devoted his life to the study of the Brachiopoda, and completed his monograph on all the fossil forms from the British Isles—a great work which, with Supplements, was published during the years 1851–85.

The Palæontographical Society appointed a number of local secretaries, most of them Fellows of the Geological Society and ardent collectors of fossils, and some of them contributors of monographs. To collectors the publications of that Society gave a great stimulus, as during many years it continued possible for studious observers, who were not trained palæontologists, to identify their own fossils from the excellent plates and descriptions.

Valpy, of Enborne Lodge, Newbury (1819–1904), who specially collected from the Devonian of Ilfracombe; William Cunnington, of Devizes (1813–1906); Charles Moore, of Ilminster, and afterwards of Bath (1814–81), whose collection forms an important part of the Bath Museum; Thomas Wright, of Cheltenham (1809–84); John Lycett, of Minchinhampton (died 1882); Edwin Witchell, of Stroud (1826–87); the Rev. W. S. Symonds, of Pendock, in Worcestershire (1818–87); the Rev. P. B. Brodie, of Rowington, in Warwickshire (1815–97); Thomas Beesley, of Banbury (1818–96); James Parker, of Oxford; Robert F. Tomes, of Welford, and afterwards of South Littleton, near Evesham (1823–1904); John Gray, of Hagley; Henry Johnson, of Dudley (1823–85); John Ward, of Longton, Staffordshire (1837–1906); Robert Lightbody, of Ludlow (died 1874); David Homfray, of Portmadoc (1822–93); G. H. Morton, of Liverpool (1826–1900); George Tate, of Alnwick (1805–71); James Thomson, of Glasgow (1823–1900); James Powrie, of Reswallie, Forfar; Mrs. Elizabeth Gray, of Edinburgh; John Leckenby, of Scarborough (1814–77); Samuel Sharp, of Dallington Hall, Northampton (1814–82); James Carter, of Cambridge (1813–95); Caleb B. Rose, of Swaffham, afterwards of Yarmouth (1790–1872); John Gunn, of Irstead, afterwards of Norwich (1801–90); Robert Fitch, of Norwich (1802–95); the Rev. Thomas Image, of Whepstead, near Bury St. Edmunds (died 1856); John Brown, of Stanway (1780–1859); John Wickham Flower, of Croydon (1807–73); W. H. Bensted, of Maidstone (1802–73); William Harris, of Charing, Kent (1797–1877); Frederic Dixon, of Worthing (1799–1849); J. Toulmin Smith (1816–69); and N. T. Wetherell (1800–75), of Highgate.[1]

The names of many species of fossils, such as *Asaphus Homfrayi*, came to be associated with these enthusiastic workers; while in the case of one Silurian Ophiuroid or brittle-star, Salter attempted to immortalise Robert Lightbody in the appellation *Protaster leptosoma*.

The enthusiasm of most collectors is unbounded. Owen mentioned, in 1849, that he made an excursion to some chalk-pits near Arundel with J. E. Gray, F. Dixon, and Lord Northampton, who was an ardent collector of flint fossils. After the marquis had been hammering over a heap of stones through a long afternoon, one

[1] Some of the great collections, or portions of them, made by the geologists

of the pitmen remarked, 'That man doan't work for his living; if he went on that gate he could do nought next day.'[1]

Samuel Peace Pratt (1789–1863), who for many years took an active interest in the proceedings of the Society, was a man of wide attainments and a diligent collector of fossils; he also devoted much time to the naming and arranging of specimens in our Museum. He contributed to the Society papers on the Eocene mammals of the Isle of Wight, the Bone-caves of Sicily, and the Geology of Normandy. He likewise described several new species of Ammonites from the Oxford clay of Christian Malford, near Chippenham—specimens for the most part obtained by William Buy of Sutton Benger, a noted fossil collector and dealer, whose handiwork is seen in many a museum, in the squared slabs of Oxfordian shale, containing, among other organic remains, the forms familiarly known in bygone days as *Ammonites Jason.*

An incident that illustrates the ways of great collectors was mentioned at a meeting of the Geologists' Association in December 1898, by Mr. James Parker. He referred to the fossiliferous iron-sands of Shotover, and observed that once upon a time he visited the locality in company with Professor Phillips and the Rev. P. B. Brodie. Now, Brodie, as everyone knew, was an enthusiastic collector of fossils, and was never known to give away a specimen. On this occasion they were examining some thin slabs of rock, and the question arose as to whether they contained Cyprides. The evidence was very poor, and Brodie, after carefully studying one slab, thought it might, perhaps, contain Cyprides, but was very doubtful. He handed the specimen to Phillips. 'Will you give it to me?' said Phillips. 'Certainly,' replied Brodie. 'Parker,

a beautiful impression of a fossil fern, and remarked to Brodie, that at last he had turned over a new leaf!

Brodie initiated in this country a new study in his 'History of the Fossil Insects of the Secondary Rocks of England,' published in 1845: a work in which he was aided by J. O. Westwood, afterwards Hope Professor of Zoology at Oxford.

Palæobotany was taken up by John Lindley and William Hutton in their 'Fossil Flora of Great Britain' (1831–37); and by Henry Witham, who, in his 'Observations on Fossil Vegetables,' in 1831, first brought the microscope into the study of plant structures (see p. 170).

Sir Joseph Hooker commenced the study of fossil plants about the year 1846, when he was appointed botanist to the Geological Survey, and he contributed several papers on the subject to the *Quarterly Journal*.

Edward Forbes, who at this date was palæontologist to the Geological Survey, aroused much interest by his luminous essay 'On the Connexion between the Distribution of the existing Fauna and Flora of the British Isles, and the geological changes which have affected their area, especially during the epoch of the Northern Drift.'[1]

Again, Sir Charles J. F. Bunbury (1809–86) for some years represented botany on the Council and at the evening meetings of the Society. He became interested in the subject while at Trinity College, Cambridge, and afterwards, during a year's residence at the Cape of Good Hope, he studied the flora of that region. He was proposed as a Fellow of the Society, in 1835, by Dr. Somerville. Afterwards he married the second daughter of Leonard Horner, the sister of Lady Lyell, and was induced by Sir Charles Lyell to devote special attention to fossil plants.[2]

Edward William Binney (1812–81), an enthusiastic Lancashire geologist, likewise became an authority on

[1] *Mem. Geol. Survey*, i. p. 336; see also 'The Origin of the British Flora,' by C. Reid, 1899.

[2] 'Life of Sir Charles J. F. Bunbury, Bart.,' edited by Mrs. Henry Lyell, 2 vols. 1906.

fossil botany, and contributed to the Palæontographical Society a Monograph on the Structure of Fossil Plants found in the Coal-measures. Another ardent worker, W. C. Williamson, to whom reference has already been made, was never a Fellow of the Society, but he was awarded the Wollaston medal in 1890 for his researches on the structure of coal-plants. In 1870, and for many subsequent years, Mr. William Carruthers represented botanical science on the Council. He directed his attention to the plants of the Coal-measures, but more particularly to those of the Secondary formations.

In 1847 James Nicol, F.R.S.E., was appointed assistant secretary to the Society, in the room of Professor Ansted, who had resigned; and in the following year J. de Carle Sowerby gave up the curatorship, as the Council had regretfully come to the conclusion that they could not afford to expend more than 50*l.* a year on the care of the Museum. Nicol, in 1849, was appointed professor of Geology in Queen's College, Cork, but he continued for a while to hold office and edit the *Quarterly Journal*. In 1850 Mr. T. Rupert Jones was appointed assistant secretary, librarian, and curator.

During the presidency of Sir Charles Lyell in 1849, H.R.H. Prince Albert of Saxe-Coburg and Gotha, K.G., F.R.S., who had been proposed as a Fellow on April 4, was admitted on May 30.

Dr. Henry Woodward, who, as a youth, was present on this memorable occasion, has told that, when he arrived at Somerset House, Charlton, the house steward, was much excited, and, taking him on one side, observed, in a stage-whisper, that the Prince was coming to be admitted as a Fellow, and every '*stranger*' must have his name given in to the president. The room was full, and there were present on the front benches, Professor Sedgwick, Sir Roderick Murchison, Leonard Horner, Dr. Fitton, and many other distinguished Fellows, as well as Charles Babbage, and other notable visitors. The Prince sat on the

right front bench, supported by two of his equerries. In due course he was called upon by the president, who addressed him, as customary: 'In the name and by the authority of the Geological Society of London, I hereby admit you a Fellow thereof;' and, after shaking hands, the Prince replied: 'Mr. President, I am very proud of the honour, just conferred upon me, of being elected a Knight of the Hammer.' Then, after the usual formal business, the paper of the evening was read. It was by Murchison, 'On the Distribution of the Superficial Detritus of the Alps, as compared with that of Northern Europe.' [1]

> The author argued that a study of the physical phenomena of the Alps and Jura compel the geologist to restrict the former extension of the Alpine glaciers within infinitely less bounds than had been assigned them by Venetz, Charpentier, and Agassiz. He attributed the dispersion of Scandinavian erratics to the agency of floating ice, when large portions of the Continent and of the British Isles were under the sea.

The Prince, who wore on his breast the blue ribbon and on his coat the star of the Garter, paid great attention to the paper and to the discussion. Not so the poor equerries, who, feeling no interest in the matter, speedily dropped asleep, and, what appeared most amusing, they each leaned upon the Prince's shoulders, and he, quite unconsciously, sat bolt upright and alert to the very end; and after shaking hands with the leading Fellows, he departed to Buckingham Palace with his tired companions.

During the year 1849 the British Association held its meeting at Birmingham, and an excursion was made to Dudley, when Sir Roderick Murchison, in the great cavern of the Castle Hill, briefly explained the system of strata

part of the Silurian region, yet Sir Roderick had extended the Silurian domain almost illimitably, and it was only just and proper that there, upon a Silurian rock, he should be acknowledged the modern king of Siluria. The Bishop, then taking a gigantic speaking-trumpet, which he had brought with him, called upon all present to repeat after him the words which are given below. He then spoke through the trumpet, giving one word at a time, to enable those present to repeat it altogether—Hail—King—of—Siluria! Then, after a pause, the words were repeated a second and a third time.

The vast assembly thrice responded with stentorian voices and most hearty hurrahs, and ever afterwards Sir Roderick was proud to be acknowledged 'King of Siluria.' About 25,000 persons visited the Dudley caverns on that day in 1849, though they were not all present at the time the Bishop's call of acknowledgment was made.[1]

The treasurer of the Geological Society during the years 1843–52 was John Lewis Prevost (1796–1852). He was Consul-General of the Swiss Confederation in London, a member of the Council of University College, and a director of the London and North-Western Railway.

[1] Article communicated by John Rabone to the *Midland Naturalist*, December 1891, p. 268; see also 'Life of Sir Roderick I. Murchison,' by A. Geikie, vol. ii. 1875, p. 103.

CHAPTER XI

The Rise of Petrology. Close of the Cambro-Silurian Controversy

MICROSCOPIC STRUCTURE OF ROCKS—H. C. SORBY—DAVID FORBES—GEOLOGICAL DINNERS—DANIEL SHARPE—PRESTWICH AND EASTER EXCURSIONS—THE END OF THE 'TRANSACTIONS'—A. G. BAIN—MANTELL AND THE ELGIN REPTILES—OWEN AND HUXLEY—FINAL CONTROVERSY ON CAMBRIAN AND SILURIAN—THE TERM ORDOVICIAN

A NEW departure in geological research marked the opening of the session for 1850–51, when Mr. Henry Clifton Sorby read a paper 'On the Microscopical Structure of the Calcareous Grit of the Yorkshire Coast.' Although the microscope had been applied by earlier workers to the study of minerals, it was not until after William Nicol, of Edinburgh, had devised a process of making thin slices of fossil wood, made known in 1831, that researches on the intimate structure of rocks became possible.[1] Sorby was the first to examine by transmitted light thin sections of rocks, prepared with his own hands; and he may truly be said to have initiated the modern science of petrology. With his wonted enthusiasm he pursued the subject, and at the end of 1857 he communicated to the Society his famous paper 'On Some Peculiarities in the Microscopical Structure of Crystals Applicable to the Determination of the Aqueous or Igneous Origin of Minerals and Rocks.'[2]

In this he described the results of experiments under

crystals in order to determine, from the ratio of the fluid contents to the vacuoles in their cavities, the temperature and pressure at which the crystal itself had been formed. In a paper 'On the Original Nature and Subsequent Alteration of Mica-Schist,' published in the *Quarterly Journal* for 1863, he called attention to structures in that rock which he considered to be representative of a ripple-drift, and thus to prove that the schist had prior to metamorphism been a sediment. Though his interpretation of the structures has been disputed, the sedimentary origin of many mica-schists is indubitable. His two presidential addresses, delivered to the Society in 1879 and the following year, embody the results of long and careful investigations; the former describing the structure of calcareous rocks from recent muds and travertine, through the limestones of successive geological deposits in this country, down to those thoroughly crystalline; while the second one gives the results of a similar investigation of the sedimentary rocks other than calcareous, from the most recent examples to those affected by contact, pressure, or other metamorphism.[1]

The first, we believe, to follow Dr. Sorby in the application of the microscope—for he tells us he began in 1852—was David Forbes (1828–76), a younger brother of Edward Forbes. He, however, appears not to have made any direct communication of his results to the Society, for he refers only to megascopic study even in his classic paper on 'Bolivia and Southern Peru,' published in the *Quarterly Journal* for 1860. He contributed a valuable essay on 'The Microscope in Geology' to the *Popular Science Review* for 1867, and his studies enabled him to make, in the debates at our evening meetings and elsewhere,

scope, Sir Archibald Geikie had commenced petrographical studies on the Scottish volcanic rocks.

In 1851, when Sedgwick was nearly sixty-six years of age, the Wollaston Palladium medal was awarded to him by the Council of the Geological Society, and presented by Sir Charles Lyell. In his reply Sedgwick remarked that his labours were still in progress, his task was yet undone; and he spoke with gratitude of the many years of active and intellectual communion he had been permitted to hold with the members of the Society. At the commencement of the next session, in November 1851, he brought before the Society a paper 'On the Slate Rocks of Devon and Cornwall,' observing in the opening paragraph, 'I rejoice to appear once more as a fellow-labourer, and to lay the first-fruits of my summer's task before the Geological Society.'[1]

Of the more convivial proceedings during this period, we find that Ramsay, in 1848, after recording his attendance at the anniversary meeting of the Society and at the dinner afterwards, remarked, 'We broke up about eleven, and in the long run Smyth, Reeks, Bristow, and I had some supper. Got home at half-past three.' Three years later he mentioned that at the anniversary dinner, when William Hopkins, the new president, took the chair, 'Sedgwick made the great speech of the evening. By turns he made us cry and roar with laughter, as he willed. His pathos and his wit were equally admirable. Home at twelve.'[2]

The following *menu* for the anniversary dinner at the Freemasons' Tavern in 1853 has been contributed by Professor T. Rupert Jones, who was present on the occasion.[3] It is of interest as a record of the kinds of dishes served fifty years ago.

[1] *Quart. Journ. Geol. Soc.* viii. p. 1.

[2] 'Memoir of Sir A. C. Ramsay,' by Sir A. Geikie, 1895, pp. 124, 177.

[3] It is a MS. written in ink, dated as given, and signed at the foot by the proprietors. It is probably the list from which a selection was made for he dinner.

GEOLOGICAL SOCIETY

February 18, 1853

Soups—Mullagatawny, Julienne, Carrot and Rice, A la Reine, Ox Tail, Clear, Leek

Fish—Salmon, Turbot, Salt Fish, Boudin of Whitings, Eels à la Toulouse, Salmon Cutlets, Fried Whitings, Smelts

Second Service

Roast Turkeys	Braised and Roast Fowls
Boiled Legs of Pork	Hams and Tongues
Chines and Haunches of Mutton	Raised French Pies
Stewed Beef and Spanish Onions	Raised Mutton Pies
Roast Beef	Roast Lamb

Brocoli Potatoes

Entrées

Bulotines de Volaille	Sauté de Mauviettes
Riz de Veau piqué	Côtelettes de Mouton
Perdrix aux Choux	Côtelettes de Porc
Poitrine d'Agneau	Petits Pâtés aux Huîtres

Filets de Perdrix à la Parisienne

Third Service

Wild Ducks, Widgeon, Snipes, Larks, Guinea-fowls, Pea-fowls, Black Puddings, Mushrooms, Prawns, Goslings

Gâteau à la Polonaise	Gâteaux de riz d'Orange
Napolitaine Gâteaux	Charlotte de Russe
Meringues de Venise	Compôte of Damsons
Venetian Puddings	Russian Puddings
Meringues	Rhubarb Tart
Cheese Cakes	Mince Pies
Lemon Jellies	Orange Jellies

In 1852 it was notified that the Council had purchased Lewis's Map of Scotland, and had requested Mr. Greenough and Mr. Sharpe to colour it geologically. In the following year they reported that

> 'This laborious task, involving so much of research and of minute information, has been accomplished by Mr. Sharpe, with the assistance of the information supplied him by Mr. Greenough,' and it was resolved 'that Mr. Sharpe be requested to correct the Map from time to time, as new and more perfect information may be received.'

Daniel Sharpe (1806–56), who undertook this honorary task, was a nephew of Samuel Rogers, the poet,

and in all respects a remarkable man. He had done excellent work among many formations, among eruptive and metamorphic rocks, as well as in palæontology. In early manhood Sharpe became partner in a Portuguese mercantile business, and resided in Lisbon for three years, 1835–38. Taking an active interest in geology, he brought before the Society papers on the geology of Portugal, and many of his fossils were deposited in the Society's Museum. He dealt with the Cambrian and Silurian rocks of the Lake District and North Wales; and with the Lower Greensand of Faringdon. He discussed the age of the Blackdown Beds—regarding them as a littoral deposit of the Gault; and he described for the Palæontographical Society the Cephalopoda of the Chalk. He further contributed important papers relating to cleavage and foliation in Scottish and Alpine regions, and to the structure of Mont Blanc. It is sad to relate that in 1856 Sharpe was thrown from his horse, when riding near Norwood; the accident proved fatal, and 'removed him from amongst us only a short time after the unanimous vote of the Geological Society had placed him at its head as President.'[1]

For many years, from 1845 to 1870 and occasionally until 1880, when he had attained the age of sixty-eight, Prestwich annually arranged an Easter excursion with four or five energetic Fellows of the Society, amongst whom, on different occasions, were Daniel Sharpe, Godwin-Austen, W. W. Smyth, Edward Forbes, John Morris, James Nicol, George Busk, Alfred Tylor, William Cunnington, Captain (afterwards Sir Douglas) Galton, Sir John Lubbock (now Lord Avebury), Mr. (now Sir) John Evans, J. Gwyn Jeffreys, and Professor T. McKenny Hughes.

The sponge-gravels of Faringdon, the Crag district of

conductor. He wrote on one occasion in 1851, to say that 'I will leave it to Sharpe to fight the battle about dinner. All I stipulate for, is that you will allow us breakfasts.' When Prestwich was no longer able to take part, excursions were for a time continued by some of his old companions; and in 1893 he wrote 'I am glad to hear of the Easter excursions continued under such pleasant conditions, but do not approve of the introduction of that relaxing element, fishing. Why we sometimes had not time to eat fish, much less to catch them.'[1]

In 1852, finding that the stock of the Society's *Transactions* did not decrease at a satisfactory rate, the Council reported that

> During the past year, Mr. Lumley, the bookseller in Southampton Street, proposed to the Council to purchase the stock of unsold *Transactions* in the Society's possession. The Council, after anxious consideration, came to the conclusion that the best mode of putting these works in circulation, and thereby diffusing a taste for geological research, was to dispose of them to a bookseller of reputation. They accordingly concluded an agreement with Mr. Lumley, under which they made over to him for the sum of 100*l.* all their stock of *Transactions*, with the exception of 50 copies which the Society retains for its own purposes. It was stipulated that the copper plates should continue to be the property of the Society, and Mr. Lumley should have the use of them for completing his own sets.

Serious delays had indeed occurred in the publication of papers in the *Transactions*. In 1845 the important memoir by Andrew Geddes Bain (1797–1864) on the discovery of the fossil remains of Bidental and other Reptiles in South Africa, was read before the Society. The remains were described by Professor Owen as belonging

publication with the memoirs. Towards the cost of these Warburton and Greenough had in the first instance liberally supplied the funds; and the united work of Bain and Owen formed the whole of part 4 of vol. vii. of the second series of *Transactions*, which was not issued until 1856. At that date the publication of *Transactions* ceased. Professor T. Rupert Jones, who, as assistant secretary, edited this last volume, became so interested in South African geology that he acquired a mastery of the literature, and came to be recognised as the authority in this country on questions relating to the subject.

Mantell in 1852 described the new genus *Telerpeton* from the Elgin sandstones, regarded at that time as wholly belonging to the Old Red Sandstone. Six years later Huxley described a new reptile, obtained by the Rev. George Gordon, minister of Birnie, near Elgin. This new form, named *Hyperodapedon Gordoni*, was so distinctly of Triassic affinities, that Murchison, who had advocated the Old Red Sandstone age of the Elgin strata, then suggested that there might be two groups of sandstone of distinct ages [1]; and this has proved to be the case.

A number of new reptiles have since been obtained from the Triassic sandstones of Elgin, notably two new genera, closely allied to *Dicynodon*, and named *Gordonia* and *Geikia*; and one new genus allied to *Pareiasaurus*, and named *Elginia*. These were described by Mr. E. T. Newton in a paper read before the Royal Society in 1892. It is a remarkable fact that he had not a particle of the bones to deal with, the whole having been dissolved away; he had before him only the cavities in sandstone from which, after untold labour, he obtained casts in gutta-percha of various bones and skulls. It is interesting also to note the correspondence, pointed out by Mr. Newton, between the reptiles of Elgin and those of the Karoo Beds of South Africa described by Owen, and by Professor H. G. Seeley. Similar reptiles occur likewise in the Gondwana Beds of India, and near Archangel in Russia.

[1] *Quart. Journ. Geol. Soc.* xv. p. 436.

Among the many enthusiastic workers on Geology in remoter regions of Great Britain, none deserves our recognition more than the Rev. George Gordon (1801–1893), who at the age of ninety was able to wield his geological hammer, and, journeying in a basket-chaise, was keen to conduct an interested student to the fine quarries of Old Red Sandstone and Trias in the vicinity of Elgin. Associated with him in his local researches, another zealous observer, the Rev. J. M. Joass, of Golspie, has added much to our knowledge of the Secondary and older strata in north-eastern Scotland.

From about the year 1850 onwards for ten or twelve years there was a good deal of controversy over bones, between Mantell and Owen, John Edward Gray and Owen, Owen and Falconer, Falconer and Huxley, and Huxley and Owen. It is therefore interesting to read the impression of Sir Charles Bunbury, who after an interview with Owen recorded: 'Owen is delightful—with such vast knowledge, most unassuming simplicity, and a true and unaffected eloquence when excited by a favourite subject.'[1] No man, indeed, could be more amiable, yet in the midst of heated controversy his smile, apparently child-like and bland, was rather apt to accentuate caustic remarks. On one occasion, as told by Sir John Evans, Owen when engaged with Falconer in a discussion on fossil bones, spoke of his antagonist as 'that distinguished *botanist*, Dr. Falconer.'

In 1851 there was 'great stir in the scientific world' about who was to occupy König's place at the British Museum, and the name of Owen had been suggested.[2]

Huxley remarked 'The heartburnings and jealousies about this matter are beyond all conception,' and it was predicted that if Gray and Owen 'came to be officers of the same institution, in a year or two the total result will be a caudal vertebra of each remaining after the manner

[1] 'Life of Bunbury,' vol. i. 1906, p. 217.

[2] Charles König had been appointed Keeper of the Department of Natural History in 1813, and since 1837 of the Department of Geology and Mineralogy, while John Edward Gray was Keeper of Zoology.

of the Kilkenny cats.' In the end a zoologist, G. R. Waterhouse, a most amiable man, distinguished for his researches on mammals and insects, was appointed to the geological post. (See p. 213.)

In contrast to Owen and Gray, Edward Forbes was regarded as 'quite another being,' who 'has sympathies for all, and an earnest truth-seeking, thoroughly genial disposition which win for him your affection as well as your respect.'[1] As Jukes once remarked, 'His heart and his intellect were alike large and catholic in their instincts and capacities. He seemed not to perceive, or perceiving, not to regard, the failings and imperfections of men, but to look at their capabilities, and seek for and call forth what powers and good qualities they possessed.'[2]

Huxley did not enter the arena until after 1854, when he succeeded Forbes as Professor of Natural History at the School of Mines. The combined post of Palæontologist to the Geological Survey and the Professorship had been offered to him by Sir Henry De la Beche, but Huxley said:

> I refused the former point blank, and accepted the latter only provisionally, telling Sir Henry that I did not care for fossils, and that I should give up natural history as soon as I could get a physiological post. But I held the office for thirty-one years, and a large part of my work was palæontological.[3]

While, as just mentioned, this was an age of contention over bones, so also the controversy over the Cambrian and Silurian rocks came once more prominently before the Society, and the dispute reached its climax during the years 1852–54.

The division between Murchison's Upper and Lower Silurian was still wrongly defined owing to the grouping together of Caradoc and May Hill Sandstones: the facts

being misunderstood alike by Sedgwick and Murchison. In maintaining the rights of his Cambrian system Sedgwick claimed that he had given to the equivalents of the Llandeilo flags a right place in his sections, and that Murchison, having misinterpreted the relations of his lower groups, was bound to yield them up to the Cambrian.

Against this view Murchison exclaimed, 'Whilst he leaves me the Caradoc sandstone, he would cut away from it the next underlying formation, or my own Llandeilo flags; though it is known to every one who has worked in these primeval rocks that *many of the same species of shells and trilobites characterise both the Caradoc and Llandeilo formations.*'[1]

If hard blows were given by Sedgwick, it must be remembered that he, and not Murchison, was labouring under a sense of injustice. Murchison was the man in possession, who in all good faith had entered portions of a territory that would unquestionably have belonged to his fellow-labourer had the boundaries been properly 'pegged out,' and he was the first to make known somewhat fully the palæontological riches of his claim.

When to a sense of injustice there are added gout and dyspepsia, an acerbity of temper will almost infallibly result; and to these causes, in Sedgwick's case, must be attributed sundry outbursts of bitterness, which after all were spasmodic, and alien to his true nature. As remarked by Prof. Bonney, 'he always appeared to be not only truly noble in spirit, but also illuminated with that divine fire which distinguishes the man of genius from the man of talent.'[2]

On December 3, 1851, Sedgwick brought before the Society a paper 'On the Lower Palæozoic Rocks at the Base of the Carboniferous Chain between Ravenstonedale and Ribblesdale.'[3] In the following February he read an

[1] See references to *Edin. New Phil. Journ.* &c. on p. 183.

[2] *Nature*, July 10, 1890, p. 242; see also remarks in the 'Life of Sir C. J. F. Bunbury,' vol. ii. p. 295.

[3] *Quart. Journ. Geol. Soc.* viii. 1852, p. 35.

essay 'On the Classification and Nomenclature of the Lower Palæozoic Rocks of England and Wales.' In this he gave a full account of his researches on the older rocks of the Lake District and North Wales, and an historical retrospect of attempts to unite the Cambrian and Silurian rocks in a continuous section. He moreover claimed to have established a congruous nomenclature between the Welsh and Cumbrian mountains; a matter that is apt to be overlooked in regard to the rights of his Cambrian system.

The personal question he regarded as 'indeed a paltry matter; but it does involve a very important principle.'

He accepted 'the interpretation of the structure of Wales as given in the great map, published under the direction of Sir Henry de la Beche, which is one of the noblest works of its kind that has appeared since geology was a science. In this map we have the superficial delineation of the true system of Siluria perfectly represented in its most minute details; and the authors have, for the first time, laid down the range of the Caradoc group in a manner that is intelligible and complete. But they have given the name "Lower Silurian" to all the vast series of rocks in Wales, which are below the Caradoc sandstone. I do not believe that their authority, great as it is, can permanently establish a name that is geographically incongruous and historically unjust.'

He claimed 'the right of naming the Cambrian groups, because I flinched not from their difficulties, made out their general structure, collected their fossils, and first comprehended their respective relations to the groups above them and below them, in the great and complicated

tended to impugn the good faith of Murchison, and therefore would not be admitted at the present day into the *Quarterly Journal*. These passages related to the views of Murchison and himself as they were gradually evolved during their studies of the Lower Palæozoic rocks, since 1831, a period of twenty years during which the vagaries of memory might well lead to misunderstanding.

The Council considered the paper with care and deliberation, and it was not until their meeting on April 7, 1852, that their decision was given. There were present, William Hopkins (President), J. Carrick Moore, Col. Portlock, Dr. Bigsby, Mr. Horner, Dr. Hooker, Professor Ansted, Mr. S. V. Wood, Mr. S. P. Pratt, Mr. Bunbury, and Mr. Greenough.

> Professor Sedgwick's paper on the Classification of the Palæozoic rocks was balloted for and ordered to be printed in the abstracted form recommended by the Referee.

Owing to some mistake the paper was printed in full, much to the consternation of the Council. At their next meeting on May 19, 1852,

> The Council observed with regret that the paper of Professor Sedgwick in No. 30 of the *Journal*, May 1, 1852, had been published inadvertently with certain passages which they had required to be omitted; it was therefore resolved that the number be recalled, and pages 152 to the end cancelled.

This resolution was extraordinary. Many copies of the *Journal* had already been distributed, and it was impossible to cancel the 'Historical Retrospect' which Sedgwick had written.[1] The author indeed regarded the resolution of the Council as an insult: it was certainly useless as well as ill-judged, and it led to much correspondence and discussion; but it is evident that no disrespect was contemplated by the Council on this or on any other occasion in the history of the Society.

[1] See also 'Life of Murchison,' by A. Geikie, vol. ii. 1875, p 141.

At their meeting on December 14, 1853, when there were present Edward Forbes (President), Mr. Horner, Colonel Portlock, Professor Phillips, Dr. Bigsby, Mr. Hamilton, Mr. Sharpe, Mr. P. N. Johnson, Mr. Bowerbank, and Mr. Hopkins, it was

> Resolved that the Council have learned with regret that Professor Sedgwick is under the impression that the minute passed in May 1852, and subsequently rescinded, imputed to him that he had not complied with an order of the Council. They disclaim having had any such intention, and request the President to communicate with Professor Sedgwick, and to assure him that no such imputation was intended to be conveyed by that minute, the real meaning of which was that the officers charged with the publication of the *Journal* had inadvertently printed matter which the Council had ordered to be suppressed.

In the meantime as Sedgwick had given his views on the controverted question of Cambrian and Silurian nomenclature, Murchison, with whom much sympathy was felt, was rightly accorded permission by the Council to reply in a paper, read June 16, 1852, 'On the Meaning of the Term "Silurian System" as adopted by Geologists in various countries during the last ten years.' As remarked by Sir A. Geikie, 'it was a most temperate and friendly rejoinder.'

Murchison's contention was that he had 'completed in 1838 the illustration of a natural system which had been worked out by fossil evidences in 1833, 1834, and 1835, whilst in the same years Professor Sedgwick had neither shown the real physical relations of his rocks to my already well-known types, nor had he published any

that the so-called "Cambrian" is absolutely composed of undulations of my Silurian rocks, there is no question at issue.' Thus 'all the fossils of the region of Cambria or North Wales (down to the Lingula-beds inclusive) are now classed as Silurian.'

The term Cambrian was in fact restricted to the unfossiliferous rocks of the Longmynd in Shropshire and to the Harlech Grits and Llanberis Slates in the western portion of North Wales; and Murchison argued that 'the proposed application of the word "Cambrian" must necessarily cause an alteration of a fundamental character in the nomenclature used in every memoir and work on rocks of this age during the last ten or eleven years.'

He concluded by assuring

> 'Those who do not understand the nature of the social union of the members of the Geological Society, that the controversy which has prevailed between the eloquent Woodwardian Professor and myself has not for a moment interrupted our strong personal friendship. I am indeed confident we shall slide down the hill of life with the same mutual regard which animated us formerly when climbing together many a mountain both at home and abroad.'[1]

He had expressed similar sentiments, in almost identical language, in the course of discussion with Sedgwick, printed elsewhere at this period;[2] and Sedgwick had replied

> 'To the concluding words of my friend's comment I express my heartfelt concurrence. When we went round the Highlands of Scotland in 1827, I was then his superior in physical endurance, but a quarter of a century has, alas! made me but a sorry labourer in the field. Still I am not without hopes of again meeting him in his true Silurian

It is perhaps well that Sedgwick and Murchison gave their respective views on the Cambro-Silurian question in the *Quarterly Journal*, considering their influential position as Fellows of the Society, and the long period over which the unfortunate controversy had extended. Enough had now been said; and it is not surprising that the Council should pass a resolution, as Sedgwick has stated, forbidding him henceforth 'to bring before them any paper involving the Classification and Nomenclature of our older Palæozoic rocks.' There appears to be no record of this decision in the Society's books, and probably one of the secretaries was desired to intimate to the professor that further purely controversial matter could not be accepted. Nevertheless, as Sedgwick admitted,[1] he did again 'twice trespass on the forbidden ground of Palæozoic Nomenclature,' in papers subsequently brought before the Society.

At the opening meeting on November 3, of the Session 1852-53, Sedgwick communicated the important paper 'On the separation of the Caradoc Sandstone into two distinct groups, the "May Hill," and the "Caradoc."'

This was duly sent to a referee, and considered at a meeting of the Council on December 1, 1852; present: William Hopkins (president), Dr. Bigsby, Sir R. I. Murchison, Mr. Horner, Mr. Smyth, Professor Ansted, Mr. Greenough, Mr. Austen, Mr. Hamilton, Mr. Sharpe, Mr. Bowerbank, Mr. S. V. Wood.

That all possible consideration was given to Sedgwick may be judged from the following Council Minutes:—

> Professor Sedgwick's paper on the separation of the May Hill and Caradoc Sandstones into two distinct groups was ordered to be re-referred, with the view of specially reporting on the propriety of omitting all the controversial portion of the paper.
>
> On January 5, 1853, it was ordered that Professor

been modified by the author, was ordered to be referred back to the [second] referee, to consider whether the alterations made by the author were satisfactory.

On March 9, 1853, Professor Sedgwick's paper was balloted for and ordered to be printed.[1]

Sedgwick remarked that 'the paper was opposed by all who took part in the discussion; but they all allowed the importance of the paper, if our statements were correct.'[2]

As a matter of fact, it settled the question as to the true base of Murchison's Upper Silurian and the higher limit of his Lower Silurian—the Upper Cambrian of Sedgwick; and this view of 'the physical break between the Lower and Upper Silurian contended for by Sedgwick' was admitted afterwards by Murchison.[3]

In connection with previous remarks it is interesting to read in a letter on these controversial topics, written to Murchison on October 18, 1853, that Sedgwick said, 'I hope you won't think my last *letter* ill-tempered. If so, set it down to the fiend gout;' and he concluded, 'Ever (whether in peace or war) your affectionate old friend, A. Sedgwick.'[4]

The first part only of a subsequent paper by Sedgwick, 'On the May Hill Sandstone, and the Palæozoic System of the British Isles,' was read before the Society on May 3, 1854. The second part of the paper entered on controverted questions, 'in a conviction of their importance.' Afterwards the entire paper, which was printed in short abstract in the *Quarterly Journal*, was withdrawn by the author and published elsewhere.[5] It cannot be said that Sedgwick was dealt with unjustly on this occasion, more especially as he had communicated during the previous

year to the British Association his matured views 'On the Classification and Nomenclature of the Older Palæozoic Rocks of Britain.' This paper was printed in full, and was regarded as the most important he had brought before the Association.[1]

While Sedgwick's views were thus placed before the geological public, Murchison brought out, in 1854, the first edition of his octavo volume, 'Siluria: the History of the Oldest Known Rocks containing Organic Remains'—a volume that summarised in some ways, and amplified in others, the material of his larger work on the 'Silurian System.' The knowledge of the Lower Palæozoic rocks acquired in all quarters of the globe was dealt with. The secondary title was afterwards appropriately modified into 'A History of the Oldest Rocks in the British Isles and Other Countries.' This work reached a fifth edition in 1872, and organic remains were then admitted to occur not only in Cambrian, but even in Laurentian rocks.

In the first edition of his 'Siluria' (1854, p. 10), Murchison said that if Sedgwick's work 'had been published eighteen years ago, or in 1836, my friend, seeing that his Bala and my Llandeilo rocks were identical, might have proposed (although my fossils were first named and classified) that the Lower Silurian should be merged in the Cambrian.' Sedgwick had, indeed, at one time proposed a compromise, 'that of calling the Bala group Cambro-Silurian. This compromise was rejected by Murchison, and was afterwards withdrawn.'[2] Such a course, if accepted, would have been honourable alike to both disputants.

Thus the matter stood when, at the death of De la Beche, Murchison was appointed director-general of the Geological Survey. Henceforth for many years his grouping was widely adopted in this country and also abroad; a grouping that was extended downwards until it included in the 'Primordial Silurian' the strata with *Paradoxides* at St. Davids, now known as Menevian.

Authorities, however, were not agreed on the nomenclature. Jukes, in 1862, adopted the grouping of Cambrian, Lower or Cambro-Silurian (Lingula Flags to Lower Llandovery), and Upper Silurian or Silurian Proper.[1] At a later date (1871) the Silurian grouping was restricted, and the Cambrian taken to include the divisions from the Harlech to the Tremadoc Beds; a grouping since generally adopted in this country. Nevertheless trouble still continued with regard to the use of the terms Lower Silurian and Upper Cambrian, by the followers of Murchison on the one hand and of Sedgwick on the other.

With the view of cutting the Gordian knot and of putting an end to 'the interminable discussion' by framing a 'scheme of classification which, while it systematises the known facts, holds the balance true with reference to the opposing claims of the two great pioneers' in the study of the Lower Palæozoic strata, Professor Charles Lapworth, in 1879, proposed the term Ordovician, as equivalent to Lower Silurian or Cambro-Silurian, and to include the strata from Arenig to Bala and Caradoc.[2] The results of his brilliant researches on the older rocks of the Southern Uplands of Scotland, whereby he first mastered the stratigraphy of the Moffat region, were communicated to the Society in November 1877; they established his reputation, and gave him title to suggest

That the word Ordovician proved equally unacceptable to the biographers of Murchison and of Sedgwick is well known.[1] Nevertheless, it is recognised generally that this great Protozoic series of Cambrian, Ordovician, and Silurian contains the records of three important faunas, each deserving of separate designation.[2]

Ordovician appeared in the title of a paper published in the *Quarterly Journal* in 1882; it has since been adopted in many essays read before the Society, and more recently in the publications of the Geological Survey.[3]

Sedgwick remarked in 1855 of the Geological Society: 'It was, in its early days, composed of robust, joyous, and independent spirits, who toiled well in the field, and who did battle and cuffed opinions with much spirit and great goodwill;' and he regretted that in after years the discussions, 'while they improved in variety and accuracy of knowledge, became less joyous, less liberal.'[4] Despite the above remarks, which are not wholly inapplicable now, Sedgwick said (1855) for the last two years he had not been present at a single meeting of the Geological Society. 'Not because I wished to be away, or ever feared to do battle for what I thought the truth, against whatever seeming odds; but simply because I was unable to attend the meetings.' The reason why his personal connection with the Society ceased in the year 1854 is more happily and more justly expressed in the above paragraph, than it was at a much later date when he observed that it 'ought to have ended two years sooner.'[5]

Mention should be made of the distinguished palæontologist, Frederick McCoy (1823–99), who assisted Sir

[1] 'Life and Letters of Sedgwick,' p. 555; see also review by Professor T. G. Bonney, *Nature*, July 10, 1890, p. 242: Sir A. Geikie, 'Text-Book

Richard Griffith in Ireland, and worked with Sedgwick in the Woodwardian Museum at Cambridge during the years 1846–50, till he became professor of Geology in Queen's College, Belfast. In 1854 he was appointed professor of Natural Science in the University of Melbourne, and in course of time was recognised as the leading naturalist in Australia. He was created K.C.M.G. in 1891.

The Rev. W. B. Clarke (1798–1878), to whom reference has already been made (p. 130), settled in New South Wales in 1839, and laboured so ardently and successfully at the geology of the country, that he came to be designated 'the Father of Australian Geology.' He was 'the first explorer who proclaimed the probable auriferous riches of Australia on true scientific grounds—that is, by obtaining gold *in situ*, and tracing its parent rocks.' [1]

[1] Geikie, 'Life of Murchison,' vol. ii. p. 135.

CHAPTER XII

THE SOUTHERN UPLANDS AND THE NORTH-WEST HIGHLANDS OF SCOTLAND

WORK IN NORTH WALES, THE LAKE DISTRICT, AND THE SOUTHERN UPLANDS OF SCOTLAND — J. CARRICK MOORE — HARKNESS — H. A. NICHOLSON — WORK IN THE NORTH-WEST HIGHLANDS — C. W. PEACH AND THE DURNESS FOSSILS — MURCHISON AND JAMES NICOL — MURCHISON AND GEIKIE — LAPWORTH AND THE 'SECRET OF THE HIGHLANDS' — METAMORPHISM — GODWIN-AUSTEN ON COAL-MEASURES — RAMSAY ON PERMIAN BRECCIAS — COUNCIL, 1857 — MILITARY AND NAVAL GEOLOGISTS — CHARLES MOORE AND OTHERS ON RHÆTIC BEDS — ABSTRACTS OF PROCEEDINGS

FROM about the years 1846 to 1853 A. C. Ramsay and W. T. Aveline, and during great part of the time, A. R. C. Selwyn and J. B. Jukes, were vigorously engaged in the Geological Survey of North Wales.[1] Other Fellows of the Society were occupied in the study of the older rocks of the South of Scotland. Among these John Carrick Moore (1805–98), who became a Fellow in 1838, was a nephew of Sir John Moore, of Corunna, an active member of Council, and for many years a familiar figure at the meetings of the Society, where his spare form, habited like a beau of the early part of the nineteenth century, served to recall those good old times. He inherited from his father the estate of Corsewall in the northern part of the Rhinns of Wigtownshire, near Stranraer. Early in life he began to study the rocks in that picturesque region; there, in 1840, he discovered graptolites,[2] and gradually he extended his labours over the district of Carrick. Both Sedgwick and Lyell visited the area, and the former gave

[1] For many interesting reminiscences of their work, see 'Letters,' &c., of J. B. Jukes, 1871.

[2] *Proc. Geol. Soc.* iii. p. 277.

such an animated description of the Girvan strata, at the meeting of the British Association at Edinburgh in 1850, that Murchison (with his friend James Nicol), hastened away to investigate the ground. The results appeared in a memoir on the 'Silurian Rocks of the South of Scotland,' a work 'characterised throughout by all Murchison's keen geological insight, comprehensive grasp of detail, and brilliancy of generalisation.'[1]

James Nicol (1810–79), to whom reference has already been made (p. 167), had been a pupil of Jameson. After holding a geological professorship for four years at Cork, he was appointed in 1853 to the chair of Civil and Natural History in Marischal College, Aberdeen. Meanwhile he had, in 1844, published an excellent 'Guide to the Geology of Scotland.'[2] His heart, indeed, was ever in his native country, and during the years 1848–54 he made observations on the Lower Palæozoic rocks of the Southern Uplands.

Other workers were attracted to this district, as well as to the Palæozoic regions of the Lake District. One of these was Robert Harkness (1816–78), a Lancashire man, who was educated at Dumfries and at Edinburgh University. In 1853 he succeeded James Nicol in the chair of Geology at Queen's College, Cork, and worked at Irish geology in expeditions made to Dingle, to Connemara, and the Giant's Causeway. He devoted some attention to the schistose rocks of the Scottish Highlands, but became particularly interested in the New Red rocks of Dumfries and the Vale of Eden, and likewise in the older rocks of the Southern Uplands and of Cumberland and Westmorland. Of him Sir A. Geikie wrote: 'Who that has been privileged with his friendship will not cherish the memory of his earnest-

never absent from the platform of Section C at the British Association meetings, always ready to rise among the speakers there, and to reappear at the festive gatherings in the evening?'[1]

It should not be forgotten that to the Rev. J. G. Cumming (1812–68) we were indebted for admirable papers on the geology of the Isle of Man, as well as for a separate work on the island published in 1848. Many years later Mr. G. W. Lamplugh has remarked on 'the acumen and thoroughness which distinguish all the work of this investigator.'[2]

Another labourer in some of the same fields was Henry Alleyne Nicholson (1844–99); a man of great acquirements, untiring industry, and withal such charm of character, that it was good to be in his company. He began his geological career with an essay on the 'Geology of Cumberland and Westmorland.' After taking many university honours, and filling a variety of collegiate posts—in the Medical School at Edinburgh, in Toronto, in Durham College, and at St. Andrews, he became Regius professor of Natural History at Aberdeen. To the geology of his native country, the Lake District, Nicholson returned again and again, working in earlier years with Robert Harkness, and afterwards with Dr. J. E. Marr. The later researches of these observers on graptolite zones and on the evidence of recurrent faunas in Lower Palæozoic times, have since been reviewed by Mr. Hudleston.[3]

As early as 1866–67 Mr. T. McKenny Hughes, while engaged on the Geological Survey, made notable additions to our knowledge of the Silurian and older rocks of Kirkby Lonsdale and Horton-in-Ribblesdale. He succeeded Sedgwick in 1873 as Woodwardian professor of Geology at Cambridge.

[1] *Nature*, October 10, 1878. The name of Professor Harkness is now associated with certain scholarships for men and women at Cambridge.

[2] 'Geology of the Isle of Man,' *Mem. Geol. Survey*, 1903, p. 19.

[3] Address to Geol. Soc. 1894.

Despite all that was done by these active workers, and by the Geological Survey in its earlier examination of the Southern Uplands, there remained much to be unravelled, and, as proved later on by Professor Lapworth, it was only by tracing out the palæontological zones that the true sequence and structure of the convoluted Moffat rocks could be determined. His masterly paper on that subject has already been referred to (p. 187). It was followed by an equally elaborate memoir on 'The Girvan Succession,' read before the Society in June 1882.[1]

While Cornwall, as already mentioned, presents geological difficulties perhaps as great as in any part of Britain, yet in the Scottish Highlands the difficulties of complexity of structure are augmented by the arduous character of the work. In the North-west Highlands especially, the red sandstones, now known as Torridonian, the quartzites, the limestones, the large tracts of gneiss and crystalline schists, have formed a battle-ground on which, both as regards structure and age, the most contrary opinions have been expressed.

The Torridon Sandstone, though regarded by Macculloch as a Primary formation, was held by others to be Old Red Sandstone; and the opinion was also put forward that some areas of the Sandstone were Primary, others Old Red Sandstone.

Light began to dawn when, in the winter of 1854–55, Charles Peach, then resident at Wick, happened to be at Durness, and 'observed a weathered fossil in a dyke on the roadside; this was enough for his penetrating eye; he immediately set to work,' and soon obtained *in situ* a most important series of fossils. They were not well preserved, and were at first thought to resemble *Clymenia* and *Goniatites*. Hence arose the suggestion that the

limestone was probably newer than Silurian, perhaps Devonian, or possibly Lower Carboniferous.[1]

It was not until December 1, 1858, in a paper read before the Society by Murchison, that the Durness fossils were described and figured by Salter, who identified several species of *Orthoceras*, the heteropod *Maclurea*, and other forms of Lower Silurian type and American facies.

Particulars of Peach's original discovery, as above quoted, were given in a paper read before the Society on December 15 by John Miller, of Thurso, who recognised the distinction between the purple sandstones of Cape Wrath, then regarded as Cambrian, and the Old Red Sandstone in the neighbourhood of Tongue. John Miller was in form perhaps the stoutest Fellow ever elected into the Society; his medial circumference was so great that he could only sit on the end seat of any one of the benches in the meeting-room, and when on departing he attempted to occupy a four-wheeled cab, and finally obtained entry with a rush, it became an unsolved problem how he ever made exit again. Familiarly known as 'Huge Miller,' he was a good-natured, cheery geologist.

As in the case of the Cambro-Silurian question, there arose a great Highland controversy, in which blows were exchanged at times with equal disregard of personal sensibilities.

Sir Archibald Geikie has given some interesting reminiscences of the Glasgow meeting of the British Association in 1855, when the geologists mustered strongly, and Murchison, who was again president of Section C, read a paper on the relations of the crystalline rocks of the North Highlands. Then Sedgwick 'came up once more among his Northern brethren of the hammer,' and

exclaimed, "Oh, I'm not going to fight him!" The smile passed at once into a good laugh and general applause through the room.'[1]

The discussion was on the true place of the crystalline rocks that were found to overlie the Durness rocks; and Sedgwick supported his old associate with regard to the relative antiquity of the limestones and the red conglomerates.

The progress of knowledge in the mountainous region of Sutherland was naturally slow, and so long as no one realised the possibility of a flaw in the sequence, it is not surprising that all were misled by the seemingly clear succession, above the fundamental gneiss, of lower quartzite, Durness limestone and upper quartzite, passing into a newer series of flaggy gneisses and schists.

James Nicol was the first to perceive some of the main features in this region of great disturbance. He had worked with Murchison until 1855, and afterwards he laboured independently, examining the ground year after year, until in 1859 he brought his matured views before the British Association at Aberdeen, and elaborated them in a paper read before the Geological Society in December of the following year. A great contest took place at the Aberdeen meeting, with Murchison supported by Ramsay on the one side, and Nicol on the other. Nicol maintained that the upward succession was from the Highland gneisses and schists; that these were overlain unconformably by Torridon sandstone, and again by the Durness quartzites, fucoid beds, and limestones. Moreover, he pointed out that abnormal appearances of sequence, in the 'Upper' quartzite and 'Newer' schistose rocks, were repetitions due to great foldings and displacements with upcast or overthrow faults, whereby older had been forced over

his wonted ardour, he determined in the course of 1860 to go again over some of the debatable ground. On this occasion, which was in fact his last great expedition in the field, Murchison was accompanied by Sir A. Geikie, who has told of the keen enthusiasm and the remarkable endurance in the rough mountain district of his old chief, then in his sixty-ninth year.[1] The results of their observations were brought before the Society in February 1861; and in an appendix to this paper Murchison drew attention to what he conceived to be inaccuracies in the lately published sections of Nicol. To these criticisms Nicol made reply in a note appended to his next paper, which dealt with the Southern Grampians, was read on June 18, 1862, and published in May 1863. The Council ordered the paper to be printed in full, but without the note. This was not an unjust decision when it is remembered that the paper by Murchison and Geikie referred directly to the area in dispute, whereas that of Nicol related to another portion of the Highlands. In his 'Geology and Scenery of Scotland,' published in 1866, Nicol, however, took the opportunity of making a final reply to his 'illustrious opponent—from whom only the most thorough conviction that [his] views were well founded, and that the question was one on which it became a teacher of geology in Scotland to give no uncertain utterance, could have compelled [him] to differ.'

In later years, commencing in 1878, Dr. Henry Hicks, Professor Bonney, Dr. Charles Callaway, and Mr. Hudleston, grappled from time to time with some of the problems in the Scottish Highlands; and in 1882 Professor Lapworth commenced to study in detail the somewhat bewitching region of Durness and Eriboll, with the aid of six-inch maps. In a series of articles, commencing in March 1883, he described and illustrated the facts which gave the clue to 'The Secret of the Highlands.' His observations had led him to believe 'that we have in the so-called metamorphic Silurian region of the Highlands of Scotland a portion of

[1] 'Life of Murchison,' vol. ii. p. 230.

an old mountain system, formed of a complex of rock formations of very different geological ages. These have been crushed and crumpled together by excessive lateral pressure, locally inverted, profoundly dislocated, and partially metamorphosed.' At the same time, while he regarded the disproof of the ascending series of Murchison as a triumph for Nicol, yet, as might be expected, the truth with regard to all points of structure was by no means wholly on one side.[1]

In November 1884, Sir Archibald Geikie announced that the results of the detailed mapping by the Geological Survey, commenced in the previous year in Sutherland, had convinced him that the stratigraphical sequence above the Durness limestone, contended for by Murchison, was no longer tenable.[2]

When informed, after the Aberdeen meeting of the British Association in 1885, of Professor Judd's appreciation, in his address to Section C, of the work of James Nicol, his widow quietly and with quaint humour replied, 'I knew well James would be right.'[3] Thus happily was the Highland controversy closed in regard to the main points at issue.

Three years later the conclusions attained by the Geological Survey in the intricate region between Durness and Assynt were communicated to the Society, in a memoir containing a lucid exposition of the extraordinary geological structures, and an historical account of previous researches on the subject.[4] The subsequent discovery of the *Olenellus*-zone in the fucoid beds of Durness, brought before the Society in 1892, fixed their age as Lower Cambrian.[5]

The presence of reversed faults, producing great

[1] *Geol. Mag.* 1883, pp. 121, &c., and *Proc. Geol. Assoc.* viii. p. 441.
[2] *Nature*, xxxi. November 1884, p. 29.

horizontal displacement, had been proved in the Somersetshire coalfield, where the Radstock 'overlap-fault' was described in 1864 by G. C. Greenwell and James McMurtrie. Considerable inversions had been recognised long previously in the regions of Abberley and Malvern by Murchison and John Phillips; but in this country no such vast displacements as the thrust-planes, now determined in the structure of the North-west Highlands, had hitherto been suspected.

Regional metamorphism, attributed 'to the dynamical and chemical effects of mechanical movements acting alike on crystalline and clastic rocks,' now became an interesting study, and 'pressure metamorphism,' as apart from 'contact metamorphism,' attracted much attention.[1]

The debates at the Geological Society have naturally been more animated and more interesting when controversies have arisen, than in the cases when undisputed facts and conclusions have been brought before the meetings. Pengelly has told that when the great paper by Godwin-Austen 'On the Possible Extension of the Coal-Measures beneath the South-Eastern Part of England' was read on May 30, 1855, 'the author was by no means spared, as the various speakers expressed themselves freely. This part was extremely interesting, not only on account of the remarks made, but also because it gave me an opportunity of seeing and hearing many eminent men, as Lyell, Murchison, Colonel Portlock, Sharpe, Smyth, Prestwich, Morris, &c. Daubeny and Percy were also there, but did not speak.'[2]

Ramsay's paper on the Permian breccias and probable

a tumble-down house will give plenty of them; and then as to old localities for the fragments, independently of not having cakes which have been eaten, who the dickens, in such places, can say what rocks are beneath the sprawl of New Reds?'[1] Here it is interesting to bear in mind the subsequent evidence obtained in India, South Africa, and Eastern Australia, which in Dr. W. T. Blanford's opinion has justified the belief in extensive glaciation towards the close of the Palæozoic era.[2]

In February 1857, when the Geological Society had been established fifty years, Colonel Portlock was *President*; with Godwin-Austen, William Hopkins, Horner, and Murchison, *Vice-Presidents*; R. W. Mylne and W. W. Smyth, *Secretaries*; W. J. Hamilton, *Foreign Secretary*; J. Prestwich, *Treasurer*; and S. H. Beckles, Daubeny, the Earl of Ducie, Falconer, T. F. Gibson, Colonel H. James, Lyell, N. S. Maskelyne, J. Carrick Moore, Owen, S. R. Pattison, S. P. Pratt, A. C. Ramsay, and Alfred Tylor, other members of *Council*.

Dr. Falconer, who had left India in 1855, now began to take a prominent part in the affairs of the Society.

Thomas Field Gibson (1803–90), who served on the Council for a few years, was a patron of geology; a silk manufacturer in London, with a country house at Sandown in the Isle of Wight. That home was a frequent meeting-place of geologists, amongst whom were Fitton, De la Beche, and Edward Forbes.

The legal adviser at this time was S. R. Pattison (1809–1901), a solicitor, formerly of Launceston, who had done good geological work in Cornwall. Often consulted on matters of law, he was ever ready to give his services to the Society.

At the close of 1857 the total number of Fellows was 811, and of honorary and foreign members 70.

have been taken of the circumstance. Even the Geological Society Club had no special gathering: eleven members and one visitor were present on November 18, namely, Portlock, Bigsby, Colonel James, T. F. Gibson, Smyth, Mylne, Percy, Prestwich, D. Galton, Murchison, and Professor H. D. Rogers; and the only record of their proceedings is in the statement that five bottles of ale, six of soda, two of seltzer, seven of sherry, and two of port, likewise tea and coffee, were consumed [1] (see p. 204).

It may be remarked that, notably among military men, the new president, Colonel Portlock, had early recognised the value of geological science in his profession.[2] De la Beche, Murchison, and Lonsdale had been educated for the army; and the two latter had seen active service, Murchison at Corunna and Lonsdale at Waterloo, experiences which, apart from warfare, were probably helpful in their subsequent studies of physical features.

Frederick Wollaston Hutton (1836–1905), when lieutenant in the 23rd Royal Welsh Fusiliers, served with distinction in the Crimea and at Lucknow. In 1860 he entered the Staff College, Sandhurst, and wrote an essay on the 'Importance of a Knowledge of Geology to Military Men.'[3] Retiring from the army in 1865, he emigrated to New Zealand, and ultimately became curator of the Museum at Christchurch, New Zealand. He was distinguished for his zoological and geological researches. He came to England in 1905 after an absence of nearly forty years, and on one occasion dined as the guest of the Geological Society Club. Unfortunately he did not survive the homeward voyage to New Zealand.

Mr. T. Rupert Jones was appointed, in 1858, lecturer, and in 1862 professor, of Geology at the Royal Military College, Sandhurst, and subsequently also at the Staff College, until, in 1882, the authorities no longer deemed

[1] It is probable, as Professor Bonney informs us, that the ale and soda

it necessary to maintain a geological professor. For many years, however, he taught the relations of geology to topography, to questions of sanitation, and water-supply. To such matters, often of vital importance to an army in the field, Professor W. W. Watts has recently drawn attention, urging especially the military importance of acquiring a good 'eye for a country.'[1]

Naval men have not devoted so much attention to geology; perhaps, as General C. A. McMahon once remarked, because it has always been their duty to try and avoid rocks.

Nevertheless Sir John Franklin served on the Council in 1830–31; and he had a few years previously taken his first lessons in geology from Fitton and Webster, at the Society's Museum. Captain F. Marryat, R.N., became a member of the Society in 1817, but resigned five years later. He had meanwhile been elected F.R.S., but is no doubt better known as the author of 'Peter Simple' and 'Mr. Midshipman Easy.' Captain (afterwards Rear-Admiral Sir Francis) Beaufort, the distinguished hydrographer, was early elected an honorary member of the Geological Society. These Officers, however, made no geological communications to the Society.

A notable exception should be mentioned, in Captain (afterwards Vice-Admiral) Thomas Abel Brimage Spratt (1811–88), who was a member of Council in 1866–67. He served on board the 'Beacon' during the years 1841–43, when Edward Forbes was naturalist, and together they studied the bathymetrical distribution of marine life. Captain Spratt brought before us geological observations on some of the islands and shores of the Mediterranean and on the delta of the Nile. To him we owe the discovery of the remains of the pigmy elephant in Malta. His 'Travels and Researches in Crete' were published in 1865.

Fifty years ago Sir Archibald Geikie communicated to the Geological Society his first paper, on the geology of

[1] Address to Geol. Section, Brit. Assoc. Southport, 1903.

Strath, Skye; and to that fascinating region he has returned again and again, giving his attention more particularly to the volcanic phenomena of this and other of the Inner Hebrides. In the identification of the fossils, which in his first expedition he collected from the Lias of Skye, Pabba, and Scalpa, he was aided by Dr. Thomas Wright, who marked out the successive zones that were represented.

Wright afterwards made known the existence in south-western England of the zone of *Avicula contorta*; and this formation, previously grouped as the Lias bone-bed, was further elucidated by Charles Moore, who introduced into this country the use of the name *Rhætic*, and figured and described many of the fossils of that formation.

In consequence of these researches H. W. Bristow and Robert Etheridge, of the Geological Survey, made a special examination of the Rhætic Beds in the West of England and in South Wales; and the results were briefly notified in 1864. Murchison manifested so much interest in the subject that he visited Penarth with Bristow, and besought him to find the *Avicula contorta*. This he succeeded in doing. Then considering it desirable that a name borrowed from a British locality should be used on the Geological Survey map, Murchison suggested that the term Penarth Beds be adopted for the equivalents of the Rhætic formation.[1]

A little later some controversy arose on the age of certain conglomeratic limestones on the Glamorganshire coast near Bridgend. Edward Bernard Tawney (1841–82), whose brief career 'was an admirable instance of successful work achieved in spite of a frail and suffering frame,' brought before the Society in 1865 a paper on the western limit of the Rhætic Beds in South Wales. He then expressed the view that the so-called 'Lias conglomerate' of Sutton and Southerndown near Bridgend was of Rhætic age. This view (ultimately abandoned by Tawney) was contested in papers read in March 1867 by H. W.

[1] *Geol. Mag.* 1864, p. 238.

Bristow and Charles Moore, and in May of the same year by Ralph Tate. The publication of Moore's paper was delayed until the end of the year, whereas Bristow's paper was issued in the August number of the *Quarterly Journal*. The postponement of his paper was a cause of much chagrin to Moore; nevertheless it was an elaborate essay of 120 pages, with four plates of fossils, the most important of his contributions to the *Journal*, and according to an editorial note it was 'unavoidably deferred.' Unfortunately Moore misapprehended the cause of delay, and complained that his paper had been deferred until one of the Geological Survey staff 'had been sent down to examine and report.'[1] As a matter of fact, Bristow's field-work in the district was carried out in the summer of 1866, at least six months before Moore's paper was read before the Society.

In connection with Murchison's visit to Penarth, it is interesting to note that in 1870 Sedgwick paid a visit to Bath, and was keenly interested in seeing the fine Rhætic section on the Midland Railway at Weston, under the guidance of the Rev. H. H. Winwood.[2]

The present form of Abstracts of the *Proceedings of the Geological Society* dates from May 20, 1857, when No. 1 was issued. The gratuitous circulation of monthly Abstracts both to resident and non-resident Fellows was at first undertaken, but some modifications in the method of publication and distribution have been made from time to time. In 1882 the Council announced that the Abstracts were to be paged continuously, and furnished with title-page and index, so that when complete they might be sold to the public. Nevertheless, the separate numbers were not regarded strictly as publications. Now and again they contained abstracts of papers that were subsequently withdrawn by the author, so that the title only

[1] 'Charles Moore, F.G.S., and his Work,' by the Rev. H. H. Winwood. *Proc. Bath Nat. Hist. Soc.* vii. 1892, p. 247.

[2] *Op. cit.* p. 31.

was printed in the *Quarterly Journal*, and publication could not be recognised unless such abstracts were printed in the *Philosophical Magazine*, the *Geological Magazine*, or other periodical. In 1905 the Council decided that each number of the Abstracts be technically published, and the price was fixed at *6d.*

As an addendum it may be mentioned that the visitor at the Geological Club dinner on November 18, 1857 (see p. 200), was Professor W. B. Rogers, brother of Henry D. Rogers. He stated in a letter to his wife, dated London, November 20, 1857:

'I have now been nearly two weeks in this vast wilderness of men, and am beginning to enjoy some of its noble opportunities for scientific intercourse. On Wednesday I had a delightful dinner with the Geological Club from 5.30 to 8, when we proceeded to the meeting. There, after a paper by Phillips, we had a long abstract on American Geology by good old Dr. Bigsby, which called up Henry and myself as well as Murchison and others, making the meeting a very animated and interesting one.'[1]

[1] 'Life and Letters of William Barton Rogers,' edited by his Wife, vol. i. 1896, p. 382.

CHAPTER XIII

ANTIQUITY OF MAN. PALÆONTOLOGICAL NOMENCLATURE

ORMEROD'S INDEX—THE 'GEOLOGIST' AND THE 'GEOLOGICAL MAGAZINE'—THE GEOLOGISTS' ASSOCIATION AND SOME PROVINCIAL GEOLOGICAL SOCIETIES—GREENOUGH'S GEOLOGICAL MAP (THIRD EDITION)—BRIXHAM CAVE—FALCONER, PENGELLY, AND BUSK—FLINT IMPLEMENTS—PRESTWICH—SIR JOHN EVANS—LYELL'S 'ANTIQUITY OF MAN'—DARWIN'S 'ORIGIN OF SPECIES'—HUXLEY ON HOMOTAXIS—NOMENCLATURE—PHYLOGENY AND HOMŒOMORPHY

AFTER having thus far dealt rather fully with the first fifty years in the history of the Geological Society, it will be expedient to treat as briefly as possible the later history. Reference will therefore be made only to some of the main incidents, in chronological order as they arose, with such supplementary remarks as seem desirable.

For many years Ormerod's 'Classified Index' to the publications of the Society was a much appreciated work of reference. It is still of service as a guide to the papers in the *Transactions* and *Proceedings*, and it is useful also in its general groupings of subjects and localities.

The MS. of the work was prepared and presented by G. W. Ormerod, and the first edition was published in 1858. It was announced in the following year that 'Fifty copies have been sold; but more than one hundred gentlemen entered their names as subscribers, many of whom, however, have not as yet demanded their copies.' Ten years later nearly all the copies had been sold.

Devonshire, living at Chagford, and afterwards at Teignmouth, when the rocks of Dartmoor and the Teign Valley, and the New Red sandstones and breccias of the coast, occupied his attention.

In 1869 the Council received from Ormerod a revised edition of his 'Index;' it was published in 1870, and included references up to vol. xxiv. of the *Quarterly Journal*. Subsequently three supplements were published —in 1877, 1883, and finally in 1890, shortly before the death of the compiler. They brought the references up to vol. xxxviii. In connexion with this Index the following work should be mentioned:—

Boston Public Library.—Bibliographies of special subjects originally published in the Bulletins of the Library.—No. 4. 'Classified Index to the Maps in the Publications of the Geological Society of London, 1811–85,' by Richard Bliss, librarian of Redwood Library, Newport, Rhode Island, 1887 (Boston: Printed by order of the Trustees).

In 1858 S. J. Mackie, a Fellow of the Society, who resided for some years at Folkestone, commenced the publication of *The Geologist; a Popular Monthly Magazine of Geology*. It proved to be a useful journal for the discussion of geological questions, and it contained an admixture of important original articles with others of a popular character. Six full volumes were published, but the work came to an end with the seventh volume in June 1864.

At that date it was superseded by *The Geological Magazine, or Monthly Journal of Geology; with which is incorporated 'The Geologist,'* edited by two Fellows of the Society, Professor T. Rupert Jones, assisted by Henry Woodward. In July of the following year Professor Jones retired from the chief editorship, and the magazine

number of the magazine—in all more than 500—has been arranged and edited by him.

After the publishers of the *Geologist* had parted with their magazine, Mackie commenced *The Geological and Natural History Repertory, and Journal of Prehistoric Archæology and Ethnology.* It existed for three years, 1865–67, but one volume only was published.

In 1858 the Geologists' Association was formed, through the influence of several of our Fellows, notably the Rev. Thomas Wiltshire, Professor James Tennant, and S. J. Mackie, with support from others interested in geological science. J. Toulmin Smith, an authority on Chalk sponges, was chosen as the first president. One of the original objects was to afford means for the cultivation of geology by mutual help.[1] By the papers read, and by the numerous excursions made to various parts of the British Isles, and occasionally abroad, the Association has done immense service in spreading a knowledge and love of geological science. It celebrates its jubilee next year.

In 1859 the Liverpool Geological Society was instituted; largely through the exertions of G. H. Morton (1826–1900), an ardent local worker, and a pioneer in the study of the distribution of the Carboniferous Limestone fossils of North Wales. In 1860 the Glasgow Geological Society was formed by John Young—afterwards keeper of the Hunterian Museum at Glasgow—supported by Professor H. D. Rogers, Dr. James Bryce, and subsequently by the Rev. H. W. Crosskey, and others.

The Norwich Geological Society was founded in April 1864 by the Rev. John Gunn, a Fellow of the Society, and J. E. Taylor. It existed for twenty years, when it was appropriately merged in the Norfolk and Norwich

Hull Geological Society was founded in 1888, and has flourished with the aid of the Rev. E. M. Cole, Mr. J. W. Stather, and Mr. T. Sheppard.

In 1864, in London, a Junior Geological Club was started by several Fellows of the Society, including P. Martin Duncan, Alfred Tylor, Robert Etheridge, Henry Woodward, T. Rupert Jones, Harry G. Seeley, C. Carter Blake, H. M. Jenkins, and George E. Roberts. The Club, which met at the Rainbow Tavern, ceased to exist before the close of the following year.

In 1858 the Council of the Geological Society appointed a special committee to revise the Greenough Geological Map. It comprised Murchison, Colonel [afterwards Sir] H. James, R. W. Mylne, Godwin-Austen, Prestwich, Morris, the president (John Phillips), and the secretaries (T. Davidson and W. W. Smyth). Revisions were made by Murchison, Phillips, Prestwich, and Godwin-Austen, and 'a very large proportion of the improvements and corrections' were taken from the published maps of the Geological Survey. This third edition of Greenough's Map was published in 1865, and, as will be seen from the title, which was as follows, the original work of William Smith was more adequately acknowledged: [1]

A Physical and Geological Map of England and Wales, by the late G. B. Greenough, Esq., F.R.S., F.G.S., on the basis of the original Map of William Smith, 1815. Revised and improved under the superintendence of a Committee of the Geological Society of London. Size, 84 inches by 63; scale, 6 miles to 1 inch. Price of the complete Map in sheets, to Fellows of the Society, 2*l.* 2*s.*

In January 1858 discovery was made of the now famous bone cave, at Brixham, in Devonshire. It was soon afterwards visited by William Pengelly, and on May 12 Hugh Falconer brought the subject before the Council of the Geological Society. From a personal examination he expressed his belief that the cave con-

that measures be taken without delay to have the contents thoroughly explored. It was resolved that a copy of Dr. Falconer's communication be transmitted to the director-general of the Geological Survey, 'with a view of ascertaining whether a subject of this nature falls within the province of that department.' The answer was in the negative; but in the end Murchison instructed H. W. Bristow to make an exact plan of the cave, and this was done.

Eventually a grant of 200*l.* from the Royal Society was received, together with donations from Miss (afterwards the Baroness) Burdett-Coutts and others; and a committee of the Society was the same year appointed to direct a systematic exploration of the bone cave, and the expenditure of the money. The committee consisted of Dr. Falconer, chairman and secretary; J. Prestwich, treasurer; Lyell, Godwin-Austen, George Busk, John Percy, Owen, A. C. Ramsay, the Rev. R. Everest, S. H. Beckles, W. Pengelly, together with the president (John Phillips) and the secretaries (T. Davidson and W. W. Smyth). A local sub-committee, consisting of Pengelly, Edward Vivian, and others, was formed to superintend the actual working of the cave. The services of the keen fossil-collector, Henry Keeping (now of the Sedgwick Museum,[1] Cambridge), were also secured. The main scientific exploration was, however, carried out by Pengelly.

The excavations at Brixham had not proceeded very far when Falconer was able to report the occurrence of flint implements in association with the relics of extinct mammalia. The discovery was notified by Pengelly at the British Association in 1858, and brought briefly before a meeting of the Geological Society, by Prestwich, in

William Pengelly (1812–94) will ever be remembered for his enthusiastic labours in connection with Kent's Cavern, Torquay, the detailed exploration lasting nearly sixteen years. He also investigated the lignites and clays of Bovey Tracey, with aid from H. Keeping in the collecting of the plant-remains; and throughout his life he did much to promote a knowledge of geology in Devonshire.[1]

George Busk (1807–86), who in early life was a naval surgeon, became interested in zoology and palæontology, and made a special study of polyzoa. At a later date he turned his attention to the Pleistocene mammalia from caverns and valley deposits, and was for some years a leading authority on the subject.

In a letter written to Prestwich from Abbeville on November 1, 1858, Falconer related how he had been to see the great but neglected collection of Boucher de Perthes, with the view of specially examining the flint hatchets which the latter had procured with his own hands from deposits yielding remains of the mammoth. The discoveries of Boucher de Perthes had been announced in 1846, but his views had been met with ridicule and discredit in his own country. In April 1859 Prestwich, who was joined by Mr. (now Sir) John Evans, visited Abbeville.[2] The results were of paramount importance in the history of geology, inasmuch as they fully confirmed the contention of Boucher de Perthes, that rudely worked flint implements occurred with remains of extinct mammalia in undisturbed beds of valley gravel. No time was lost in making known these conclusions. Prestwich read a paper before the Royal Society on May 26, 'On the Occurrence of Flint Implements, associated with the Remains of Animals of Extinct Species in Beds of a late

same year, brought before the Society of Antiquaries his memoir on 'Flint Implements in the Drift: being an Account of their Discovery on the Continent and in England.'[1]

While introducing what to many individuals appeared a startling discovery, it was shown by reference to previous literature that the actual facts were not new, though their significance was now for the first time understood and appreciated. Sir John Evans reproduced two plates of flint weapons that had been found at Hoxne, in Suffolk, and brought before the Society of Antiquaries in 1797 (see p. 4). He figured also a flint implement dug up in the later part of the seventeenth century in Gray's Inn Lane, London, where also remains of an elephant had been found. These are preserved in the British Museum. Prestwich, also, drew attention to the fact that about the year 1830 the Rev. John McEnery, a Roman Catholic priest residing near Torquay,[2] had made explorations in Kent's Hole, and obtained worked flints, of rude form, which he supposed to have been used as arrowheads and knives. With these he had also collected remains of mammoth, rhinoceros, bear, and hyæna.

Research was stimulated in all directions, and one of our Fellows, James Wyatt, of Bedford, was especially successful in his discoveries in the Valley deposits of the Great Ouse. Prestwich, in 1861, brought before the Geological Society an account of further discoveries of flint implements, and gave a list of localities that should especially be searched. Among other places he mentioned Axminster, near which town so many fine chert implements were in after years discovered. John Wickham Flower, at a later date, drew attention to the occurrence

[1] *Archæologia*, xxxviii. 1860; and second memoir, 1862.

[2] McEnery died in 1841. His MSS. were long lost or overlooked, but

of flint implements in the neighbourhood of Thetford and Santon Downham.

Lyell, as might be expected, was intensely interested in the new discoveries; he made many expeditions to study the facts on the ground, and diligently set to work on his 'Antiquity of Man.' In February 1863 he published the first edition of this work, and so much public attention did it attract that a second edition was issued in April, and a third in November of the same year. The fourth edition was not published until 1873. Sir John Lubbock (now Lord Avebury) also took particular interest in the study of Early Man, and produced in 1865 his 'Prehistoric Times,' of which several editions have been issued.

The publication of Lyell's 'Antiquity of Man' roused some indignation on the part of Falconer and Prestwich, who ventilated their views in the *Athenæum* for April 1863. They felt that Lyell's 'treatment of the history of the subject was in important respects so meagre that the labours of the original investigators were not made manifest.' The criticisms were not without justification, although, as remarked in the 'Life' of Prestwich, 'Lyell was naturally regarded as the judge who could better than any other geologist sum up the evidence and place it clearly and intelligibly before those who had no special scientific knowledge.'[1] He had, it is true, personally studied the evidence, and in the end he recast and amplified, to the satisfaction of all, his history of research among cavern and river deposits.

Special interest in the origin and antiquity of man had naturally been created by Darwin's 'Origin of Species,' published in 1859, a volume which had led to a revolution in the views on this subject; and Huxley, in referring

deposits, he discussed the Glacial period in reference to man's appearance in Europe, and the origin of species as bearing on man's place in nature.[1] Huxley followed with a separate work on the 'Evidence as to Man's Place in Nature' (1863).

These, indeed, were stirring times, both as regards evolution in general and the age and origin of man. The animated debates at scientific meetings, and the discussions in the public press, were humorously summed up, in 1863, in 'A Report of a Sad Case recently tried before the Lord Mayor, Owen *versus* Huxley, in which will be found fully given the merits of the great recent Bone Case.'[2]

The question of a type of flint implement earlier and ruder than the palæolithic, and since termed eolithic, was brought before the Society in 1889 and 1891 by Sir Joseph Prestwich, who called attention to the remarkable discoveries made by Mr. Benjamin Harrison, of Ightham, of these enigmatic implements. The higher antiquity assigned to these specimens, and the artificial designing of many of them, although supported by a number of authorities, including Dr. H. P. Blackmore, have been disputed by others, amongst whom are Sir John Evans, and our Foreign Correspondent, Professor Marcellin Boule.[3]

Huxley, who became a Fellow of the Society in 1856, and secretary in 1859, was requested in 1862 to prepare the Anniversary Address in the unavoidable absence abroad of the president, Leonard Horner. He then delivered his famous address on 'Contemporaneity and Homotaxis' (similarity of order); and dealt also with the meagre evidence then afforded by the geological record of pro-

and in zones of elevation and depth, and from the time necessary for migration, that similarity of forms in distant deposits cannot be taken as proof of synchrony.

Of this discourse Lyell said: 'I never remember an address listened to with such interest or received with such applause, though there were many private protests against some of his bold opinions.'[1] It is generally admitted that Huxley carried his argument too far in respect to the difficulties of correlation; and Dr. J. E. Marr has since maintained that the time taken for the migration of forms is short compared with the period during which they existed, so that the strata containing similar faunas may truly be spoken of as contemporaneous and not merely as homotaxial.[2] The evidence, however, that has been gathered tends to show that approximate, rather than rigid, correlation is all that can be expected. The researches carried on by one of our Fellows, Professor H. Shaler Williams, among the Devonian rocks in America, prove that there has been transgression of one fauna over another, thus indicating that the limits of a formation founded upon sudden change in the fossil contents cannot be regarded as synchronous for two parts of even the same province.[3]

The subject of nomenclature at an early date occupied the attention of the members of the Geological Society (see p. 23), and has since been fully discussed in the volumes issued by the International Geological Congress. It is now admitted that, as regards geological formations and epochs, a dual nomenclature is necessary. Local names, such as those introduced by William Smith, are needed in all countries for the main stratigraphical divisions; while chronological terms, which cannot be restricted within the limits of stratigraphical divisions,

[1] 'Life of Lyell,' vol. ii. 1881, p. 356.

[2] 'The Principles of Stratigraphical Geology, 1898, p. 51; see also W. T. Blanford, Address to Geol. Soc. 1889.

[3] 'The Correlation of Geological Faunas: a Contribution to Devonian Palæontology,' Bulletin No. 210, U.S. Geol. Survey, 1904; and F. R. Cowper Reed, *Geol. Mag.* 1907, p. 228.

are necessary to co-ordinate the life-history, and enable us to correlate formations.[1]

The nomenclature of species, on the other hand, is not in such a condition as to promote geological peace of mind. More than sixty years ago, when a committee of the British Association, with H. E. Strickland as reporter, was appointed to consider the rules of zoological nomenclature, comments were made on the 'anarchical state of their science' with respect to names of genera and species.[2] Since that time it can hardly be said that the confusion has become less confounded.

Modern palæontological nomenclature is based on the binomial system, introduced in the tenth edition of the 'Systema Naturæ' of Linnæus (1758–59). The 'law of priority' is regarded as its fundamental maxim; and a great impetus towards an ultimate fixity of names on this basis has been given by the indefatigable labours of Mr. C. Davies Sherborn, in his 'Index Generum et Specierum Animalium.' This, however, has not proved an unmixed blessing, as names zoological and palæontological have been changed and changed again, often beyond recognition by the ordinary student. To those who are not devoid of sentiment it appears serious that the historical landmarks are one by one removed or obliterated, and associations are lost, while a great burden is put on those who require to translate modern names into intelligible form.

In addition to this, the study of phylogeny has naturally become of absorbing interest to the palæontologist, and has led to a subdivision of genera and species, necessary in the process of research, but appalling to most brethren of the hammer.

In his address of 1893 Mr. Hudleston commented on the terrible tax imposed on the memory by the pace at

[1] See W. T. Blanford, Address to Geol. Soc. 1889; and J. E. Marr, Address to Geol. Soc. 1906.

[2] The latest rules are the 'Règles Internationales de la Nomenclature Zoologiques adoptées par les Congrès Internationaux de Zoologie,' edited by Professor R. Blanchard, Paris, 1905.

which the evolution in the names of Ammonite-genera was then proceeding. So difficult is it for anyone to grapple with them that we find three or four different generic names to one species in as many text-books. The more the genera and species are divided, the more difficult is it to affix precise names to any specimen; and in the later zonal work it is not infrequent to find a specimen recorded as *near to*, or *conforming to*, or *having affinities with* such and such a species; or, if it be a coral, it may be termed simply a *koninckophyllid cyathophyllum*.

After all, it is but natural that the study of 'pedigree palæontology,' as Mr. Hudleston has termed it, should upset old-fashioned views. Indeed, since palæontologists have come to recognise not only ordinary varieties and mutations, but that there is such a phenomenon as 'heterogenetic homœomorphy,' which 'may occur either at the same geological period or at widely separated intervals,' the woes of the geologist who would like to name his own fossils seem to be almost beyond alleviation.[1] No longer, for instance, would anyone give a Sowerbian name to an Australian ammonite.

We live, it is said, in a transition stage, and if palæontology has for a time become an intricate study of nomenclature, as well as of organisms, the great work that is being achieved by many able and patient workers commands admiration. Moreover, we are assured that there is hope in the far-away future, when all the old names have been unearthed, and no more changes will be required.

[1] 'Palæontology: Invertebrate,' by H. Woods, 3rd ed. 1902, p. 14; see also Jurassic fauna of Cutch, vol. iii. *Mem. Geol. Surv. India*, by Dr. F. L.

CHAPTER XIV

Eozoon Canadense AND THE LAURENTIAN ROCKS. THE OLDER ROCKS OF PEMBROKESHIRE. PETROLOGY

Eozoon Canadense AND THE LAURENTIAN ROCKS—H. B. HOLL—HENRY HICKS AND RESEARCHES IN PEMBROKESHIRE—THE GEOLOGICAL SOCIETY AND THE GEOLOGICAL SURVEY—PETROLOGY—SAMUEL ALLPORT—J. CLIFTON WARD — J. ARTHUR PHILLIPS — THE MINERALOGICAL SOCIETY—VOLCANIC ROCKS OF SKYE—NOMENCLATURE OF ROCKS—EARTHQUAKES—COSMOGONY—GEOLOGICAL TIME

IN 1858 Dr. T. Sterry Hunt 'argued from the chemical characters of the Laurentian rocks the probability of the existence of organic life at that early period.' Five years later Sir William Logan figured in his 'Report on the Geology of Canada' (1863) a probable fossil that had been obtained from those rocks, which were regarded as among the most ancient on the earth's surface. In the following year (1864), when he attended the meeting of the British Association in Bath, Logan introduced to this country specimens that were considered by Dr. J. W. Dawson to be organic, to belong to Foraminifera, and to be worthy of the appellation *Eozoon Canadense*.[1]

Lyell, who was president of the Association, looked upon the discovery as the greatest that had been made in his time, and Dr. W. B. Carpenter subsequently expressed his opinion that the structures belonged to a colossal rhizopod. In November 1864 Logan brought the *Eozoon* before the Geological Society, and in the spring of 1865 Ramsay lectured on the subject at the Royal Institution.

In a paper read before the Society early in 1866 the nature of *Eozoon* was contested by Professors William

[1] 'Life of Sir William E. Logan,' by B. J. Harrington, 1883, pp. 365–376.

King and T. H. Rowney, who maintained that it had no life-history. Again, in 1868 they renewed their opposition.[1] They met, however, with little support, the organic origin of *Eozoon* being championed by W. K. Parker, T. Rupert Jones, P. M. Duncan, and Carpenter, as well as by Huxley, the president. That it is ever hazardous to express an opinion unless you know, was forcibly brought to the mind of one opponent of *Eozoon* as a fossil, a palæontologist who was not an expert on Protozoa. On examining a slide under the microscope he expressed his conviction that the structure shown by it was not organic, only to be informed that he was looking at a recent foraminifer!

Needless to say, the 'organism' was figured in text-books, and soon became familiar to every geological student as the oldest known fossil. Nevertheless, whether at home or abroad, this belief did not continue to receive support as time progressed.

Faith in the fossil was seriously impaired in 1879 by Dr. Karl Möbius. Again, in 1891, Dr. J. W. Gregory pointed out not only that the famous specimen from Tudor, in Ontario, lacked all the structures which caused the typical *Eozoon* to be regarded as organic, but also that it was a calc-mica-schist, a metamorphic rock of post-Laurentian age. Belief in the fossil was generally abandoned when Dr. H. J. Johnston-Lavis and Dr. Gregory declared in 1894 that eozoonal structure occurred in ejected blocks of igneous rock at Monte Somma.[2]

That rocks as old as the Laurentian might occur in Britain was pointed out in 1859 by Ramsay, who, when accompanying Murchison to the North-west Highlands,

similar antiquity; and this view, though not accepted at the time by Murchison,[1] has been since freely admitted to be true, in the sense that the rock is Pre-Cambrian or Archæan.

Harvey Buchanan Holl (1820–86) was born at Worcester, and when a lad of seventeen accompanied De la Beche, for six months, during his survey of Cornwall and Devon. By De la Beche he was commended to H. D. Rogers, and with that able geologist he worked for three years on the Geological Survey of Pennsylvania. On his return to England Holl qualified for the medical profession; he then served as an army surgeon in the Crimea, and afterwards practised in London. Retiring to Malvern in 1862, he devoted himself to geological and palæontological researches. He wrote on the Inferior Oolite of the West of England, and on the complex area of Devonian rocks in South Devon. Fossil sponges and ostracoda also occupied his attention.[2]

In 1865 Henry Hicks (1837–99), then in practice as a medical man at St. Davids, brought before the Society his first communication, in which he named a new species of trilobite, *Anopolenus Salteri*, after J. W. Salter, 'in memory of pleasant days spent together on the cliffs of St. Davids.' In the same year the two workers gave the name 'Menevian' to the group of dark slates and flags that yield *Paradoxides*.[3] From that date, and for many years, Hicks laboured with indomitable energy and success at the palæontology and stratigraphy of the older rocks of South Wales, and especially of Pembrokeshire.

As early as 1864 Salter and Hicks had suspected the presence at St. Davids of a ridge of Pre-Cambrian rocks. Hicks drew attention to this in 1872, and referred more

out; but he differed from him in the matter of the Pre-Cambrian or supposed Laurentian rocks, regarding them as metamorphosed Cambrian deposits which had lost all traces of their aqueous origin. Ramsay spoke then of his own work in Pembrokeshire, which he commenced in 1841, when he joined the Geological Survey, and, turning to Hicks, asked 'How old were you at that time?' exclaiming, 'Why, you were only a baby!' During these years there were many stormy debates between Ramsay and Hicks. The former, always impatient of details, and anxious only for broad generalisations, did not readily sympathise with particulars based on palæontological research; while Hicks, keen and enthusiastic, was sufficiently warm-tempered to be ever ready to do battle.

It has been considered that the relations between the Geological Society and Geological Survey became about this time somewhat strained. The debates on the older rocks of South Wales tended to convey the impression that the results of amateur work were not cordially recognised by the professional geologist. Perhaps it was hardly appreciated at the time that the geological surveyor, who had to carry on his work amid many drawbacks in the struggle for existence, must be imbued with the spirit of the amateur in order to maintain enthusiasm in his task. Nor were Government surveyors the only professional geologists. As Professor Bonney remarked in his presidential address for 1885, a man who has devoted his life to the study and teaching of geology is equally a professional geologist, and 'the discovery of truth is not limited to any age or any workers.' Lyell, after holding

porcellanites, volcanic breccias and felstones. At a later date he separated from these certain hälleflintas, breccias, and quartz-felsites, under the name of Arvonian. He was aided in petrographical work by Thomas Davies (1837–92), who, during many years' work in the Mineralogical Department of the British Museum, 'acquired an eye-knowledge of minerals which has rarely been surpassed.'

The views of Hicks aroused much controversy at the time, and they were contested in 1883 in a stirring paper brought before the Society by Sir A. Geikie. Much has since been done in the study of the fundamental rocks in the British Islands, in the regions of Malvern and the Western Midlands, in Charnwood Forest and in the Scottish Highlands. Critical remarks on these and other more or less contentious matters will be found in several of the later presidential addresses, wherein the Monian system of J. F. Blake, and the Archæan rocks in general have been discussed.[1]

In 1874 Samuel Allport (1816–97), one of the pioneers in British petrology, who by patient labour for some years had acquired great skill in the preparation of rock-slices, published an admirable paper on the 'Microscopic Structure and Composition of British Carboniferous Dolerites,' in which he dealt a heavy blow to the attempt at making geological age a factor in the classification of igneous rocks. He showed, indeed, that it was often impossible to distinguish them from similar rocks of Tertiary times. This was followed in 1876 by another comprehensive paper on the 'Metamorphic Rocks surrounding the Land's End Granite,' and that by a very interesting communication on the 'Ancient Devitrified Pitchstones and Perlites from the "Lower Silurian" [now recognised as Pre-Cambrian] of Shropshire.' The Diorites of the Warwickshire coal-field were described in 1879 by

[1] See Addresses by Professor T. G. Bonney, 1885, 1886; by Sir A. Geikie, 1891; and by Mr. Hudleston, 1894. John Frederick Blake (1839–1906) was a man of great ability and enthusiasm, and with a versatility that led him to wander into many geological domains.

the same careful observer, who separated these igneous rocks from the Dolerites elsewhere associated with Carboniferous rocks. Allport thus gave a definite hint that the accompanying shales might not really be Carboniferous, as surmised by Jukes, and as demonstrated afterwards by Professor Lapworth who found Cambrian fossils in them.

The *Quarterly Journal* for 1875 contains a paper by J. Clifton Ward (1843–80), read during the previous year at the first meeting of the session, on the 'Comparative Microscopic Structure of some Ancient and Modern Volcanic Rocks;' and this was followed, somewhat later, by observations on the 'Granitic, Granitoid, and associated Metamorphic Rocks of the Lake District.'[1]

Sir A. Geikie has told of an interesting meeting in 1877 in Cumberland, when Ramsay summoned him as Director for Scotland, together with B. N. Peach and J. Horne, to meet Bristow, then Director for England and Wales, with Aveline and Ward, in order to settle some questions of classification on the borderland of the two countries.

> The party having dined, Ward and I had retired to another room that we might examine under the microscope some of his volcanic rocks, and compare them with the Palæozoic volcanic series of Scotland. We had been engaged on this task for an hour or two when Ramsay joined us. He sat rather impatiently watching us for a while, and then starting up, left the room, after exclaiming, 'I cannot see of what use these slides can be to a field-man. I don't believe in looking at a mountain with a microscope.'[2]

Ministers of the Church have in many instances become geologists; it is not often that a geologist has entered the ministry. This, however, was the case with James Clifton Ward. He retired from the Geological Survey in 1878, to become curate of St. John's at Keswick, and two years

ditions that stimulate much that is good beside the spirit of scientific inquiry,'[1] Ward laboured with signal advantage, but, alas! for a period all too brief.

The volume of the *Quarterly Journal* for 1875 contains a valuable paper on the 'Rocks of the Mining District of Cornwall, and their relation to Metalliferous Deposits,' by J. Arthur Phillips (1822–87), who resembled David Forbes in his chemical knowledge and wide experience in the field. This paper was followed next year by one on the 'So-called Greenstones of Western Cornwall,' and two years later, by another on the 'So-called Greenstones of Central and Eastern Cornwall.' He published other important papers, notably those on the 'Constitution and History of Grits and Sands,' and on the Red Sands of the Arabian Desert.

Frank Rutley (1842–1904) began his petrographical work, also in 1875, by a paper on 'Peculiarities in the Microscopic Structure of Felspars,' and he laboured on with remarkable industry and enthusiasm, even in his later years when stricken with severe illness. In 1877 Professor T. G. Bonney published an investigation of the Serpentine and Associated Rocks of the Lizard district, and the first instalment of a study (with the Rev. E. Hill) of the Pre-Carboniferous Rocks of Charnwood Forest. But with the former year microscopic petrology may be said to have established itself in our *Journal*, and the number of contributions since that date has steadily increased. In the volume for 1900 its methods of research are indicated in at least twenty-four papers.

There is no doubt that the study of petrology brought about a revival in the study of mineralogy.

The Mineralogical Society of Great Britain and Ireland was established at a meeting held on February 3, 1876, when there were present: H. C. Sorby as chairman, D. T. Ansted, the Rev. S. Haughton, M. Foster Heddle, T. G. Bonney, A. H. Church, A. Geikie, R. P. Greg, James Nicol, and F. W. Rudler. The meetings at first took

[1] J. E. Marr, Address to Geol. Soc. 1906.

place in the old theatre of the School of Mines at Jermyn Street, and have since been appropriately held in the apartments of the Geological Society.

In his presidential address to the Geological Society in 1887, Professor Judd referred to the neglect of mineralogy on the part of the Geological Society, after the early days in its history. It is true that William Hallowes Miller (1801–80), distinguished as mineralogist and crystallographer, who succeeded Whewell as professor of Mineralogy at Cambridge, became a member of Council in 1839, and again twenty years later; but he never brought any paper before the Society.

The Council, however, recognised work done in mineralogy by awarding the Wollaston Medal to Des Cloizeaux in 1886; and to Professor Nevil Story Maskelyne in 1893. Mineralogists, as in the case of T. Davies and others, took up the subject of petrology, and 'An Introduction to the Study of Rocks,' by Mr. L. Fletcher, was issued by the British Museum in 1895.

The subjects of practical mineralogy and mining were at one time represented on the Council by John Percy (1817–89), who, after taking the degree of M.D. at Edinburgh, practised at Birmingham, where he became interested in metallurgical processes, and eventually rose to be one of the most brilliant teachers and lecturers at the School of Mines. Another professor at that Institution, Warington W. Smyth, gave his services to the Society for a period extending over forty years, as member of Council, Secretary, President, and Foreign Secretary. Eminent as a teacher, he was distinguished for his sound knowledge of mining and mineralogy. Among other posts he held that of Chief Inspector of Crown Mines, and he was knighted in 1887. Mr. H. Bauerman, John Arthur Phillips, and later Sir Clement Le Neve Foster, have likewise represented on the Council the above-mentioned subjects.

The history of volcanic action in this country, dealt with by Sir A. Geikie in his presidential addresses for 1891 and 1892, was amplified and beautifully illustrated in his two volumes on 'The Ancient Volcanoes of Great Britain,' published in 1897 (see also pp. 201–2).

This fiery topic has not been without its disputes. Some of the later papers and the resultant controversies, whether on igneous rocks or metamorphism, were dealt with by Mr. Hudleston in his address for 1894. Therein we may read of the problems presented by the Lizard, the Dartmoor granite, the schistose rocks of Bolt Head and Start Point, and the Channel Isles; and of conflicts of opinion, in some of which Professor Bonney, General McMahon, Dr. Teall, Mr. A. R. Hunt, Mr. Ussher, and others were involved.

A series of papers on the 'Secondary Rocks of Scotland,' written in a spirit of ardent enthusiasm, was read before the Society in 1873, 1874, and 1878, by 'Professor Judd, who had the good fortune to make some of the most remarkable discoveries in the Western Isles of Scotland which have been placed to the score of a British geologist.' [1] In the course of his work on the Lias and Oolites, he dealt also with the 'Ancient Volcanoes of the Highlands,' whereby eventually a combat arose with Sir A. Geikie on the order of appearance of the igneous rocks of Skye. As Mr. Hudleston stated, the question resolved 'itself very much into a matter of field-geology.' In the course of the Geological Survey this was carried out in detail by Mr. Alfred Harker,[2] whose results have confirmed the conclusions at which Sir A. Geikie had arrived with respect to the relative ages of the masses of gabbro and granophyre, and to the origin from fissure eruptions of the great sheets of earlier basalt.

Dr. Teall, in his address for 1901, dealt with the

Here, as in palæontology, advances of knowledge bring in shoals of new names, with which even the specialist finds it difficult to keep in touch. The 'New Rock Classification,' by Messrs. Whitman Cross, J. P. Iddings, L. V. Pirsson, and H. S. Washington, which emanated from Chicago in 1903, was the product, in part, of one of our foreign members and one foreign correspondent. In this a new mode of nomenclature has been drawn up with great care, in order to give a kind of quantitative estimate of the mineral ingredients of rocks:

> Thus ferro-magnesian minerals are called femic, and, when dominant, dofemic; from a variety of combinations we get such terms as docalcic, dosodic, domolic (dominant olivine), perolic (extremely rich in olivine), &c.

In reviewing this nomenclature Mr. Harker remarked that 'compositors and proof-readers will not be among those who welcome the new terminology.'[1]

Earthquakes, which during recent years have kept busy both Professor John Milne and Dr. Charles Davison, early attracted the attention of Robert Mallet (1810–81), whose 'Earthquake Catalogue' was published by the British Association in 1858. This famous work, together with his subsequent researches on volcanic energy, and kindred subjects, justified the Council, in 1877, in awarding to him the Wollaston Medal.

The Rev. O. Fisher, in a paper read before the Society in 1875, discussed Mallet's theory of volcanic energy; and he dealt generally with this and other matters in his 'Physics of the Earth's Crust,' the first edition of which was published in 1881. Therein he spoke of the 'natural unwillingness among geologists to involve themselves in

the cooled surface of the globe. That the study of cosmogony has undergone a revival has been remarked in connection with the extended treatment of the subject in the recent three-volume work on geology by T. C. Chamberlin and R. D. Salisbury. The subject, however, has passed from the realm of speculation into that of legitimate hypothesis.

The age of the earth and geological time have received much attention, in the presidential addresses of John Phillips, 1860, and of Huxley, 1869, and elsewhere from Lord Kelvin, Professor T. McK. Hughes, Mr. T. Mellard Reade, Professor J. Joly, Professor W. J. Sollas,[1] Sir A. Geikie,[2] and many others. At present it may be said that an estimate of one hundred million years, for the period during which life has existed on the earth, is regarded as fairly approximate.

[1] 'The Age of the Earth and other Geological Studies,' 1905.
[2] 'Landscape in History and other Essays,' 1905, p. 198.

CHAPTER XV

THE DEVONIAN QUESTION. DENUDATION. ORIGIN OF SCENERY. GLACIAL GEOLOGY

JUKES ON DEVONIAN—ROBERT ETHERIDGE—A. CHAMPERNOWNE—HICKS—JUKES ON RIVER VALLEYS—TORRENTIAL ACTION—SUBAËRIAL DENUDATION—RAMSAY ON GLACIAL ORIGIN OF CERTAIN LAKES—SIR A. GEIKIE ON LAND-ICE—T. F. JAMIESON—GLEN ROY—S. V. WOOD, JUN.—GLACIAL GEOLOGY—ADVANCES IN GENERAL GEOLOGY—ECONOMIC GEOLOGY

IT was a memorable meeting in March 1866, when Jukes brought before the Society his views on 'The Carboniferous Slate (or Devonian Rocks) and the Old Red Sandstone of South Ireland and North Devon,' and it was an impressive scene when he arose in the crowded assembly, a fine stalwart figure, adjusting his shirt-cuffs as if about to turn them up, while observing in firm yet genial tones that he had to fight against all the best geologists of the day. Murchison was there, with his old Inverness cape, which he sometimes brought into the meeting room, sitting on a front bench, with his hands on his stout walking-stick.

Jukes's main contention was that the mass of the Devonian slaty rocks was equivalent to the Carboniferous Slate of Ireland. He indicated a conformable succession

Joseph Beete Jukes

M.A., F.R.S.

Director of the Geological Survey of Ireland.

repetition of the slaty beds to the south of the Down, then, to say the least of it, he roused controversy.

Of Jukes, it has been remarked by Sir A. Geikie, that 'a more joyous, generous, kindly spirit lived not among us. In the heartiness and hilarity with which he threw himself into whatever he had to do, he preserved almost the freshness of boyhood.' Moreover, in the prime of his life he had 'a capacity for field-geology second to that of no one in this country.'[1] His 'Geology of the South Staffordshire Coal-field' was spoken of by Professor Lapworth in 1898, long after the second edition had been out of print, as 'a model of what such a work should be.'[2]

In November of 1866 Jukes communicated to the Society 'Additional Notes on the Grouping of the Rocks of North Devon and West Somerset,' but, as the Council decided to print only an abstract without illustrations, the author withdrew the paper, and the title alone was printed in the *Quarterly Journal*. Jukes, therefore, published his further views in a pamphlet, prefacing it with criticisms on the referee system at the Society, with a history of the term Devonian, and an account of his own opportunities of acquiring a knowledge of the subject. The pamphlet, with its colour-printed map, more clearly depicted Jukes's views, but when it is remembered that his former paper was published in the August number of the *Quarterly Journal*, it was early thus to require a supplement.

There had been no time for reply by opponents to the serious questions that had been raised. Robert Etheridge, then palæontologist to the Geological Survey, had, however, been instructed by Murchison to investigate the succession in North Devon and West Somerset, and to

Bristol district, and had become an authority on Jurassic mollusca, he had no special acquaintance with Devonian palæontology nor with the rocks of that age. When he first arrived on the ground, an active, vigorous, and withal tender-hearted man, the contemplation of the great moorland hills, and the folded, fractured, and cleaved character of the rocks, gave him such an impression of the immensity of his task, that he sat down and wept. He was not, however, a man to be daunted, and he set to work with persistent energy.

Largely aided by the suites of fossils that had been collected by R. H. Valpy (see p. 164), Townsend M. Hall (1845–99), the Rev. W. Mules, and the Rev. H. H. Winwood, he had no difficulty in showing the distinction between the fauna of the Ilfracombe beds and that of the slaty series south of Pickwell Down, and thus proving that there was no repetition of the main subdivisions north and south. On his map he marked out the broad subdivisions of the strata from the Quantocks to Ilfracombe and Baggy Point; and his general conclusions were subsequently supported by researches carried on by Arthur Champernowne and Mr. W. A. E. Ussher, to the latter of whom our knowledge of the structure and relations of the Devonian strata in South Devon and East Cornwall is most largely due.

> Arthur Champernowne (1839–87), of Dartington Hall, Totnes, whose grandfather was an early member of the Society, became a distinguished amateur worker in geology. With a sound knowledge both of petrology and palæontology, he attacked with conspicuous ability some of the problems in Devonshire geology, but unfortunately died ere his results were fully matured.

All observers have confirmed the general correlation of the Ilfracombe Beds with the main mass of the South Devon limestones, the distinctive fauna of which had led

in the 'unfossiliferous' Morte Slates. A few years later (1896–97), he announced that *Stricklandia* and other fossils of Silurian character had been found in the same rocks. The fossils were described by the Rev. G. F. Whidborne, who has so largely furthered our knowledge of the Devonian fossils of Devonshire, and Hicks then contended that the Morte Slates were older rocks thrust up by faults. Thus again the Devonian question was brought into prominence; and although the identification of the fossils, which were poorly preserved, has been severely criticised, it was admitted that doubt had been thrown on the regularity of the North Devon succession.

The sculpturing of scenery has ever been an interesting subject of study, albeit one of controversy. Ramsay in 1846 had published his essay 'On the Denudation of South Wales and the adjacent counties of England,' in which the probability of great plains of marine erosion was first broached.[1]

Jukes in 1862 brought before the Society his celebrated paper on the mode of formation of some of the river-valleys in the south of Ireland, wherein he explained that the streams must have originated on a plain, uplifted so as to give initial direction to their flow. Across this plain the main channels were excavated, while the bordering features were due to the effects of subaërial denudation on rocks of different lithological character.

In a postscript to that paper he mentioned, among other instances, the ravine of the Avon at Bristol as likely to have originated in a similar way. He also referred to the Weald of Kent, and asked

> whether the Chalk, when once bared by marine denudation,

> valleys that began to run down the slopes of the Chalk from the then dominant ridge that first appeared as dry land during or after the Eocene period?[1]

Here we find the germ of the explanation afterwards advocated by Ramsay, and elaborated by C. Le Neve Foster and William Topley.

It should not, however, be forgotten that Conybeare, in 1829, read before the Society a paper on the Valley of the Thames, and contrasted the extensive denudations which must have occurred with the permanence of its present surface; and he then remarked that to explain the distribution of the gravel by the operation of the actual rivers, it was necessary 'to suppose that an uniform plain originally existed from the summit of Highgate to the Hertfordshire chalk downs, and from the top of Shooter's Hill to those of Kent.'[2]

Lyell has given some account of the discussion on that paper, when Greenough observed that no river 'within times of history has deepened its channel one foot!' while Conybeare 'admits three deluges before the Noachian! and Buckland adds God knows how many *catastrophes* besides, so we have driven them out of the Mosaic record fairly.'[3]

These remarks are of interest when we consider the modern views as expounded, with modifications, by Professor William Morris Davis.

Moreover, the strongly expressed doctrines on diluvial action held by Buckland and Conybeare, and opposed by Lyell, are supported to some extent now by those who urge that much excavation was done by torrential waters derived from the melting of great areas of land-ice. Again, our notions of the origin of some gorges may

of overflow channels from ice-dammed lakes during the later stages of the Glacial period.

The idea of a Pluvial period, that followed the Glacial period, was advocated by Alfred Tylor as early as 1853, when he made suggestions for computing the rate of denudation by estimating the amount of material carried to sea by rivers, and the loss on sea-coasts by marine action.[1]

The now classic paper by Mr. W. Whitaker, on 'Subaërial Denudation,' was read before the Geological Society in May 1867, and for some reason—perhaps the Council were afraid of controversial subjects—it became a 'Rejected Address,' and was published in the *Geological Magazine*. There it formed an interesting contribution to a great discussion, carried on in the earlier volumes of that journal, on the relative powers of the agents of marine and subaërial denudation. In that controversy Sir A. Geikie, A. H. Green, William Topley, G. H. Kinahan, Daniel Mackintosh, and others took part, and the advocates of the marine erosion of many inland features may be said to have suffered defeat.

In considering the subject of denudation it is interesting to mention that in 1899 the Society published, under the editorship of Sir Archibald Geikie, a portion of the third volume of Hutton's 'Theory of the Earth,' the manuscript of which had been presented to the Society in 1856 by Leonard Horner.[2]

In later years mountains and mountain structure have attracted the attention of many Fellows, notably of the Rev. Osmond Fisher and Mr. T. Mellard Reade. Ramsay in successive editions of his 'Physical Geology and Geography of Great Britain,' Professor E. Hull in the companion work on Ireland, Sir A. Geikie in his 'Scenery of

[1] *Quart. Journ. Geol. Soc.* ix. p. 49; xxiv. p. 105; xxv. p. 9. *Geol. Mag.* 1872, p. 498; 1875, p. 462. Alfred Tylor (1824–84) was a member of the Society of Friends, a brass founder, and manufacturer of copper and other metal-work in the City.

[2] In 1900 Mrs. Katherine Lyell presented to the Library a MS. volume of Notes on the Huttonian Theory, compiled by Leonard Horner.

Scotland,' and more recently Lord Avebury in his 'Scenery of England,' have brought vividly before us the relations between geological structure and the form of the ground. On the other hand, Professor Hull and Mr. A. J. Jukes-Browne have dealt more particularly with the foundation of the land, in their works on the Physical History and Building of the British Isles. Questions relating to the permanence of continents and ocean-basins have likewise created much discussion.

On February 21, 1862, Andrew Crombie Ramsay was elected president, and he commenced duty by presiding at the annual dinner of the Society, with the Duke of Argyll on his right and the Earl of Ducie on his left, and a company of nearly ninety.[1]

As early as 1848 he had been impressed by the evidences of glacial action in North Wales, and in 1860 he published a little volume on 'The Old Glaciers of Switzerland and North Wales,' in which he suggested the possible glacial erosion of certain rock-basins now occupied by lakes. In March 1862, shortly after he had been called to the chair, he brought before the Society his famous paper 'On the Glacial Origin of certain Lakes in Switzerland, the Black Forest, Great Britain, Sweden, North America, and elsewhere,' wherein he advocated excavation by ice-action (see p. 140).

Needless to say, the subject stirred up a lively discussion. 'Lyell damned the paper with faint praise, and Falconer vigorously opposed it. It was admirably defended by Huxley.'[2] In this, as in other of his brilliant expositions, the enthusiasm of Ramsay carried him somewhat further

President 1862-64.

Walker & Boutall Ph Sc

President 1862-64.

challenged ever since. At the same time, as remarked so recently as May 1906 by Professor E. J. Garwood (who, by-the-by, gives no material support to Ramsay's views), 'several eminent authorities still attribute the origin of some of the larger Swiss and Italian lakes to ice-erosion. . . . It is evident, therefore, that this theory is in no wise extinct.'[1]

In 1861 Sir Archibald Geikie was impressed with the theory of land-ice as explanatory of the striated rock surfaces and boulder clay, and he has remarked that, in the following year, the view was 'ably confirmed by the independent observations of Mr. T. F. Jamieson in a paper read before the Geological Society. Sir Charles Lyell has adopted the same explanation, and doubtless it will ere long come to be universally accepted in this country, as it ought to have been fully twenty years ago, when its first outlines were sketched by Agassiz.' These remarks, penned in 1863, form part of a prefatory note to Sir A. Geikie's classic memoir 'On the Phenomena of the Glacial Drift of Scotland,' a memoir which did much to stir up interest in glacial phenomena in this country. Eleven years later there appeared the fascinating story of 'The Great Ice Age,' as told by his brother, Professor James Geikie.

Mr. T. F. Jamieson, who has done more than any other Fellow of the Society to illuminate the pages of the *Quarterly Journal* by researches on the glacial phenomena of Scotland, in January 1863 brought before us his explanation of the parallel roads of Glen Roy, in Lochaber. The results of his detailed researches confirmed the suggestions made by Agassiz and Buckland, that certain glens had been converted into glacier lakes by ice from adjacent mountains. Few subjects have been

made another expedition fifty-one years later, and observed that '*there can be no doubt* that the glacial theory is the only feasible one.' He was then in his seventy-second year, but it was remarked that 'his mind is delightfully fresh and active, and it is a pleasure to see that he still retains enough of bodily vigour and activity to be able to ascend the Highland mountains.' [1]

The more detailed study of the distribution of the various superficial deposits in this country was initiated by Joshua Trimmer, who demonstrated the practical importance of the subject in his 'Proposals for a Geological Survey, specially directed to Agricultural Objects,' issued in 1850.

At a later date Searles V. Wood, jun. (1830–84), took up the subject with remarkable energy. In December 1864 he communicated to the Society a paper on the Drift of the East of England and its divisions. He had then extended his observations over eight counties, and his views, based on such a comprehensive survey, were entitled to a consideration that, unfortunately, they did not receive from the Council. They were thought to have been derived, without due acknowledgment, from those of Trimmer, and his map was asserted to be decidedly incorrect. Mr. Wood, who was educated for the law, and had practised as a solicitor from 1851 to 1865, resolved to publish his paper, and in the introduction he defended his case with ability, showing that the criticisms of the Council were altogether unjustified. The last edition of the Greenough map had lately been edited by a com-

Wood, happily, bore no permanent ill-will against the Council for their singular action, and continued his researches with unabated vigour, and in greater detail. He contributed numerous papers to the *Quarterly Journal*, and finally summed up the results of his researches in an exhaustive memoir, in two parts, on the Newer Pliocene period in England, including therein the records of Pleistocene times. These highly important papers are so crowded with facts that they are rather difficult to follow, and somewhat tedious to read. Wood had a remarkable memory. He could recall with ease the precise pit or cutting in which he had, perhaps long previously, observed particular facts, and he recorded his observations with a precision and amplitude more fitted for a legal document than for a paper in the *Quarterly Journal*.

In the year 1867 he presented to the Geological Society an elaborate and neatly written MS., with numerous illustrations, entitled

> 'A Memoir in explanation of the Structure of the Glacial and Post-glacial Beds, mapped in a geological survey of the Ordnance Sheets Nos. 1 and 2, comprising the Thames Valley between London and the Sea, and the Valleys of the Lea, Roding, Ravensbourne, Cray, Darent, Crouch, and Chelmer Rivers, and of the Blackwater Estuary, and other subordinate valleys; incorporated with which is an essay upon the general structure of the Post-glacial System over the East, South-east, South, and part of the South-west of England.'
>
> It was dated Brentwood, January 1867, and comprised fifty-four sheets of MS., with several geological maps, including those of Eastern Essex, on the one-inch scale.

Of this memoir it may be said that it was worthy of a place in the *Transactions*.

Not the least important work of Wood was the inspiration he gave to Mr. F. W. Harmer to co-operate with him, and together they produced a 'Geological Map of the Crag District of East Anglia,'[1] on which the distribution of Boulder-clay and other Drift deposits was for the first time clearly and admirably depicted.

[1] Published with an Explanatory Memoir in the Supplement to the 'Crag Mollusca,' part i. 1872 (*Palæontogr. Soc.*).

The relations between the Glacial Drifts and the Thames valley deposits led to a good deal of discussion between S. V. Wood, jun., Professor W. Boyd Dawkins, and others ; and the different views have been summarised and criticised by Mr. Whitaker.[1] More recently the important discovery of Boulder-clay beneath one of the higher valley gravels at Hornchurch was brought before the Society by Mr. T. V. Holmes.

That the views put forward by Agassiz, and supported by many a geologist, are still contested by some, is a fact not to be denied.[2] Land-ice is not the only agent that distributed the Drift, and sundry geologists have been more impressed with the action of coast-ice, or of bergs floating over a submerged area.

In the vicissitudes of the Pleistocene period there is much to be learnt as regards changes of level, whether of land or water, and of climatic conditions such as might evidence the milder episodes termed interglacial.[3]

In order to help matters the *Glacialists' Magazine* was started in 1890 by Professor P. F. Kendall, but it came to an end with its fifth volume in 1897.

The views of James Croll (1821–90),[4] that were founded on astronomical considerations, and long dominated the theories of glacial phenomena, have during late years been found wanting, and the notions of alternate glaciation of the northern and southern hemispheres, and of the regular recurrence of glacial epochs, have been abandoned.

Diverse opinions have been expressed by the Rev. H. W. Crosskey (1826–93),[5] by Henry Carvill Lewis

[1] 'Geology of London,' vol. i. 1889, *Mem. Geol. Survey.*
[2] See Hudleston, Address to Geol. Soc. 1893.

(1853–88),[1] Thomas Belt (1832–78), Maxwell H. Close (1822–1903), Dugald Bell (1827–98), by Colonel H. W. Feilden,[2] Mr. T. Mellard Reade, Mr. R. H. Tiddeman, J. G. Goodchild (1844–1906), and others; while a diluvial theory resuscitated by Sir Henry H. Howorth, in 'The Mammoth and the Flood,' led to his 'Glacial Nightmare,' which has given place to volumes on 'Ice or Water' (1905).

An excellent history of 'Fifty Years' Progress in British Geology' (1837–87) was given in November 1887 by Mr. F. W. Rudler in his presidential Address to the Geologists' Association, and this was followed in February 1889 by an equally lucid account of researches on 'Experimental Geology.'[3] A review of the labours of the Geological Society during a period of about seven years occupied the presidential Addresses of Mr. Hudleston (1893 and 1894), wherein he referred to the difficulties of paying equal attention to all workers, and likened his task to 'that of a man who tries to lift up a beehive.'

Advances have been made in all directions. The detailed study of the Carboniferous rocks and their life-history has engaged many workers, with results of great interest and importance. The age of the Peel Sandstones in the Isle of Man, of the Red Rocks of Devonshire, and the saliferous strata of Durham have engaged attention, not without controversy. The minor subdivisions of the Rhætic Beds, the zones and 'hemeræ' of the Inferior Oolite, the origin of Oolite, and the problem of *Girvanella*, the fossils and subdivisions of the Speeton Clay, the Red Chalk, and the zones in the White Chalk, have likewise attracted many zealous workers. Nor have such comparatively barren strata as the Bagshot Sands and the Westleton Beds proved devoid of interest or dispute.

[1] 'Papers and Notes on the Glacial Geology of Great Britain and

In palæontology there have, perhaps, in later years, been more contests over Reptilia and Corals than other forms of life; but progress in all branches has been great.

That geology is a science that should prove of benefit to humanity, apart from its 'chief glory' in the pure quest after knowledge and new ideas,[1] apart from the less disinterested quest after fame, was indicated in the original preface to the *Transactions* (p. 15).

From time to time the economic bearings have been brought, not inappropriately, before the Fellows, as in Addresses by Prestwich, Sir John Evans, and Mr. Whitaker. Deep borings, water supply, the faults, flexures, and irregularities in coal-fields—all have an interest alike scientific and practical. On this subject Professor Lapworth has well remarked:—

> The economic geology, as such, is as much the province of the geologist, and demands as respectful a treatment, as the detailed stratigraphy of a country; . . . indeed, as it has been well said, not one of us, if we are scientists at heart, can afford to ignore any branch of our science, 'even though it be conspicuously—and even glaringly—useful.'[2]

In illustration of these remarks it may be mentioned that in 1843 the Rev. J. S. Henslow (1796–1861), then professor of Botany at Cambridge, brought before the Society a notice of the concretions in the Red Crag, at Felixstow, and expressed his conviction that they were of coprolitic origin. Subsequently he drew attention to nodules of similar origin in the Cambridge 'Greensand.' Analyses were made, the fact that the phosphate of lime could be rendered available for agricultural purposes was

to his discovery'; but 'no acknowledgment was ever made of his services to the public weal.'[1]

Again, Godwin-Austen's inferences with regard to the occurrence of Coal-measures beneath the south-eastern part of England have borne good scientific fruit; the practical fruit still remains to be gathered[2] (see also p. 198).

[1] Smyth, *Quart. Journ. Geol. Soc.* xviii. 1862, p. xxxvi; see also 'Memoir of the Rev. J. S. Henslow,' by the Rev. Leonard Jenyns, 1862, p. 201; and *Proc. Geol. Soc.* iv. p. 281.

[2] See W. Boyd Dawkins, 'The Discovery of the South-eastern Coalfield,' *Journ. Soc. Arts*, lv. 1907, p. 450.

CHAPTER XVI

ATTENDANCE OF LADIES. THE MUSEUM AND LIBRARY. MEDALS AND FUNDS. GEOLOGICAL LITERATURE

ADMISSION OF LADIES TO MEETINGS—THE MUSEUM AND LIBRARY—THE MURCHISON MEDAL—REMOVAL TO BURLINGTON HOUSE—PROPOSALS TO TRANSFER THE MUSEUM—THE LYELL MEDAL—THE BARLOW-JAMESON FUND—THE BIGSBY MEDAL—INTERNATIONAL GEOLOGICAL CONGRESS IN 1888—W. T. BLANFORD—J. W. HULKE—THE PRESTWICH MEDAL—THE DANIEL-PIDGEON FUND—COUNCIL MEETINGS—NUMBER OF FELLOWS—SELECTION OF PAPERS—LITERATURE OF GEOLOGY—BIBLIOGRAPHIES AND INDEXES—CONCLUSION—COUNCIL, 1907

WE are informed by Dr. Henry Woodward that during the years 1860–62, when Mr. Leonard Horner was president, a strong effort was made to render the meetings of the Society more popular and attractive to the general public by the admission of ladies to the meetings.

The Council felt that the proposal to admit the fair sex, although supported by the president, Leonard Horner, and by his son-in-law Sir Charles Lyell, and many others, could not be carried into effect in the apartments of the Society at Somerset House, as the meeting room was inadequate to the probable influx of a large number of visitors.

A special general meeting was therefore held before the ordinary meeting on June 13, 1860, to consider the propriety of holding future meetings of the Society at Burlington House. A resolution in favour of the change was carried, and arrangements were made with the Royal Society and with the University of London, to occupy for the Wednesday evening-meetings the temporary theatre that had been erected in the quadrangle of old Burlington House.

It may be mentioned that since 1858 several applications were made to the Government that they would consider the claims of the Geological Society for rooms, when the reconstruction of Burlington House was taken in hand. To this, in 1860, a guarded answer was received from the Chancellor of the Exchequer.

In accordance with the above-mentioned resolution invitations were issued to Fellows to bring their wives and daughters, or lady friends, to the ordinary evening-meetings, to be held during the session commencing November 7, 1860, at Burlington House. After the Council had concluded its sitting at Somerset House, Professor T. Rupert Jones, assistant secretary, Mr. George E. Roberts, the clerk, Mr. H. M. Jenkins, and Mr. A. Stair, Library and Museum assistants, attended by Charlton, the house steward, together with minute-book, diagrams, chalk, pens and ink, attendance-book, and other needful accessories, were conveyed in two four-wheeled cabs, from Somerset House, Strand, to old Burlington House, Piccadilly, where the diagrams were fixed up, and all other arrangements were made. After dining, the president and Council and other members of the Geological Society Club arrived, and the meeting was formally opened. Dr. Henry Woodward attended several of these meetings, but, as he remarks, alas for the lack of enthusiasm in that elder generation of ladies, as compared with the interest manifested in these enlightened days!—only three or four ladies appeared, but among them Lady Lyell and the Misses Horner were constant attendants.

A proposal brought before the Council on June 7, 1861, that the meetings for the next session should take place

At a special general meeting held on January 8, 1863, it was resolved that the meetings of the Society be held in the Society's rooms at Somerset House, on and after the anniversary meeting then ensuing (February 20). Thus the presence of ladies was discontinued, and the men returned to their privileged abode (see also p. 118).

The question of admitting women as Fellows of the Geological Society came up for discussion when the bye-laws underwent revision in 1889. No special mention of this was made in the printed *Proceedings* of the Society, but the question was raised on Section III., Article 1 (Bye-laws, p. 5), when it was proposed that the words, 'or her,' should be added at the end of the article. This was defeated by a majority of four, out of sixty-two Fellows voting. Sir Joseph Prestwich warmly supported the proposal, pointing to the prominent part taken by women for a number of years in various departments of learning, and he expressed his conviction that the time had come when they should be admitted as Fellows.[1]

Since that date the work of women has been recognised in the awards made to Miss C. A. Raisin, D.Sc., Miss Jane Donald, D.Sc. (Mrs. Longstaff), Miss G. L. Elles, D.Sc., Mrs. Elizabeth Gray, Miss E. M. R. Wood, D.Sc. (Mrs. Shakespear), and Miss Helen Drew. Moreover, not only have further important papers by women been communicated to the Society, by Mrs. M. M. Ogilvie Gordon, D.Sc., Miss M. C. Crosfield, Miss E. G. Skeat, Miss Maud Healey, and Miss I. L. Slater, B.A., but on certain occasions the authoresses have been present, and have ably given an account of their work. Their admission to general meetings of the Society was facilitated in 1904, when the Bye-law Art. 3, Section XII. was modified so as to allow visitors to be introduced by Fellows or Foreign Members without requiring the 'consent of the majority of the Fellows present.' A proposal to elect women as Associates was negatived at a special meeting on May 15, 1907.

[1] We are indebted for some of the above particulars to Dr. G. J. Hinde; the subject was further discussed by Dr. Henry Woodward in his presidential Address in 1895.

It may be mentioned that in 1862 the number of Fellows was 900, and at the end of 1863 it reached 1,001.

During the year 1862 the Council took into consideration the question of electing Foreign Correspondents, and at a special general meeting of the Society held on January 8, 1863, it was resolved :—

1. That the number of Foreign Members be in future limited to forty, instead of fifty as heretofore.

2. That a Class of Foreign Correspondents be instituted, not exceeding forty in number.

3. That the Foreign Members shall be elected out of the list of Foreign Correspondents.

The following Bye-law was passed at a special general meeting held on January 20, 1897 :—

The Foreign Members shall be selected from the list of Foreign Correspondents, or from among distinguished Fellows who are not British subjects, and may be recommended by Fellows in the same manner as already provided in the case of Foreign Correspondents.

On December 17, 1862, in reply to an application to retire from Mr. McLauchlan (see p. 101), it was decided that, as a special case, he should be allowed to remain a Fellow of the Society without further payment. To provide means to meet such cases a Geological Relief Fund has since been established.

A full report on the Museum of the Society was published in 1850. At that date Museum and Library were open to the Fellows from 11 till 5. The present hours of 10 till 5 were adopted a few years later. The naming and arranging of the recent mollusca in the collection were revised in 1859 by S. P. Woodward. In 1860 it was decided that in future the Society would do wisely to concentrate 'attention principally on the foreign collection, as it is known to us all that for British geology the Museum in Jermyn Street affords every facility for reference.'

Details of the foreign collection were given in the report for 1861, reference being made to Mr. Horner's elaborate and valuable catalogue of all the contributions

from all countries. Again in 1864 the Council gave a further 'detailed account of the advantages they possess on their own premises for studying different branches of geological science.'

During the years 1863 to 1867 the two rooms of the Museum at Somerset House continued to be of service. They were utilised occasionally by Falconer, Lartet, and John Phillips; and the Lower Museum, more especially, was in winter time, with its cosy fires, a pleasant resort for conversation.

Nevertheless the Library had grown immensely in comparison with the Museum. The room of the assistant secretary, portions of the meeting room, of the tea-room and Council room, were gradually invaded by books: an arrangement that proved exceedingly inconvenient to the librarian and his assistants.

The Library in fact came to be recognised as of far greater importance to the Fellows than the Museum. It was not possible to offer sufficient remuneration for a curator of standing, and increasing difficulty was felt in keeping the collections named and in order. It was realised also that the want which the Society in its earlier days had supplied was no longer experienced.[1]

In their Report for 1869, the Council decided on the discontinuance of a general collection, and restricted the future additions to specimens illustrative of papers and to others received only from abroad.

In 1869 Mr. W. S. Dallas became assistant secretary, and for more than twenty-one years he served the Society with single-heartedness and zeal; his 'large treasures of knowledge and experience,' and 'his genial kindly ways,' gaining him the esteem and affection of every Fellow who made his acquaintance.[2]

THE MURCHISON MEDAL.

Geology in King's College, London. He was secretary of the Society from 1864–71, and afterwards president. Another member, and the treasurer from 1868–82, was John Gwyn Jeffreys (1809–85), who had been educated as a solicitor, and was a conchologist, famous for his knowledge of British recent and pleistocene mollusca. He was succeeded as treasurer by the Rev. Thomas Wiltshire (1826–1902), who looked after the financial interests of the Society until 1895. Mr. Wiltshire, who had paid much attention to the Cretaceous mollusca, was honorary secretary of the Palæontographical Society from 1863–99.

The year 1871 was marked by the foundation of

THE MURCHISON MEDAL,

awarded according to the conditions of the Murchison Geological Fund, which was established under the will of Sir Roderick Impey Murchison, Bart., K.C.B., F.R.S.

The following is the description of the medal:—

Obverse—SIR RODERICK I. MURCHISON, BART., K.C.B. 1866. Bust to left; on truncation of bust, L. C. WYON.

Reverse—SILURIA. Two geological hammers in saltire, between them a trilobite, *Encrinurus punctatus* (above); a brachiopod, *Pentamerus Knighti* (on left), a trilobite, *Ampyx nudus* (below); and a gasteropod *Euomphalus rugosus* (on right). On either side and below, a border of Graptolites; beneath, L. C. WYON.

By his will Murchison bequeathed the sum of 1,000*l.* to the Society, to be styled 'The Murchison Geological Fund.'

The annual income thereof was to 'be applied in every consecutive year in such manner as the Council of the said Society may deem most useful in advancing Geological Science, whether by granting sums of money to travellers in pursuit of knowledge, to authors of memoirs, or to persons actually employed in any inquiries bearing upon the science of Geology, or in rewarding any such travellers, authors, or other persons whom such Council may consider deserving of recompense.' He further directed 'that the Council shall in every consecutive year give a bronze cast of the Murchison Medal, executed by Mr. Leonard Wyon,[1] which I have hereafter directed to be annually furnished to the Geological Society, to some person to whom such Council shall grant any sum of money or recompense in respect of Geological Science.'

It has been customary to give the sum of ten guineas with the medal, and the balance as a fund.

[1] The medal is in fact from the same die as that given originally at the Royal School of Mines, and subsequently at the Royal College of Science.

In 1874 the Society moved from Somerset House to its present apartments in Burlington House, and at the annual meeting in February 1875 the president, Sir John Evans, congratulated the Society on being at last in full possession of the handsome and commodious apartments which, by the liberality of her Majesty's Government, had been provided for their use.

The cost of removal and furniture for the new rooms was 1,935*l.* 15*s.* 5*d.*, and over 1,000*l.* of this was met by subscription from the Fellows.

Old Burlington House, built about 1664 by Richard Boyle, 1st Earl of Burlington and 2nd Earl of Cork, and rebuilt about 1731 by his great-grandson the 3rd Earl of Burlington and 4th Earl of Cork, was purchased by Government in 1854.

In 1868 the entrance colonnade was removed, and the new buildings were erected in 1872.

In 1874 the Council announced a change in the arrangement of the component parts of the *Quarterly Journal*. The chronological arrangement of papers was no longer to be strictly adhered to, and thus 'Postponed Papers' were not placed separately. The details of the business of the meetings were paged separately, under the title of '*Proceedings* of the Geological Society,' together with the Annual Report and the presidential Address. This change was commenced in vol. xxxii. (1876), and continued until vol. l. (1894). The old style of paging with small Roman numerals in the *Proceedings*, so much more convenient for quotation, was resumed in 1895.

During earlier years it was no exception for authors, whose papers had been postponed, to make additions and emendations, as in the case of Fitton (p. 124), and later on with papers by Prestwich, and others. All additions and alterations are now rightly indicated by square brackets.

In 1887 it was announced that the Library at Burlington House was to be kept open on the days of the Society's meetings from 5 to 8 P.M.

During the rearrangement of specimens at the time of the removal to Burlington House in 1874, numerous

duplicates were presented to the British Museum, the Museum of Practical Geology, King's College, the University of Cambridge, and the Orphan Working School, Haverstock Hill, London.

A most important task, undertaken in 1891, was the labelling and registration by Mr. C. Davies Sherborn of the type specimens in the Museum; it was completed in 1899.

In 1895 the president of the Society (Dr. Henry Woodward) remarked that the expansion of the Library 'will eventually call for the transfer of the Museum to another home, and the utilisation of the space now filled with cabinets of fossils by shelves of books.' This question was seriously entertained by the Council, who reported in 1896

> that if the Society decided that the maintenance of the collections in their present condition was undesirable, the British Museum (Natural History) would probably be the most satisfactory receptacle for them. The Council have accordingly been in communication with the Trustees of the British Museum, and find that they would be willing to receive such portions of the collections as the Society may wish to transfer to them on the following conditions: The specimens which are types, and those which illustrate papers read before the Society, are to be preserved and maintained apart, and the Trustees will reimburse the Society for the expenses in connection with the transference up to a sum not exceeding 300*l.*

To consider this matter a special general meeting of the Society was held on May 20, 1896; and after a prolonged and somewhat animated discussion 'the previous question' was moved and agreed to, and no further result was attained.

After that meeting the Rev. J. F. Blake made an offer to prepare and edit, without any remuneration, a catalogue of the type- and other important specimens in the Society's Museum, based on Mr. C. Davies Sherborn's manuscript catalogue. This offer was accepted, and the Council recommended that no further action be taken with regard to the Museum till this Catalogue was placed in the hands of the Fellows.

The Catalogue was issued in 1902 under the title:—

> 'List of the Types and Figured Specimens recognised by C. D. Sherborn, F.G.S., in the Collection of the Geological Society of London. Verified and arranged with additions.' By J. F. Blake, M.A., F.G.S., with an Appendix (synopsis of the contents of the Geological Society's Museum).

This volume is of value in recording not only the minerals, rocks, and fossils, but also other objects of historic interest, such as the apparatus and specimens used by Sir James Hall in his experiments on the vitrification of basalts.

In 1875 notification was made of the foundation of

THE LYELL MEDAL,

awarded under the conditions of the will and codicil of Sir Charles Lyell, Bart., D.C.L., F.R.S.

The following is the description of the medal:—

> Obverse—CHARLES LYELL. Bare head to left; beneath head, 1873; on truncation, L. C. WYON.
>
> Reverse—The three columns of the Temple of Jupiter Serapis at Puzzuoli, which have been submerged and have again risen.[1]

By his will Lyell bequeathed to the Society the sum of 2,000*l.* and 'the Die executed by Mr. Leonard Wyon of a Medal to be cast in bronze and to be given annually and called the Lyell Medal, and to be regarded as a mark of honorary distinction and as an expression on the part of the governing body of the Society that the Medallist (who may be of any country or either sex) has deserved well of the Science,'—'not less than one third of the annual interest [of the fund] to accompany the

[1] See Lyell, 'Principles of Geology,' and Suess, 'Das Antlitz der Erde,' English translation, ii. 1906, p. 368.

THE LYELL MEDAL.

Medal, the remaining interest to be given in one or more portions, at the discretion of the Council, for the encouragement of Geology or of any of the allied sciences by which they shall consider Geology to have been most materially advanced, either for travelling expenses or for a memoir or paper published or in progress, and without reference to the sex or nationality of the author, or the language in which any such memoir or paper may be written.'

In a codicil, dated January 1874, there is a further provision for suspending the award for one year 'as it may sometimes be a source of embarrassment when there are several medals to bestow to be forced to find a fit recipient. In this case the Council would have in the year following a larger sum from the interest of the 2,000*l.*, as well as two medals to give away—which might be an advantage, because it has sometimes happened that two persons have been jointly engaged in the same exploration in the same country, or perhaps on allied subjects in different countries, and the Council may think that the labours of both of them may deserve to be crowned by a mark of their approbation. In this case a medal may be given to each, with such proportion of the interest as the Council may decide, always not being less to each Medal than one third of the annual interest.' This codicil was unattested.

In 1876 the awards of the proceeds of

THE BARLOW-JAMESON FUND

were established, under the will of the late Dr. H. C. Barlow, F.G.S.

He bequeathed by will, dated July 27, 1867, 'the sum of Five Hundred Pounds Consols (free of legacy duty), the perpetual interest of which is to be applied every two or three years, as may be approved by the Council, to or for the advancement of Geological Science, and is to be called the "Barlow-Jameson Fund."'

Henry Clark Barlow, M.D. (1806–76), educated first as an architect and surveyor, afterwards took up medicine and obtained the degree of M.D. at Edinburgh, but never practised. He travelled much in Europe, especially in Italy, and gradually became absorbed in the study of the 'Divina Commedia,' and ever afterwards was an enthusiastic lover of Dante. As a diversion from a consideration of the 'Inferno,' he gave a good deal of attention to the relations between geology and scenery, collected many specimens, and joined the Geological Society in 1865. He frequently attended the meetings, and was more concerned, at the time, than any other Fellow, if the *Quarterly Journal* was not issued punctually. In appearance he was a veritable sage, with long white beard, and fine aquiline features.

While at Edinburgh he had attended the lectures of Robert Jameson, and there acquired a general interest in geology, and it was with the view of doing honour to the memory of his old teacher that he directed in his will that the fund should be called the Barlow-Jameson Fund.

THE BIGSBY MEDAL

was founded in 1877 by Dr. J. J. Bigsby, F.R.S. The following is the description of the medal :—

Obverse—J. J. BIGSBY, M.D., F.R.S. BIENNIAL PRIZE MEDAL, FOUNDED 1876. Head to left.

Reverse—In outer circle : AWARDED BY THE GEOLOGICAL SOCIETY OF LONDON FOR WORK OF GREAT MERIT. A representation of a fossil Echinoderm from the Trenton Limestone (Ordovician) around it, AGELACRINITES DICKSONI. FOUND 1822 . CANADA. Beneath, J. S. and A. B. WYON.

In 1877 Dr. Bigsby gave to the Society a sum of 200*l.*, the interest of which was to be devoted to providing a medal to be given biennially, preferentially to one who had studied American Geology, 'as an acknowledgment of eminent services in any department of Geology, irrespective of the receiver's country; but he must not be older than 45 years at his last birthday, thus probably not too old for further work, and not too young to have done much.' The medal is struck in gold.

If, by the terms connected with his medal, Dr. Bigsby intimated that no geologist was too old at forty-five, but might be at forty-six, he showed by his own record that a man could do good work until nearly double that age. He ever maintained that one secret of long life was useful occupation.

John Jeremiah Bigsby, M.D. (1792–1881), was a pioneer of geology in Canada. Logan remarked of him in 1863 : 'No observer was more accurate than Dr. J. J. Bigsby, secretary to the Boundary Commissioners under the Treaty of Ghent. His range of investigation extended from Quebec to Lake Superior, and beyond the

THE BIGSBY MEDAL.

Commencing his active career in the Army Medical Service at the Cape of Good Hope, he served afterwards in Canada, and from 1827 to 1846 he was in practice at Newark-on-Trent; then, settling in London, he took an active part in the work of the Society. During later years he devoted himself to the catalogues of Palæozoic fossils, to which reference has previously been made (p. 159). While engaged in these tasks, between the years 1862 and 1868, no one borrowed more books from the Library of the Society, and no Fellow showed greater kindness of heart and consideration for subordinates. To the Library assistant it was indeed a pleasure to work at all times, even after official hours, for a man who commanded not only respect but affection.

In September 1888, when the fourth meeting of the International Geological Congress was held in London, a reception was given to the members in the rooms of the Geological Society, by its president, Dr. Blanford.

> Although Professor Huxley was chosen as *Honorary President* of the Congress, the chief duties devolved upon Sir Joseph Prestwich as *President*; the *Vice-Presidents* being Dr. Blanford, Sir A. Geikie, and Professor Hughes; the *Secretaries* J. W. Hulke and W. Topley, and the *Treasurer*, F. W. Rudler.

William Thomas Blanford (1832–1905) was distinguished among the Fellows of the Society for his wide knowledge of geology, and of its bearings on problems in physical geography and natural history. From 1854 to 1882 he was engaged on the Geological Survey of India, and during his field experiences he paid much attention to zoology, especially to mollusca, reptiles, birds, and mammals. His services, as naturalist, were enlisted in the Abyssinian expedition in 1867–68, when he accompanied the army to Magdala and back; and he published in 1870 'Observations on the Geology and Zoology of Abyssinia.' In 1872 he was engaged on the Persian Boundary Commission, and in 1876 he published a volume on the Zoology and Geology of Persia. Three years later

he became joint author with H. B. Medlicott of the 'Manual of the Geology of India.' After his retirement from the Indian Geological Survey he settled in this country, and devoted much time to the service of the Geological Society, becoming secretary in 1884, president in 1888, and subsequently serving as treasurer for ten years. He received the Wollaston Medal in 1883.

Mention should also here be made of John Whitaker Hulke (1830–95), a distinguished surgeon who had seen service in the Crimean war, and ultimately became president of the College of Surgeons. From 1869 onwards he devoted his leisure time to the study of fossil reptilia, and more especially of the Dinosauria, on which he became a leading authority. He served for many years on the Council, filled the offices of president, secretary, and foreign secretary, and was awarded the Wollaston Medal in 1887.

In 1896 there was founded

THE PRESTWICH MEDAL,

awarded under the conditions of the will of the late Sir Joseph Prestwich, D.C.L., F.R.S.

The following is the description of the medal:—

Obverse—JOSEPH PRESTWICH. Bust to left. In the field, BORN 1812; DIED 1896. Under the bust, F. B. (Frank Boucher) AFTER H. PINKER.

Reverse—THE GEOLOGICAL SOCIETY OF LONDON TO. . . . A representation of the fossil Arachnid *Prestwichia rotundata*. A ribbon for the name of the recipient.

According to the terms of bequest, Sir Joseph Prestwich left to the Geological Society a sum of 800*l.*, but owing to depreciation in the value of investments, this and other legacies had to be abated, and the sum of 709*l.* 2*s.* 10*d.* was received by the Council. 'To apply the accumulated annual proceeds, . . . at the end of every three years, in providing a Gold Medal of the value of Twenty Pounds, which, with a purse containing the remainder of the said accumulated proceeds, is to be awarded . . . to the person or persons, either male or female, and either resident in England or abroad, who shall in the opinion of the said Society have done well for the advancement of the science of Geology; or, it shall be lawful . . . from time to time to accumulate the said annual proceeds for a period not exceeding six years, and apply the said accumulated

THE PRESTWICH MEDAL.

annual proceeds to some object of special research bearing on Stratigraphical or Physical Geology, to be carried out by one single individual or by a Committee; or, failing these objects, the said Society may accumulate the said annual proceeds for either three or six years, and devote such proceeds to such special purposes as the Society may decide.'

The legacy became payable after the decease of Lady Prestwich in 1899, and was received in two instalments, in 1900 and 1904.

In 1902 there was established another Award, derived from the proceeds of the

'DANIEL-PIDGEON FUND,'

founded in accordance with the will of Daniel Pidgeon, F.G.S.

By his will, dated March 17, 1898, Daniel Pidgeon gave expression to the following wishes, leaving their fulfilment to the discretion of Mrs. Pidgeon.

'First, that she will give or bequeath One Thousand Pounds to the Council of the Geological Society of London in trust for the creation of an annual grant derivable from the interest on said One Thousand Pounds, to be used at the discretion of said Council, in whatever way may in their opinion best promote Geological Original Research, their Grantees being in all cases not more than twenty-eight years of age.'

On the death of the testator on March 13, 1900, Mrs. Pidgeon decided to give effect to her husband's wishes, and on January 23, 1902, established a Trust to be known as the Daniel-Pidgeon Fund. This was carried out by means of a Deed Poll, which empowered the Council to make rules as to the method of granting the fund. The idea is to give it to a student who offers to do a definite piece of work; and the award is made in the early summer, so that the long vacation may be utilised for the undertaking. The sum amounts to about 30*l*.

Daniel Pidgeon (1833–1900) was educated as an engineer, and served for a time under Thomas Hawksley. In 1862 he became junior partner with Mr. (afterwards Sir Bernhard) Samuelson, and was thenceforward occupied in the manufacture of agricultural implements. He communicated to the Society papers on the Submerged Forest of Torbay, and on the so-called 'Raised Beaches' of Hope's Nose and the Thatcher Rock, near Torquay. He regarded the latter accumulations not as beaches, but as phenomena marking the close of the Glacial period in England.

The attendances at the Council meetings have steadily increased year by year from an average of eight in 1820

to thirteen in 1860, and nineteen in 1890 and 1900. On one occasion (June 5, 1861) only two members were present and no business could be transacted. Such an occurrence appears to have been unique.

Between 1885 and 1895 large sums were invested, and the Society was at the end of the year 1895 in possession of investments valued at the considerable sum of 10,943*l.* 5*s.* 9*d.* Other sums have since been invested, but owing to the fall in the price of stock the value of the investments has somewhat decreased. The total value of funded property, at *cost* price, on December 31, 1906, was 11,733*l.* 11*s.* 9*d.*

The total number of members and Fellows elected from the foundation of the Society up to the end of 1906 was 4,603.

The maximum number of Fellows (1,361) was reached in 1881, since which date the number has fallen to 1,252.

Of these, one Fellow, a brother of Sir Philip de Malpas Grey Egerton, and a pupil of Dr. Buckland at Oxford—the Rev. W. H. Egerton, rector of Whitchurch in Shropshire since 1846—was elected in 1832.[1]

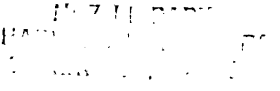
At the present time, although the total number of Fellows is lower, the number of contributing Fellows is larger than in 1881, the numbers being as follows:—

	1881	1906
Compounders	311	274
Contributing Fellows	791	946
Non-contributing	259	32
	1,361	1,252

Of the present number of Fellows 247 have communicated papers which have been read at one of the Society's meetings.

In 1898 the Council considered the question of referees, and decided that all papers should be referred as soon as convenient after they have been delivered at the

[*to face p. 256*



House of the Society.[1] In 1904 a Standing Publication Committee was appointed, and the names are now printed on the cover of the *Quarterly Journal.*

The growth of this *Journal* and the expenses attending the publication have from time to time called forth presidential comments.

In his address for 1886 Professor Bonney drew attention to the need of terseness in the writing of papers. He further expressed the opinion that selection was rendered necessary, and that while the Geological Society would rightly print important papers, the interest of which was chiefly independent of any locality, those of which the interest was mainly local would find place more appropriately in the *Transactions* of a local society, whether in this country or abroad. Two years later Professor Judd commented on the subject, pointing out the undesirability of publishing immature and controversial papers, such 'preliminary notes' as constitute one phase of a long discussion.

Again, Dr. Blanford in his Address of 1889 said: 'No papers aid more in maintaining the high character of our *Journal* than those which give the general results of an extensive series of observations, with only such details as are essential in order to enable those results to be understood.'

There is much to be said both in favour of and against the above. Those who go over the ground described with a geological paper in hand want to know the precise spots where observations were made, and particulars of each section whence fossils were obtained. Not so the reader who desires only to imbibe the main conclusions; and it is almost impossible to please both classes of inquirers. Some detailed papers on stratigraphical palæontology or on petrology may be wholly unreadable to many Fellows, and yet be of the utmost interest to those who are working at the same subjects. What is most important is that all papers be so clearly expressed that the general

[1] *Quart. Journ. Geol. Soc.* lv. p. xi.

views and conclusions of the author can be readily ascertained.

Horner, in his Addresses of 1846 and 1861, referred to the difficulty of keeping up with the progress of geology (see p. 35). Lyell, again, on receiving the Wollaston Medal in 1866, remarked on his 'inability to keep pace with the ever-increasing rate at which geology is expanding, together with the numerous sciences which are so intimately connected with it.' Lamentations on this subject have become chronic.[1] During the interval there have been added forty volumes both of the *Quarterly Journal* and of the *Geological Magazine*, not to mention countless other serials and independent works.

In this great 'talus heap' of geological literature, as it has been perhaps somewhat irreverently called, the work of all authors is apt soon to be buried up and lost sight of. To remedy this state of things no individual Fellow of the Society has helped more than Mr. Whitaker, in numerous bibliographies of counties and special subjects, and in the *Geological Record*, which he commenced in 1874 and carried on until 1879—a work that ended in a compound volume for 1880–84, edited by W. Topley and C. D. Sherborn. J. F. Blake in 1890 began in his *Annals of British Geology* to give each year a critical digest of all papers and books on geology published in the United Kingdom; he aimed at making the work readable, but his critical remarks did not please everyone. The task proved too great for one man, and it ceased with the volume for 1893.

So long ago as 1844 and 1845 Ansted compiled for the Geological Society a bibliography of the books and

a catalogue of books and pamphlets presented and purchased, but by giving also the titles of all geological articles in the *Transactions*, journals, and magazines, which were added to the Library. It was started by Professor T. Rupert Jones, at the suggestion of some members of the Council, and it proved for many years of the greatest service. This list, published at first in successive numbers of the *Quarterly Journal*, began, in February 1855, with a record from November 1 to December 31, 1854. Onwards from 1874 (vol. xxx.) it was issued annually, until the year 1894 —the end of the fiftieth volume. It was then replaced by the separate work entitled 'Geological Literature added to the Geological Society's Library'—the first issue (May 1895) being for the half-year ended December 1894, and subsequent issues being for complete years. This admirable work, compiled by Mr. William Rupert Jones, and edited by Mr. L. L. Belinfante, has become an essential aid to geological research. All works added to the Library, of whatever date, are included in the list, but it is practically a record of geological publications for each year.

A notable volume issued by the Society was the Index to the first fifty volumes of the *Quarterly Journal* (1845–94), published in 1897, and prepared with characteristic precision by Mr. Belinfante. With this should be mentioned the general index to the first forty volumes of the *Geological Magazine* (1864–1903), compiled by Mrs. Ellen S. Woodward, and edited by Dr. Henry Woodward. These works have been, and ever will be, of the utmost value for reference; but the labour was great, and it is understood that in neither case would the workers ever wish to prepare another such elaborate index.

In 1897 a committee of the Council of the Geological Society was formed in connection with the 'International Catalogue of Scientific Literature.' Under the auspices of the Royal Society bibliographical lists dealing with the literature of geology, palæontology, and mineralogy, as well as other natural sciences, have been

published, the first geological part for 1901 being issued in January 1903.

Works of this kind, as experience teaches, must either be paid for or carried on by geologists whose labours are wholly disinterested. There is no doubt, however, that they are as essential to the advance of knowledge as the addition of new facts or explanations. It is but a burden to science to publish a paper if all that is important has been said before. To those who write, a study of the previous literature is as much a duty as it should be a pleasure; yet there is a limit to human capacity.

Tennyson once remarked, in reference to parallelisms that had been pointed out in some of his poems:—

> They must always occur. A man (a Chinese scholar) some time ago wrote to me saying that in an unknown, untranslated Chinese poem there were two whole lines of mine almost word for word. Why not? Are not human eyes all over the world looking at the same objects, and must there not consequently be coincidences of thought and impressions and expressions. It is scarcely possible for anyone to say or write anything in this late time of the world to which in the rest of the literature of the world a parallel could not be found.[1]

There is a good deal of truth in this when applied to geological science.

Mr. A. Harker, in referring to the great annual output of descriptive petrology or petrography, has observed:—

> Much of it is doubtless of great value; but its value can only be very partially realised, for the reason that this accumulation of material has far outstripped the other side of the science, the business of which is to co-ordinate the scattered observations, and bring to light the principles which underlie them.[2]

The only way out of the difficulty is the collecting and sorting of the 'pearls' of geological truth, in monographs and memoirs and other works of reference, so long as adequate acknowledgment is given of the original ob-

[1] 'Life of Tennyson,' i. p. 256. [2] *Geol. Mag.* 1903, p. 174.

servers, whose labours are thus rescued from oblivion. In old times Lyell carried on this great work; in later times in this country it has devolved largely upon Sir Archibald Geikie, who has appropriately been called again to occupy the Chair as president of the Society during its Centenary celebration. In saying so much, reference should not be omitted to the monumental work of our foreign member, Eduard Suess, who first saw light on British soil, and whose work, 'Das Antlitz der Erde,' embodies a mass of original research, with full records of the labours of others in all quarters of the globe. In the words of Sir Archibald Geikie, it 'may be regarded as a noble philosophical poem, in which the story of the continents and the oceans is told by a seer gifted with rare powers of insight into the past.'[1]

Mr. Hudleston in one of his addresses, oft quoted before, observed: 'The Geological Society, as we have seen, is still a pugnacious body, though the matters over which it fights are, perhaps, less understanded of the People than was formerly the case, and for the same reason may possibly attract less general interest, although the work is none the less valuable because it requires a certain amount of special training in order that it may be appreciated.'[2]

It is one of the advantages of geology that it is truly a recreative science. If most branches require precision of knowledge in biology and physics, in chemistry and mineralogy, and much work has to be done in the museum and laboratory, to say nothing of the arm-chair, yet the fulness of the science can never be attained without the vivifying influence of mountain and moor, of valley and sea-coast. It is therefore a satisfaction to know that attractive and important work can now and ever be done, as of old, by those who, like Hugh Miller and Charles

[1] *Nature*, May 4, 1905. A translation of Suess's work, by Miss Hertha B. C. Sollas, under the direction of Professor W. J. Sollas, is in progress; two volumes have been published.

[2] Address to Geol. Soc. 1894.

Peach, had no academic training. Possessing a real love of Nature and of Science, and undaunted by the vagaries of palæontological nomenclature, they may render most useful, if humble, service, by seeking out in cliff and quarry, with particular regard to horizon, those 'Medals of Creation,' on the accurate knowledge of which, advance in our study of the life-history of the globe must ever depend.[1]

On February 15, 1907, the Council and officers elected were as follows :—

President.

Sir Archibald Geikie, D.C.L., Sec.R.S.

Vice-Presidents.

J. E. Marr, Sc.D., F.R.S.
Prof. W. J. Sollas, LL.D., F.R.S.
Aubrey Strahan, Sc.D., F.R.S.
J. J. H. Teall, D.Sc., F.R.S.

Secretaries.

Prof. W. W. Watts, M.Sc., F.R.S.
Prof. E. J. Garwood, M.A.

Foreign Secretary.

Sir John Evans, K.C.B., D.C.L., F.R.S.

Treasurer.

Horace W. Monckton, Treas.L.S.

Other Members of Council.

H. H. Arnold-Bemrose, M.A.
Prof. S. H. Cox, F.C.S.
W. H. Hudleston, M.A., F.R.S.
F. L. Kitchin, M.A., Ph.D.
George W. Lamplugh, F.R.S.
Prof. Charles Lapworth, LL.D., F.R.S.
Frederick W. Rudler, I.S.O.
Leonard J. Spencer, M.A.
Charles Fox Strangways.
Richard H. Tiddeman, M.A.
Henry Woods, M.A.
Arthur Smith Woodward, LL.D., F.R.S.

Swan Electric Engraving Co. Ltd.

Sir Archibald Geikie

Sc.D. D.C.L. LL.D. Sec.R.S.

President 1891-92; 1906-07.

APPENDIX

CHARTER

OF THE

GEOLOGICAL SOCIETY OF LONDON

[The Charter is engrossed on two parchments, to which is attached an impression in wax of the Great Seal of King George IV., preserved in a tin box. Both are edged with an engraved border of scroll-work in the style of the eighteenth century, with medallion portraits of King George III. and Queen Charlotte at the sides, and the Royal Arms and those of Mecklenburg at the top. The first is further adorned with a large portrait of King George III. in his youth, enclosed in the initial letter G. The stamps amount to 50*l.* The Charter is, it is believed, now for the first time correctly printed. There are several versions both printed and in manuscript, all made about the time the Charter was granted, and all differing from the original and from each other. The inaccuracies are slight and do not affect the sense of the Charter, but it is curious that these copies should have been issued without anyone apparently taking the trouble to collate them with the original. In the Charter, as now printed, the original has been followed exactly both as to capital letters and stops.]

George the Fourth by the Grace of God of the United Kingdom of Great Britain and Ireland King Defender of the Faith To all to whom these Presents shall come Greeting Whereas The Reverend William Buckland Bachelor in Divinity Arthur Aikin Esquire John Bostock Doctor of Physic George Bellas Greenough Esquire Henry Warburton Esquire and several others of our loving Subjects being desirous of forming a Society for investigating the Mineral structure of the Earth and having for promoting such investigation expended considerable sums of money in the purchase and collection of books maps specimens and other objects and in the publication of various works the said William Buckland Arthur Aikin

John Bostock George Bellas Greenough and Henry Warburton have humbly besought us to grant unto them and unto such other persons as shall be appointed and elected Fellows of the said Society as hereinafter is mentioned Our Royal Charter of Incorporation for the better carrying on the purposes aforesaid Now therefore Know Ye that We being desirous to encourage so laudable an undertaking of Our especial grace certain knowledge and mere motion Have willed ordained constituted declared given and granted And by these Presents Do for us our heirs and successors will ordain constitute declare give and grant that our loving subjects the said William Buckland Arthur Aikin John Bostock George Bellas Greenough and Henry Warburton and such other persons as shall from time to time be appointed and elected Fellows of the said Society in manner hereinafter directed and their respective successors shall for ever hereafter be by virtue of these presents one body politic and corporate by the name of the Geological Society of London And We do Will constitute and declare them and their successors to be one body politic and corporate for the purposes aforesaid And by the Name aforesaid to have perpetual succession and to have a Common seal with full power and authority to alter vary break and renew the same at their discretion and by the same name to sue and be sued to implead and be impleaded and answer and be answered unto in every Court or place of us our heirs and successors And We do Will constitute and grant that the persons hereby incorporated and their successors shall be for ever able and capable in the Law to purchase receive hold possess and enjoy to them and their successors any Goods and Chattels whatsoever And notwithstanding the Statutes of Mortmain to take purchase hold and enjoy to them and their successors any lands tenements and here-

the same and shall have full power and authority to sell alien charge or otherwise dispose of any real or personal property so to be by them acquired as aforesaid and to act and do in all things relating to the said Corporation in as ample manner and form as any other our liege subjects being persons able and capable in the law or any other body politic or corporate in our said United Kingdom of Great Britain and Ireland may or can act or do And We do hereby declare and grant that the number of Fellows of the said Society shall be indefinite and that they the said William Buckland Arthur Aikin John Bostock George Bellas Greenough and Henry Warburton shall be the first Fellows of the said Society and that any three or more of them shall and may on or before the Third Friday in February next ensuing the date of these Presents under their respective hands in writing appoint such other persons to be Fellows and foreign Members of the said Society as are willing to be appointed and as they may think fit And We do further declare and grant That for the better government of the said Society and for the better management of the Concerns thereof there shall be from the date of these Presents thenceforth and for ever a President and Council of the said Society and that such Council whereof the President shall be deemed a Member shall from the date of these Presents until the third Friday in February next ensuing consist of five Members and from the said third Friday in February thenceforth and for ever shall consist of twenty three Members And We do hereby appoint the said William Buckland to be first President and the said William Buckland together with the said Arthur Aikin John Bostock George Bellas Greenough and Henry Warburton to be the first Council all and each of the aforesaid Persons to continue in such

then last or other usual place of Meeting of the said Society and by method of ballot remove from the then present Council one fifth or more of the Persons of whom it shall then be composed And also shall and may by the like method of Ballot elect other persons being Fellows of the said Society into the Council who together with the persons not so removed shall form the Council for the then next ensuing year so as that the Members of such Council shall amount in number to twenty three And also that the Fellows of the said Society or any eleven or more of them shall and may at the time and in manner aforesaid by the like method of ballot elect from among the Members of the Council when formed and elected in the manner aforesaid one person to be President of the said Society for the year ensuing and so many and such persons as they shall think proper to be Vice-Presidents Secretary or Secretaries and Treasurer or Treasurers of the said Society for the year ensuing And also shall and may in case of the death of the President or of any Vice-President Secretary or Treasurer or of any other Member of the Council for the time being of the said Society within the space of two months next after such death or as near thereto as conveniently may be in manner aforesaid elect some other person being a Fellow of the said Society to supply the place of such President Vice-President Secretary Treasurer or other Member of the Council so dying And we do further declare and grant that from and after the said third Friday in February now next ensuing the Fellows of the said Society or any eleven or more of them shall and may have the power from time to time at the General Meetings of the said Society to be

such Officers and Servants again to remove and renew or restore as they shall see occasion And we do further declare and grant that from and after the said third Friday in February now next ensuing the Fellows of the said Society or any eleven or more of them shall and may have the power to make and establish such orders and bye-laws as shall appear to them useful for the government of the said Society for defining the powers to be entrusted to the Council the President and other Officers thereof and the duties to be performed by such Officers respectively for the management of the Estates Goods Lands Revenues and Business of the said Society and for the regulating the particular manner of proposing electing admitting and removing all and every the Fellows Foreign Members Officers and Servants thereof for fixing the times and places of the Meetings of the said Society and also the sum or sums to be paid by the Fellows towards carrying on the purposes of the said Society and the same Orders and Bye-Laws from time to time as they may see occasion to alter suspend or repeal and to make such new Orders and Bye-Laws in their stead as they shall think proper and expedient so as the same be not repugnant to these presents or the Laws of this our Realm And also that the Council or any five or more of the Fellows of the said Society shall have power to move the Enactment of any new Bye-Laws or the alteration suspension or repeal of any existing Bye-Law provided notice of such Motion shall have been delivered to one of the Secretaries in writing and shall have been read from the Chair at two successive meetings of the Fellows of the said Society But that no such Motion shall be deemed or taken to pass in the affirmative until the same shall have been discussed and decided by Ballot at another meeting summoned especially for that purpose an absolute majority of the Fellows then present having voted in the affirmative In witness whereof we have caused these our Letters to be made Patent Witness ourself at our Palace at Westminster this twenty-third day of April in the sixth year of our reign.

By Writ of Privy Seal.

Scott.

LIST OF

MEMBERS OF THE GEOLOGICAL SOCIETY IN ORDER OF ELECTION FROM 1807 TO THE INCORPORATION OF THE SOCIETY IN 1825

Supplemented by List of Fellows and Foreign Member elected during the Session 1825–26, prior to the publication of the first number of the *Proceedings* of the Geological Society.[1]

H.M. indicates Honorary and **F.M.** Foreign Members.

1807

Aikin, Arthur,	ORIGINAL	MEMBER.
Allen, William, F.R.S.,	,,	,,
Babington, William, M.D., F.R.S.,	,,	,,
Bournon, James Lewis, Count de, F.R.S.,	,,	,,
Davy, [Sir] Humphry, Sec. R.S.,	,,	,,
Franck, James, M.D., [F.R.S.],	,,	,,
Greenough, George Bellas, M.P., F.R.S.,	,,	,,
Knight, Richard,	,,	,,
Laird, James, M.D.,	,,	,,
Parkinson, James,	,,	,,
Pepys, William Hasledine, F.R.S.,	,,	,,
Phillips, Richard, [F.R.S.],	,,	,,
Phillips, William [F.R.S.],	,,	,,

Allan, Thomas, *Edinburgh.*	**H.M.**
Bevan, Robert, M.D., *Monmouth.*	**H.M.**
Bright, Richard, *Bristol.*	**H.M.**
Carne, Joseph, [F.R.S.], *Penzance.*	**H.M.**
Carter, Milbourne Peter, M.D., *Braintree.*	**H.M.**

[1] The names of Fellows, Foreign Members, and Foreign Correspondents elected on and after November 3, 1826, are given in order of election in the *Proceedings* and *Quarterly Journal.*

Every care has been taken to ascertain the correct spelling of the names, which are in a few cases wrongly entered in the earlier published lists.

Cheston, Richard Brown, M.D., F.R.S., *Gloucester.* H.M.
Clarke, Edward Daniel, LL.D., Prof. Mineralogy, *Cambridge.* H.M.
Clayfield, William, *Bristol.* H.M.
Conybeare, Rev. Prof. John Josias, M.A., *Oxford.* H.M.
Crawford, David, *Ballyshannon, Donegal.* H.M.
Dennis, J., *Penzance.* H.M.
Dillwyn, Lewis Weston, F.R.S., *Swansea.* H.M.
Du Gard, Thomas, M.D., *Shrewsbury.* H.M.
Gregor, Rev. W., *Creed, near Grampound.* H.M.
Hailstone, Rev. John, F.R.S., Woodwardian Professor, *Cambridge.* H.M.
Hawker, John, *Dudbridge, Gloucestershire.* H.M.
Hincks, Rev. Thomas D., Lecturer at Inst., *Cork.* H.M.
Hope, Thomas Charles, M.D., [F.R.S.], Professor of Chemistry, *Edinburgh.* H.M.
Jameson, Robert, [F.R.S.], Prof. Nat. Hist., *Edinburgh.* H.M.
Kidd, John, M.D., [F.R.S.], Professor of Chemistry, *Oxford.* H.M.
Kirwan, Richard, LL.D., F.R.S., Pres. R.I.A., *Dublin.* H.M.
MacDonnel, James, M.D., *Belfast.* H.M.
Meade, Thomas, *Chatley, near Bath.* H.M.
Menish, Henry, M.D., *Chelmsford.* H.M.
Murray, John, Lecturer on Chemistry, *Edinburgh.* H.M.
Mushet, David, *Alfreton Iron Works, Derbyshire.* H.M.
Newton, Rev. Benjamin, *Bedwin, near Marlborough.* H.M.
Parry, Caleb Hillier, M.D., F.R.S., *Bath.* H.M.
Pegge, Sir Christopher, F.R.S., Reg. Prof. Medic., *Oxford.* H.M.
Playfair, John, F.R.S., Prof. Nat. Phil., *Edinburgh.* H.M.
Rashleigh, Philip, F.R.S., *Menabilly, Cornwall.* H.M.
Rashleigh, William, [M.P., F.R.S.], *Kilmarth, Cornwall.* H.M.
Richardson, Rev. William, D.D., *Clonfecle, near Moy.* H.M.
Taylor, John, [F.R.S.], *Holwell House, Tavistock.* H.M.
Thomson, Thomas, M.D., [F.R.S.], Lecturer on Chemistry, *Edinburgh.* H.M.
Townsend, Rev. Joseph, *Pewsey, Wilts.* H.M.
Turner, Rev. William, Lect. Inst., *Newcastle.* H.M.
Ure, Andrew, M.D., [F.R.S.], *Glasgow.* H.M.
Vivian, John Henry, [F.R.S.], *Swansea.* H.M.
Watt, James, jun., [F.R.S.], *Birmingham.* H.M.
Wilkinson, Joseph, *Bath.* H.M.
Williams, John, jun., [F.R.S.], *Scorrier House, Redruth.* H.M.

1808.

Ridout, John Gibbes.
Banks, Rt. Hon. Sir Joseph, Bart., Pres. R.S.
Foster, Rt. Hon. John, M.P., F.R.S., [Baron Oriel, Ireland]. H.M.
Griffith, [Sir] Richard John, *Millicent, Ireland.* H.M.
Hawkins, John, F.R.S., *Petworth.* H.M.
Lovell, Robert, M.D., *Bristol.* H.M.
Mackenzie, Sir George S., [F.R.S.], *Coul, Dingwall.* H.M.
Roberts, William, *Gloucester.* H.M.
Seymour, Lord Webb, F.R.S., *Edinburgh.* H.M.
Greville, Rt. Hon. Charles F., P.C., F.R.S. (Patron).
Children, John George, F.R.S.
Macculloch, John, M.D., [F.R.S.]
Bingley, Robert, F.R.S.
Giddy [Gilbert] Davies, M.P., F.R.S. (elected H.M. in 1809).
Hall, Sir James, Bart., M.P., F.R.S.
Horner, Leonard, [F.R.S.]
Jaffray, Alexander.
Lowry, Wilson, [F.R.S.]
Marcet, Alexander John Gaspard, M.D., F.R.S.
Morgan, William, F.R.S.
Raine, Rev. Matthew, D.D., F.R.S.
Keir, James, F.R.S., *Dudley.* H.M.
St. Aubyn, Sir John, Bart., F.R.S.
Hume, Sir Abraham, Bart., M.P., F.R.S.
Macmichael, William, M.D., [F.R.S.]
Sowerby, James.
Affleck, Major-General [Sir] James, *Enniskillen.* H.M.
Beddoes, Thomas, M.D., *Clifton, Bristol.* H.M.
Clark, John, *Elden, Edinburgh.* H.M.
Harford, Charles Joseph, *Stapleton, Bristol.* H.M.
Higgins, William, F.R.S., Prof. Chem., Royal Dublin Soc. H.M.
Joy, Henry, *Dublin.* H.M.
Knox, Rt. Hon. George, F.R.S., *Dublin.* H.M.
Nesbitt, Major, Woodhill, *Killybeggs.* H.M.
Sampson, Rev. George V., *Temple Hill, Garvagh.* H.M.
Seaforth, Francis, Lord, F.R.S. H.M.
Skene, Charles, M.D., Prof. Anat., *Aberdeen.* H.M.
Skene, James, *Rubislaw, Aberdeenshire.* H.M.
Stephens, Rev. Walter, *Dublin.* H.M.
Walker, John, F.R.S., *Kildrum, Ireland.* H.M. [afterwards Ord. Mem.]

Birkbeck, George, M.D.
Burrow, Rev. Edward John, [F.R.S.]
Ricardo, David, [M.P.].
Saunders, William, M.D., F.R.S.
Sutton, Sir Thomas, Bart.
Barclay, James Robertson, M.D., [F.R.S.], *Dunfermline.* H.M.
Berger, J. Francis, M.D., *Geneva.* H.M.
Cunnington, William, *Heytesbury, Wilts.* H.M.
Henry, William, M.D., F.R.S., *Manchester.* H.M.
Herbert, Joseph, *Bristol.* H.M.
Keogh, Cornelius, jun., *Dublin.* H.M.
Imrie, Lieut.-Colonel, *Edinburgh.* H.M.
Winch, Nathaniel John, *Newcastle-on-Tyne.* H.M.
Atkinson, William.
Burton, James, jun.
Goodenough, Samuel, Bishop of Carlisle, F.R.S.
Edgeworth, Henry, M.D.
Hobson, William.
Jacob, William, M.P., F.R.S.
Lambert, Aylmer Bourke, F.R.S.
Ridout, John.
Warburton, Henry, [M.P., F.R.S.]
Williams, William.
Woods, Samuel.
Beaufort, Capt. [Rear-Admiral Sir] Francis, R.N., [F.R.S.], *London.* H.M.
Children, George, *Tonbridge.* H.M.
Major, Rev. Henry, *Ballyshannon.* H.M.
Selkirk, Thomas, Earl of, F.R.S., *London.* H.M.
Farish, William, M.A., Prof. Chem., *Cambridge.* H.M.
Richardson, Rev. Benjamin, *Bath.* H.M.
Walford, Thomas, *Birdbrook, Essex.* H.M.
Hue, Clement, M.D.
Shuter, Edward, M.A.
Wilkinson, Charles.
Beaufort, Rev. William, *Cork.* H.M.
Day, Samuel Skurray, *Bath.* H.M.
Faber, Richard, M.D., *Leeds.* H.M.
Millar, James, M.D., *Edinburgh.* H.M.
Necker, Louis Albert, M.D., Prof. Min., *Geneva.* H.M.
Nugent, Nicholas, M.D., *Antigua.* H.M.
Bright, John, M.D., *Birmingham.* H.M.

1809.

Boddington, Samuel.	
Davis, Samuel, F.R.S.	
Garnier, Pascal.	
Hatchett, Charles, F.R.S.	
Tilloch, Alexander.	
Bigge, Charles, *Alnwick.*	H.M.
Buddle, Thomas, jun., *Newcastle-on-Tyne.*	H.M.
Fenwick, Thomas, *Newcastle-on-Tyne.*	H.M.
Hill, George, *Newcastle-on-Tyne.*	H.M.
Monck, Sir Charles Middleton, Bart., *Belsay Castle, Northumberland.*	H.M.
Thomas, William, *Benwell, Newcastle-on-Tyne.*	H.M.
Ferguson, Robert, F.R.S.	
Warren, Pelham, M.D., [F.R.S.]	
Maconochie, James Allan, *Edinburgh.*	H.M.
Holland, [Sir] Henry, [M.D., F.R.S.], *Knutsford.*	H.M.
Easton, Josiah, *Bradford, near Taunton.*	H.M.
Apsley, Capt. Alexander.	
Lewis, John.	
Telford, Thomas, [F.R.S.]	
Webster, Thomas.	
Emerson, Alexander Lyon, M.D., *Cape of Good Hope.*	H.M.
Swedenstierna, Herr, *Stockholm.*	H.M.
Hogg, Thomas.	
Martin, William, *Macclesfield.*	H.M.
Nimmo, Rev. Alexander, *Inverness.*	H.M.
Carlisle, Anthony, F.R.S.	
Champernowne, Arthur (of Dartington Hall), *Totnes.*	
Satterley, Richard P., M.D.	
Coleman, Robert, *Dublin.*	H.M.
Jenner, Edward, M.D., F.R.S., *Berkeley.*	H.M.
Fayle, Benjamin.	
Horner, Francis, M.P.	
Roget, Peter Mark, M.D., [F.R.S.]	
Ellis, Daniel, *Edinburgh.*	H.M.

1810.

Dunston, John.
Almon, William Bruce, M.D., *Halifax, New England.* H.M.
Echman, Herr, M.D., *Gottenburg.* H.M.
Bland, Michael, [F.R.S.]
Cumberland, George, *Bristol.* H.M.
Gray, Francis, Lord, [F.R.S.], *Kinfauns Castle.* H.M.
Mammatt, Edward, *Measham.* H.M.
Milnes, William, jun., *Ashover.* H.M.
Bevan, Benjamin, *Leighton Buzzard.* H.M.
Lupton, Sackville Ball, *Thame, Oxon.* H.M.
Blore, Edward, [F.R.S.]
Chenevix, Richard, F.R.S.
Henderson, Alexander, M.D.
Lemann, F.
Lainé, Francis Joseph, *Paris.* H.M.
Birkbeck, Morris.
Harris, William, *Brislington.*
Harvey, Charles, [Charles Savill Onley], M.P., [F.R.S.].
Lettsom, John Coakley, M.D., F.R.S.
Woods, Joseph.
Solly, Samuel, [F.R.S.]
Bald, Robert, *Alloa.* H.M.
Mudge, Lieut.-Col. R. Z., R.A., F.R.S., *Woolwich.* H.M.
Williams, John Lloyd, F.R.S., *Alderbrook Hall, Cardiganshire.* H.M.
Curry, James, M.D.
Young, William.
St. Fond, Col. Faujas [de]. H.M.
Bright, Richard, jun., [F.R.S.]

1811.

Crichton, [Sir] Alexander, M.D., F.R.S.
Stokes, Charles, [F.R.S.]
Vandercom, Joseph Fitzwilliam.
Yelloly, John, M.D. [F.R.S.]
Englefield, Sir Henry Charles, Bart., F.R.S.
Conybeare, [Rev.] William Daniel, [F.R.S.]
Bennet, Hon. Henry Grey, M.P., [F.R.S.]
Rundell, Edmund Waller.
Tennant, Smithson, F.R.S.
Souza, Chevalier de Gouttinho, His Excellency [Count de Funchal].

1812.

James, William.
Serle, Rev. Philip.
Clerk, Sir George, Bart, M.P., [F.R.S.]
Blake, William, F.R.S.
Compton, Rt. Hon. Earl, [Marquis of Northampton], M.P., [F.R.S.]
Taylor, William, M.P.
Walker, Joshua.
Valentia, Rt. Hon. George, Viscount, [Earl of Mountnorris], F.R.S.
Franklin, William, M.D., [F.R.S.]
Bell, [Sir] Charles, [F.R.S.]
Moore, Daniel, F.R.S.
Slater, Rev. Edward.
Dundas, Rt. Hon. Thomas, Lord.
Wollaston, William Hyde, M.D., Sec. R.S.
Brownlow, Rt. Hon. John, Lord, F.R.S.
Crosse, John.
Cotton, Richard.
Parkes, Samuel.
Forster, John.
Forbes, Rev. Patrick.
Murdoch, Thomas, F.R.S.
Nicholson, William.
Tuthill, George Leman, M.D., F.R.S.
Hare, Thomas.

1813.

Fleming, John, M.D., F.R.S.
Hutton, Robert, [M.P.]
D'Andrada, I. B.
Vaughan, William, F.R.S.
Mackenzie, Charles, [F.R.S.]
Tudor, John Owen.
Bostock, John, M.D., [F.R.S.]
Traill, Thomas Stewart, M.D.
Lansdowne, Rt. Hon. Henry, Marquis of, F.R.S.
Long, Rt. Hon. [Sir] Charles, [Bart.], M.P., F.R.S.
Clark, [Rev. Prof.] William, M.D., [F.R.S.]
Wilkinson, Charles H., M.D.
Buckland, Rev. Prof. William, [F.R.S.]
Sotheby, William, F.R.S.

Lemon, [Sir] Charles, Bart., [F.R.S.]
Heuland, Henry.
Sabine, Joseph, F.R.S.
Smith, Thomas.
Solly, Richard Horseman, F.R.S.
Frere, Edward.
Gregory, Thomas.
Botfield, Thomas, [F.R.S.]
Culley, Matthew.
Brandram, Thomas.
Hill, William.
Elwin, Hastings.
Daniell, John Frederic, [F.R.S.]
Devonshire, William Spencer, Duke of.
Whishaw, John, [F.R.S.]
Drummond, Henry, [F.R.S.]
Price, Charles, M.D.
Lowndes, William.
Kirkwall, John, Viscount, M.P., F.R.S.
Sutherland, Alexander, M.D., [F.R.S.]
Wilbraham, George, [F.R.S.]
Hony, Rev. William Edward.
Barnes, Rev. George.
Hanson, John.
Barham, John Forster, M.P.
Bigge, Thomas.
Turner, Samuel, [F.R.S.]
Horne, Edward.
Holme, Rev. J.
Turner, Charles Hampden, [F.R.S.]
Congreve, Lieut.-Col. [Sir] William, [Bart.], M.P., F.R.S.
Sheffield, W. E.
Rennie, John, F.R.S.
Hardwicke, Rt. Hon. Philip, Earl of, F R.S.
Fox, George Croker.
Rose, William Stewart.
Smith, Thomas P.
Trower, Hutches.

1814.

Meyer, Christian Paul.
Wood, Edward.
Harrison, William.
Mills, Abraham, F.R.S.
Chantrey, [Sir] Francis, [F.R.S.]
Robley, Joseph.
Kent, Samuel Luck.
Brande, Prof. William Thomas, F.R.S.
Guilding, Rev. J., A.M.
Whitwell, Thomas Stedman.
Wilson, Joseph.
Guillemard, John, F.R.S.
Sebright, Sir John Sanders, Bart., M.P.
Powell, Baden.
Rucker, John Anthony.
Nettleship, Thomas.
Hartwell, Francis.
King, Rt. Hon. Lord.
Colby, Capt. [Major-General] Thomas F., R.E., [LL.D., F.R.S.]
Merry, William.
Dubois, William.
Slater, James Henry.
Swinburne, Sir John Edward, Bart., [F.R.S.]
Atholl, John, Duke of, K.T., F.R.S.
Prinsep, William.
Yeoman, Henry Walker.
Milton, Rt. Hon. Charles William, Viscount, M.P., F.R.S.
St. John, Rt. Hon. Lord, F.R.S.
Gordon, Robert, M.P.
Webb, Philip Barker, [F.R.S.]
Sneyd, Rev. Lewis.
Macbride, John David, LL.D.
Tyler, Rev. James Endell.
Longlands, William David.
Campbell, William Hamilton.
Skottowe, John.
Cumming, Sir William Gordon, Bart.
Hunter. William.

1815.

Harrison, Thomas, F.R.S.
Perkins, Frederick.
Rowley, Col. John, R.E., [F.R.S.]
Granville, Augustus Bozzi, M.D., [F.R.S.]
Brooke, Henry James, [F.R.S.]
Murray, William.
Stafford, George Granville Leveson, Marquis of.
Murray, Rt. Hon. Lord James, [Lord Glenlyon], [F.R.S.]
Coxe, Leonard Streate.
Booth, John, M.D.
Lygon, Hon. William Beauchamp, M.P., F.R.S.
Duckett, Col. [Sir] George, [Bart.], F.R.S.
Alexander [Sir] William, [Lord Chief Baron].
Leckie, Francis Gould.
Blackburn, Edward Berens.
Hallam, Henry, [F.R.S.]
Steers, James.
Strutt, Joseph Douglas.
Lambton, John, M.P.
Harrison, Thomas Charles, [F.R.S.]
Buch, Leopold von. F.M.
Morritt, J. B. S., M.P.
Gordon, John.
Rucker, D. H.
Ward, —.
Leman, Rev. Thomas.
Basevi, George, [F.R.S.]
Norris, John.
Forbes, William Nairn, [F.R.S.]
Nicholl, Rt. Hon. Sir John, F.R.S.
Davy, Sir Humphry, Bart., LL.D., Pres. R.S. (re-elected).
Strangways, Hon. William Thomas Horner Fox, [Earl of Ilchester, F.R.S.]
Duncan, John Shute.
Coxe, Prof. John Redman, M.D.
Esmark, Prof. Jens, Christiania. F.M.

Stevenson, Robert.
Majendie, Ashhurst, [F.R.S.]
Rhode, Samuel.
Colebrooke, Henry Thomas, [F.R.S.]
Fletcher, Samuel.

1816.

Hamilton, William, F.R.S.
Bald, William.
Muirhead, Prof. Lockhart, M.A.
Neill, Patrick, F.R.S.
Hartwell, Rev. Houlton.
Somerville, William, M.D., [F.R.S.]
Parker, Thomas.
Lucas, J. H., *Paris.* F.M.
Breislak, Scipio, *Milan.* F.M.
St. Aubin, Rev. John.
Villiers, Prof. Brochant de, *Paris.* F.M.
Monteiro, Prof. Juan Antonio de, *Lisbon.* F.M.
Pini, Il Cavaliere Ermenegildo, Prof. Nat. Hist., *Milan.* F.M.
Fraser, Alexander.
Tonnellier, Abbé, *Paris.* F.M.
Perry, James.
Hoblyn, Thomas, F.R.S.
Barrow, James, F.R.S.
Brocchi, Giovanni Battista, *Milan.* F.M.
Fitton, William Henry, M.D., F.R.S.
Monticelli, [Il Cavaliere] S., *Naples.* F.M.
Berneau, Thiebaut de, *Paris.* F.M.
Costa, Hananel Mendes da.
Marryat, Capt. Frederick, R.N., [F.R.S.]
Hanmer, Edward, [F.R.S.]
Larkin, Nathaniel John.
Nicholson, R.
Legh, Thomas, M.P., F.R.S.
Marryat, Joseph, jun.
Cumming, Rev. Prof. James, F.R.S.
Leman, Sebastian, *Paris.* F.M.
Drée, le Marquis de, *Paris.* F.M.

Raumer, Prof. Karl von, *Breslau.* F.M.
Schlotheim, Ernst Friedrich von, *Gotha.* F.M.
Shawe, Lieut.-Col. Meyrick.
Neville, Richard Janion.
Bransby, Rev. John, M.A.
Brewster [Sir] David, LL.D., F.R.S.
Baily, Francis, [F.R.S.]
Tucker, Henry.
Ellison, Nathaniel.
Hill, Anthony.
Johnson, Thomas.
Wright, Richard, M.D.
Vauquelin, M. Nicholas Louis, *Paris.* F.M.
Humboldt, Baron Alexander von, *Berlin.* F.M.
Coles, John.
Kelsall, Charles.
Kennedy, Benjamin.
De la Beche [Sir] Henry Thomas, [C.B., F.R.S.]
Leonhard, Karl Caesar von, *Munich.* F.M.
Traherne, Rev. John Montgomery, M.A., [F.R.S.]
Stewart, Col. David.
Ray, Robert.
Giesecke, Prof. [Sir] Charles Louis.
Ducane, Peter, jun.
Wood, William.
Moore, Rev. Robert, M.A.
Rowley, Rev. George, M.A., F.R.S.
Trevelyan, [Sir] Walter Calverley, [Bart.]
Wall, Rev. Martin Sandys, M.A.
Abel, Clarke, [M.D., F.R.S.]
Terry, Lieut. Wilkins George.
Carr, Thomas William, F.R.S.
Arnold, James Henry, LL.D., F.R.S.
Holford, Charles.
Freshfield, James William, [F.R.S.]

1818.

Pollock, Frederick, F.R.S.
Williams, Owen.
Turner, John.
Vetch, Capt. James, R.E., [F.R.S.]
Deacon, James Henry.
Daubeny, Charles Giles B., M.A., M.D., [F.R.S.].

Halifax, Rev. Robert.
Hicks, John Phillimore.
Rickards, Richard Fowler.
Lauder, [Sir] Thomas Dick, [Bart.]
Dansey, [Rev.] William, M.B.
Cooke, Rev. George, D.D.
Hale, William Hale.
Gurney, John.
Vine, James.
Acland, Sir Thomas Dyke, Bart.
Copeland, Alexander.
Shepley, Michael.
Edwards, William.
Mantell, Gideon Algernon, [LL.D., F.R.S.]
Gmelin, Prof. Christian Gottlob, *Tübingen.* F.M.
Mohs, Prof. Friedrich, *Freyburg.* F.M.
Marshall, William.
Tinney, William Henry.
Guest, Josiah John, [F.R.S.]
Colvile, Sir Charles Henry.
Craven, John.
Evans, Rev. Robert.
Morgan, James.
Haliburton, Alexander.
Cleveland, Prof. Parker, *Bowdoin College, New England.* F.M.
Weiss, Prof. Christian Samuel, *Berlin.* F.M.
Hall, Captain Basil, R.N., F.R.S.
Hewett, George.
Sedgwick, Rev. Prof. Adam, M.A., [F.R.S.]
Puller, Richard.
Beudant, François Sulpice, *Paris.* F.M.
Pennant, David, jun.
Simpson, Charles.
Anstice, Robert.

1819.

Clift, William, [F.R.S.]
Home, Sir Everard, Bart., F.R.S.
Templeman, Giles.
Bowles, William.

Crawshay, William, jun.
Macdonald, William, M.D.
Harrison, Matthew, jun.
Hull, William Winstanley.
Parsons, George.
Malcolm, James.
Lyell, [Sir] Charles, [Bart., F.R.S.]
Wallich, Nathaniel, M.D., [F.R.S.]
Petit, Louis Hayes, [F.R.S.]
Berzelius, Prof. J. Jacob, *Stockholm.* **F.M.**
Johnson, Percival.
Hutton, Thomas.
Lomax, Edmund.
Cole, John.
Breuner, Count A., *Vienna.* **F.M.**
Henslow, Rev. [Prof.] John Stevens, M.A.
Worthington, Charles.
Jardine, James.

1820.

Freeling, J. C.
Lubbock, Sir John William, Bart., M.P., [F.R.S.]
Johnson, Benjamin William.
Palmer, George.
Hatton, Edward Finch.
James, Rev. Edward, A.M.
Galton, Samuel, F.R.S.
Rumsey, Lacy.
Wrottesley, John.
Staunton, Sir George Thomas, Bart., M.P., F.R.S.
Sandys, William.
Hitchins, John, jun.
Millington, Prof. John.
Onslow, Col. the Hon. Mainwaring.
Sarjeant, Frederick.
Fothergill, Richard, jun.
Weaver, Thomas, [F.R.S.]
Irvine, Rev. Andrew.
Pansner, Dr. Lorenz von, *St. Petersburg.* **F.M.**
Fischer, Prof. Gotthelf, *Moscow.* **F.M.**
Hakewill, Henry.
Ricketts, Charles Milner, M.P., F.R.S.
Russell, Jesse Watts, M.P., LL.D., [F.R.S.]
Leopold, Prince of Saxe-Coburg, H.R.H.

Wilson, John.
Chaundy, Rev. Edward Elton, M.A.

1821.

Gerard, Lieut. A.
Jack, William.
Scott, David.
Crawford, John, F.R.S.
Burney, Rev. Charles Parr, M.A., F.R.S.
Lock, James.
Harrison, Thomas.
Rogers, Rev. Thomas Ellis.
Grenville, Lord William Wyndham, F.R.S.
Cartwright, Thomas.
Walker, John, F.R.S.
Cordier, Prof. Louis, *Paris.* F.M.
Campbell, Hon. John [Lord Cawdor], M.P., F.R.S.
Horsfield, Thomas, M.D., [F.R.S.]
Parkinson, John, [F.R.S.]
Colebrooke, Sir James Edward, Bart., F.R.S.
Daniel, Richard.
Philpot, Rev. B.

1822.

Gimbernat, Carlos de, *Munich.* F.M.
Braddyll, Thomas Richmond Gale.
Wood, George William.
Caldcleugh, Alexander, [F.R.S.]
Jenkyns, Rev. H.
Clare, Sir Michael B., M.D.
Webster, J. W., M.D., *Boston, Mass.* F.M.
Beaumont, Thomas Wentworth, M.P.
Christian Frederick, Prince of Denmark, H.R.H.
Onis, Chev. Luis de.
Burton, Henry, M.D.
Borromeo, Count Vitaliano, *Milan.* F.M.
Picquot, Anthony.
Guilding, Rev. Lansdown.
Hincks, Thomas Cowper.

1823.

Underwood, Thomas Richard.
Locker, Edward Hawke. F.R.S.

Everest, Captain George, [F.R.S.]
Carey, Rev. William, D.D.
Solly, Samuel Reynolds, F.R.S.
Maraschini, The Abbate Pietro, *Vicenza.* F.M.
Maclure, William, *Philadelphia.* F.M.
Risso, J. A., *Nice.* F.M.
Harvey, George, [F.R.S.]
Bigsby, John Jeremiah, M.D., [F.R.S.]
Randolph, Rev. John Honywood.
Bedford, John, Duke of.
Nordenskiöld, Nils, *Abo, Finland.* F.M.
Cohen, Francis [Sir Francis Palgrave], F.R.S.
Bicheno, James E., [F.R.S.]
Vetch, John, M.D.
Wilks, Col. Mark, [F.R.S.]
Rothman, Richard W.
Cooke, Philip Davies.
Baker, Thomas John Lloyd.
Salmond, William.
Wilkinson, Rev. John Brewster, B.D.
Hooker, Prof. [Sir] William Jackson, LL.D., F.R.S.
Maberly, Capt. [Lt. Col.] W. L., M.P.
Robinson, Rev. Hastings, M.A.
Greg, Robert Hyde.
Fraser, James Baillie.
Murray, John.
Pettiward, Roger, F.R.S.
Cooke, Rev. Robert Bryan.
Gore, Montague.
Prévost, Constant, *Paris.* F.M.
Vernon, Rev. William Venables, M.A., [F.R.S.]

1824.

Lefevre, Henry Francis Shaw.
Edington, Thomas.
Leake, George.
Artis, Edmund Tyrell.
Bunbury, Sir Henry Edward, Bart., K.C.B.
Charpentier, T., *Bex, Switzerland.* F.M.
Desmarest, Anselme Gaëtan, *Paris.* F.M.
Scrope, George [Julius] Poulett, [F.R.S.]
Aylmer, George William.
Birch, Thomas [Thomas James Bosvile].

Jemmett, William Thomas.
Gibson, John.
Gray, John Edward, [F.R.S.]
Scott, Ven. Archdeacon T. Hobbs, M.A.
Faraday, Michael, [D.C.L.], F.R.S.
Levy, Armand.
Noyes, Thomas Herbert.
Clutterbuck, Robert.
Bonar, Henry.
Haggitt, Rev. Francis, D.D., F.R.S.
Johnson, Percival Norton, [F.R.S.]
Murchison [Sir] Roderick Impey, [Bart., K.C.B., D.C.L., F.R.S.]
Phelps, John Delafield, F.R.S.
Badely, Edward Lowth.
Franklin, Capt. James, [F.R.S.]
Hibbert, Samuel, M.D.
Randolph, Rev. Francis, D.D.

1825.

Braikenridge, George Weare.
Head, [Sir] Edmund Walker, [F.R.S.]
Abbott, Edward.
Buckingham and Chandos, Richard, Duke of.
Townsend, Joseph, *Gray's Inn.*
Morgan, Charles Octavius Swinnerton, [F.R.S.]
Morison, Robert, R.N.
Corrie, John R.
Cavadia, Dr. John.
Thomson, C. Poulett.
Price, Henry Habberley.
Belcher, Lieut. [Admiral Sir] Edward, R.N.
Fennell, Rev. Robert.
Young, Thomas.
Bullock, William.

Fellows and Foreign Member elected after the Incorporation from June 3, 1825, to June 1826.

Powles, John Diston.
Quiros, Francis.
Dikes, William Hey.
Garrow, George.
Basterot, Bartholomew de.
Barry, James, M.D.
Shutt, William.
Forchhammer, Georg, Ph.D., *Copenhagen.* **F.M.**
Perkins, Henry.
Vigors, Nicholas Aylward, jun., [F.R.S.]
Heathfield, R., jun.
Herschel [Sir] John Frederick William, [Bart.], M.A., [D.C.L., K.C.H.], F.R.S.
Shrapnell, Henry Jones.
Wilde, Samuel Francis.
Caledon, Dupré Alexander, Earl of, K.P.
Clarke, Rev. William Branwhite, M.A., [F.R.S.]
Bolton, Captain [Major-General] Daniel, R.E.
Broughton, Samuel Daniel, [F.R.S.]

The six Honorary Members who agreed to become Fellows when the Society received its Charter are as follows:—

Affleck, Lieut.-Gen. Sir James.
Griffith, [Sir] Richard John, [Bart., LL.D.]
Mammatt, Edward.
Meade, Thomas.
Thomson, [Prof.] Thomas, M.D., [F.R.S.]
Watt, James, [F.R.S.]

LIST OF
PRESIDENTS OF THE GEOLOGICAL SOCIETY

With contents of the Addresses published in 1828 and subsequent years in the *Proceedings* (*P.*) and *Quarterly Journal* (*Q. J.*). Where *Proc.* is inserted after *Q. J.*, it refers to the preliminary paging, in arabic numerals, of the '*Proceedings*' in the *Quarterly Journal*. Figures in brackets are dates of birth and death.

1807–13. George Bellas Greenough, M.P., F.R.S. (1778–1855). *See* p. 12.

1813–15. Hon. Henry Grey Bennet, M.P., F.R.S. (1777–1836). *See* p. 42.

1815–16. William Blake, M.A., F.R.S.

1816–18. John Macculloch, M.D., F.R.S. (1773–1835). *See* p. 36.

1818–20. George Bellas Greenough, F.R.S. *2nd Presidency.*

1820–22. Right Hon. Earl Compton ; afterwards 2nd Marquis of Northampton, Pres. R.S. (1790–1851). *See* p. 42.

1822–24. William Babington, M.D., F.R.S. (1756–1833). *See* p. 11.

1824–26. Rev. William Buckland, F.R.S., Professor of Geology in the University of Oxford (1784–1856).

counties coloured geologically by W. Lonsdale. Unsatisfactory state of Fossil Botany. *P.* i. pp. 50–62.

1829. Progress of Geology in British Isles and Abroad. *P.* i. pp. 112–34.

1829–31. Rev. Adam Sedgwick, M.A., F.R.S., Woodwardian Professor of Geology in the University of Cambridge (1785–1873).

1830. Papers read before Society. Erosion of Valleys. Importance of Organic Remains. 'New System of Geology.' *P.* i. pp. 187–212.

1831. [The work of Wm. Smith.] Papers read before Society. Lyell's 'Principles of Geology,' vol. i. Elie de Beaumont on Mountain Systems. *P.* i. pp. 270–316.

1831–33. Roderick Impey Murchison, F.R.S. (1792–1871).

1832. Papers read before Society. Lyell's 'Principles of Geology,' vol. ii. Provincial scientific institutions. Foreign geology. *P.* i. pp. 362–86.

1833. Progress of Geology. Ordnance Survey and Geological maps. *P.* i. pp. 438–64.

1833–35. George Bellas Greenough, F.R.S. *3rd Presidency.*

1834. Progress of Geology. Theory of Elevation. Central Heat. Diluvial Action. *P.* ii. pp. 42–70.

1835. Progress of Geology. Temple of Serapis. Lyell's 'Principles of Geology,' vol. iii. Boase, 'Treatise on Primary Geology.' De la Beche, 'Researches in Theoretical Geology.' *P.* ii. pp. 145–75.

1835–37. Charles Lyell, M.A., F.R.S. (1797–1875).

1836. Progress of Geology. Erratic blocks. Transport by ice. *P.* ii. pp. 357–90.

1837. Progress of Geology. Geology of Devonshire. Elevation and Subsidence. Buckland's Bridgewater Treatise. *P.* ii. 479–523.

1837–39. Rev. William Whewell, M.A., F.R.S., Professor of Moral Philosophy, University of Cambridge (1794–1866).

1838. Progress of Geology. Descriptive Geology and Geological Dynamics. *P.* ii. pp. 624–49.

1839. Descriptive Geology and Geological Dynamics. Cambrian and Silurian. Stonesfield Slate mammals. Catastrophists and Uniformitarians. *P.* iii. pp. 61–98.

1839–41. Rev. William Buckland, D.D., F.R.S. *2nd Presidency.*

1840. Museum of Œconomic Geology and other Institutions. Geological maps. Devonian system. Progress of Geology. *P.* iii. pp. 210–67.

1841. Museum of Œconomic Geology, &c. Ordnance Geological Survey. Railway Sections. Geological Models. Photography. Physical Geology. Silurian and Devonian systems. Origin of Coal. Palæontology. Glacial Theory. *P.* iii. pp. 469–540.

1841–43. Roderick Impey Murchison, F.R.S. *2nd Presidency.*

1842. Palæozoic (Protozoic), Silurian, Devonian, Carboniferous. Magnesian Limestone. Miller's 'Old Red Sandstone.' Secondary Rocks (Magnesian Limestone to Cretaceous). Tertiary. Microscopical researches. Foreign Geology. Glacial theory. *P.* iii. pp. 637–87.

1843. The work of Wm. Lonsdale. Palæozoic rocks of the British Isles. Geological Survey in S. Wales, Ireland, &c. Progress of British Geology. Glacial theories. Raised Beaches. Geology of Russia, N. America, and Asia. Palæontology. *P.* iv. pp. 65–151.

1843–45. Henry Warburton, M.A., F.R.S. (1784?–1858).

1845–47. Leonard Horner, F.R.S. (1785–1864). *See* p. 34.

1846. Publications of Geological Society. Geological Survey. Progress of Geology. Geology of Russia. Silurian. Devonian. Carboniferous. Formation of Coal. Permian. Secondary. Tertiary. Metamorphic. Recent Changes of Level. Boulder formations. Palæontology. *Q. J.* ii. pp. 153–221.

1847. Geological Survey. Recent publications. Modern periods of geological chronology. Volcanic Dust. Forbes' Essay on the Fauna and Flora of the British Isles. Darwin on S. America. *Q. J.* iii. pp. xxx–cx.

1847–49. Sir Henry Thomas De la Beche, C.B., F.R.S., Director-General of the Geological Survey of the United Kingdom (1796–1855).

1848. Contributions to the Progress of Geology made by the Geological Society of London, by the Geological Society of Dublin, and by other societies in Cornwall, Manchester, and the W. Riding of Yorkshire. Palæontographical Society. Geological Survey and Museum. British works on Geology. Voyages of Discovery and Survey. Geological Society of France. Geological Notices. *Q. J.* iv. pp. xxv–cxx.

1849. Geological Society of London and other Geological Societies. Geological Survey and Museum. Geological Society of France. Elie de Beaumont on Mountain systems. Geological Notices. *Q. J.* v. pp. xxvi–cxvi.

1849–51. Sir Charles Lyell, M.A., F.R.S. *2nd Presidency.*

1850. Bearing of modern discoveries on the Principles of Geology. *Q. J.* vi. pp. xxxii–lxvi.

1851. The light thrown by Palæontology on the laws which govern the fluctuations of the living inhabitants of the globe. *Q. J.* vii. pp. xxxii–lxxvi.

1851–53. William Hopkins, M.A., F.R.S. (1793–1866).

1852. The period of the Drift. Contributions to Society on Palæozoic, Secondary, and Tertiary formations. *Q. J.* viii. pp. xxiv–lxxx.

1853. Elie de Beaumont on Mountain systems. *Q. J.* ix. pp. xxii–xcii.

1853–54. Edward Forbes, F.R.S., Professor of Natural History at the Royal School of Mines, and afterwards at the University of Edinburgh (1815–54).

1854. Barrande's Silurian System of Bohemia. Geology of the British Isles, and of British Colonies and Possessions. Progress of Geology abroad. Organic remains. Petrological inquiries. Text-books. Polarity in Time. *Q. J.* x. pp. xxviii–lxxxi.

1854–56. William John Hamilton, F.R.S. (1805–67).

1855. British Geology and our own *Proceedings*. Murchison's 'Siluria.' Geological Survey. Papers by D. Sharpe, Prestwich, and others. Foreign Geology. Tertiary Geology. Asia. General Works. Conclusion: Breaks and Passage-beds, Contemporaneity. *Q. J.* xi. pp. xlv–xciii.

1856. Geological Survey. Sedgwick and McCoy on British Palæozoic Rocks and Fossils Papers by Murchison, Salter, Sorby Godwin-Austen, Ramsay, and others. Palæontographical Society. Foreign Geology. Philosophy of Creation. *Q. J.* xii. pp. xliii–cxix.

1856. Daniel Sharpe, F.R.S. (1806–56).

Prestwich, Deshayes, Spratt, Cocchi, Pictet, and Humbert. Geological Society of Dublin. Geological Survey of India. Geinitz on Saxony. Various papers. Geological Survey and School of Mines. History of Creation. *Q. J.* xiii. pp. lxxvi–cxlv.

1858. Palæontological papers. Chemical Geology. Durocher's researches. Delesse on Metamorphism. Sorby on Microscopic Structure of Crystals. Cleavage. Glaciers. Descriptive Geology. Succession of life. *Q. J.* xiv. pp. lxxix–clxiii.

1858–60. John Phillips, LL.D., F.R.S., Professor of Geology in the University of Oxford (1800–74).

1859. Progress of Geology in Britain. Constitution of rocks, cleavage, &c. Plants. Zoology. Brixham Cave. Iron-ores. Gold-fields. Geological theory. *Q. J.* xv. pp. xxvii–lxi.

1860. Palæontological Data. Provinces in Space and in Time. Zones of life. Passage-beds. Distribution of Ammonites. Beds below the Chalk. Palæontological periods. Succession of life. Geological Time. *Q. J.* xvi. pp. xxxi–lv.

1860–62. Leonard Horner, F.R.S. *2nd Presidency.*

1861. Geological Survey of United Kingdom, and of India. Darwin's 'Origin of Species.' Experimental Geology. Metamorphism. Early existence of Man. *Q. J.* xvii. pp. xxxiv–lxxii.

1862. Address by Professor T. H. Huxley, F.R.S. (Secretary), 'Homotaxis' or similarity of arrangement, and 'Synchrony' or identity of date. *Q. J.* xviii. pp. xl–liv.

1862–64. Andrew Crombie Ramsay, F.R.S., Director of the Geological Survey of Great Britain (1814–91).

1863. Breaks in Succession of the British Palæozoic Strata.

1864. Breaks in Succession of the British Mesozoic Strata.

1864–66. W. J. Hamilton, F.R.S. *2nd Presidency.*

1865. Geological Survey. Greenough's Map. Progress of Geology at home and abroad.

1866. Geological Survey of United Kingdom, of Canada, and of India. Palæontographical Society. Barrande's Silurian System. Geological progress at home and abroad.

1866–68. Warington Wilkinson Smyth, M.A., F.R.S., Professor of Mining and Mineralogy at the Royal School of Mines (1817–90).

1867. Geological Surveys of Great Britain and Canada. Origin of crystalline and metamorphic rocks. Meteoric stones.

1868 Geological Surveys of Britain, Italy, Austria, United States. Physical Structure of Palestine. Change of Climatal Conditions. Composition of crystalline rocks. Subterranean temperature.

1868–70. Thomas Henry Huxley, LL.D., F.R.S., Professor of Natural History at the Royal School of Mines (1825–95).

1869. Catastrophism, Uniformitarianism, and Evolutionism. Geological Time. *Q. J.* xxv. pp. xxxviii–liii.

1870. Progress of Palæontology. The higher Vertebrata. Distribution of terrestrial forms. Permanence of great areas of land and water. *Q. J.* xxvi. pp. xlii–lxiv.

1870–72. Joseph Prestwich, F.R.S. (1812–96).

1871. Progress of Geology. Deep-sea Life and its Relations to Geology. *Q. J.* xxvii. pp. xlii–lxxv.

1872. Our Springs and Water-supply. Our Coal-measures and Coal-supply. *Q. J.* xxviii. pp. liii–xc.

1872–74. George Douglas Campbell, 8th Duke of Argyll, K.T., D.C.L., F.R.S. (1823–1900).

1873. Glacial phenomena. Mountain structure. Lake-basins. Denudation. *Q. J.* xxix. pp. li–lxxviii.

1874. Unsolved problems. *Q. J.* xxx. pp. lii–lxix.

1874–76. John Evans, D.C.L., F.R.S. (1823–).

1875. The Geological Society. Antiquity of Man. *Q. J.* xxxi. pp. lxiii–lxxvi.

1876. Geological Society. Deep-sea deposits. Arctic researches. Climatal changes. Geological progress. Water-supply. *Q. J.* xxxii. *Proc.* pp. 91–121.

1876–78. Peter Martin Duncan, M.B., F.R.S., Professor of Geology in King's College, London (1821–91).

1877. Uniformitarianism. Mountain structure. Vulcanicity. Thicknesses of strata. Pressure of atmosphere. Breaks and passage-beds. Palæontology and distribution of life. *Q. J.* xxxiii. *Proc.* pp. 64–88.

1878. Palæontology in its bearing on the physical geography of the past, and the geographical distribution of species. *Q. J.* xxxiv. *Proc.* pp. 38–72.

1878–80. Henry Clifton Sorby, LL.D., F.R.S. (1826–).

1879. The structure and origin of limestones. *Q. J.* xxxv. *Proc.* pp. 56–95.

1880. The structure and origin of non-calcareous stratified rocks. *Q. J.* xxxvi. *Proc.* pp. 46–92.

1880–82. Robert Etheridge, F.R.S., Palæontologist to the Geological Survey; afterwards Assistant Keeper of the Geological Department, British Museum (1819–1903).

1881. Analysis and Distribution of the British Palæozoic Fossils. *Q. J.* xxxvii. *Proc.* pp. 51–235.

1882. Analysis and Distribution of the British Jurassic Fossils. *Q. J.* xxxviii. *Proc.* pp. 59–236.

1882–84. John Whitaker Hulke, F.R.S., President of the Royal College of Surgeons (1830–95).

1883. Papers read during past year. Researches on fossil Reptilia. *Q. J.* xxxix. *Proc.* pp. 44–65.

1884. Papers read during past year. Skeletal structure of Dinosauria. *Q. J.* xl. *Proc.* pp. 47–57.

1884–86. Rev. Thomas George Bonney, M.A., F.R.S., Professor of Geology and Mineralogy in University College, London (1833–).

1885. Progress of Geology. The Crystalline Schists of the Central Highlands. Progress of Petrology. *Q. J.* xli. *Proc.* pp. 61–96.

1886. Selection of Papers to be published in the *Quarterly Journal.* Geological progress. Metamorphic rocks. *Q. J.* xlii. *Proc.* pp. 55–115.

1886–88. John Wesley Judd, F.R.S., Professor of Geology, Royal College of Science and School of Mines, South Kensington (1840–).

1887. The study and progress of Mineralogy. *Q. J.* xliii. *Proc.* pp. 54–82.

1888. The character of papers communicated to the Society. The principles of Palæontology. *Q. J.* xliv. *Proc.* pp. 57–84.

1888–90. William Thomas Blanford, LL.D., F.R.S. (1832–1905).

1889. Papers recently read before the Society. International Geological Congress—nomenclature, classification, and correlation of formations. *Q. J.* xlv. *Proc.* pp. 50–77.

1890. Permanence of Ocean-basins and the distribution of animals. *Q. J.* xlvi. *Proc.* pp. 59–110.

1892. Volcanic action from Old Red Sandstone to Tertiary period. *Q. J.* xlviii. *Proc.* pp. 60–179.

1892–94. Wilfrid H. Hudleston, M.A., F.R.S. (1828–).

1893. Some Recent Work of the Geological Society. *Q. J.* xlix. *Proc.* pp. 65–142.

1894. Some Recent Work of the Geological Society. *Q. J.* l. *Proc.* pp. 58–140.

1894–96. Henry Woodward, LL.D., F.R.S., Keeper of the Geological Department, British Museum (1832–).

1895. Fiftieth volume of *Quarterly Journal.* The Society's Museum. Admission of Ladies. Life-history of the Crustacea in Early Palæozoic Times. *Q. J.* li. pp. xlix–lxxxviii.

1896. Geological Society. Geological Survey. Palæontographical Society. Sundry geological appointments. Life-history of the Crustacea in Later Palæozoic and in Neozoic Times. *Q. J.* lii. pp. lii–cxviii.

1896–98. Henry Hicks, M.D., F.R.S. (1837–99).

1897. Recent evidence bearing on the Geological and Biological History of Early Cambrian and Pre-Cambrian Times. *Q. J.* liii. pp. xlix–xcii.

1898. Evidences of the Antiquity of Man furnished by Ossiferous Caverns in Glaciated Districts in Britain. *Q. J.* liv. pp. li–cii.

1898–1900. William Whitaker, B.A., F.R.S. (1836–).

1899. Water-supply and Sanitation. *Q. J.* lv. pp. liii–lxxxiii.

1900. Progress of Geology. Underground Geology. *Q. J.* lvi. pp. li–lxxxviii.

1900–02. J. J. H. Teall, M.A., F.R.S., Director of the Geological Survey of the United Kingdom (1849–).

1901. Evolution of Petrological Ideas: the Igneous Rocks. *Q. J.* lvii. pp. xlviii–lxxxvi.

1902. Evolution of Petrological Ideas: the Sedimentary Rocks and Crystalline Schists. *Q. J.* lviii. pp. li–lxxviii.

1902–04. Charles Lapworth, M.Sc., LL.D., F.R.S., Professor of Geology in the University of Birmingham. (1842–).

1903. The Relations of Geology: Geology and its Fellow Sciences. Geology and Practice. Geology and Education. *Q. J.* lix. pp. lii–xcvii.

1904. Address by Sir Archibald Geikie (Vice-President). Continental Elevation and Subsidence. *Q. J.* lx. pp. xlix–civ.

1904–06. John Edward Marr, M.A., Sc.D., F.R.S. (1857–).

1905. Classification of the Sedimentary Rocks. *Q. J.* lxi. pp. xlvii–lxxxvi.

1906. Influence of the Geological Structure of English Lakeland upon its present Features. A Study in Physiography. *Q. J.* lxii. pp. lii–cxxviii.

1906–07. Sir Archibald Geikie, Sc.D., D.C.L., LL.D., Sec. R.S. *2nd Presidency.*

1907. The Centenary. *Q. J.* lxiii. pp. l–lxix.

LIST OF SECRETARIES OF THE GEOLOGICAL SOCIETY

1807–12. James Laird, M.D.
1810–14. Leonard Horner.
1812–17. Arthur Aikin.
1814–16. Henry Warburton, F.R.S.
1816–18. Charles Stokes, [F.R.S.]
1817–19. Henry James Brooke, F.R.S.
1818–20. John Bostock, M.D., F.R.S.

1825–26. George Poulett Scrope, F.R.S.
1826–30. William John Broderip, F.R.S.
1826–28. Roderick Impey Murchison, F.R.S.
1828–29. Henry Burton, M.D.
1829–31. Roderick Impey Murchison, F.R.S.
1830–35. Prof. Edward Turner, M.D., F.R.S.
1831–32. Henry Thomas De la Beche, F.R.S.
1832–36. William John Hamilton.
1835–36. Woodbine Parish, F.R.S.
1836–38. Robert Hutton.
1836–38. Prof. John Forbes Royle, M.D., F.R.S.
1838–41. Charles Darwin, B.A., F.R.S.
1838–54. William John Hamilton, M.P.
1841–43. Edward Herbert Bunbury, M.A.
1843–45. Robert Alfred Cloyne Austen, B.A.
1845–53. John Carrick Moore, M.A.
1853–55. Robert Alfred Cloyne Godwin-Austen, B.A., F.R.S.
1855–56. John Carrick Moore, M.A., F.R.S.
1855–56. Joseph Prestwich, F.R.S.
1856–58. Robert William Mylne, F.R.S.
1856–66. Warington Wilkinson Smyth, M.A., F.R.S.
1858–59. Thomas Davidson, F.R.S.
1859–63. Prof. Thomas Henry Huxley, F.R.S.
1863–64. William John Hamilton, F.R.S.
1864–71. Prof. Peter Martin Duncan, M.B.Lond., F.R.S.
1866–74. John Evans, F.R.S.
1871–76. David Forbes, F.R.S.
1874–78. Rev. Thomas Wiltshire, M.A.
1876–78. John Whitaker Hulke, F.R.S., F.R.C.S.
1878–84. Rev. Prof. Thomas George Bonney, Sc.D., F.R.S.
1878–86. Prof. John Wesley Judd, C.B., LL.D., F.R.S.
1884–88. William Thomas Blanford, C.I.E., LL.D., F.R.S.
1886–90. Wilfrid Hudleston Hudleston, M.A., F.R.S.
1888–98. John Edward Marr, Sc.D., F.R.S.
1890–93. Henry Hicks, M.D., F.R.S.
1893–97. J. J. Harris Teall, D.Sc., M.A., F.R.S.
1897–05. Robert Stansfield Herries, M.A.
1898– Prof. William Whitehead Watts, M.A., M.Sc., F.R.S.
1905– Prof. Edmund Johnstone Garwood, M.A.

LIST OF
FOREIGN SECRETARIES OF THE GEOLOGICAL SOCIETY

1810–13. James Lewis, Count De Bournon, F.R.S.
1813–16. Samuel Solly, F.R.S.
1816–18. Augustus Bozzi Granville, M.D., F.R.S.
1818–28. Henry Heuland.
1828–29. Roderick Impey Murchison, F.R.S.
1829–35. Prof. Charles Lyell, F.R.S., F.L.S.
1835–47. Sir Henry Thomas De la Beche, F.R.S.
1847–54. Charles James Fox Bunbury, F.R.S.
1852–52. Leonard Horner, F.R.S., (Interim Treasurer).
1854–57. Samuel Peace Pratt, F.R.S.
1857–63. William John Hamilton, F.R.S.
1863–64. Hugh Falconer, A.M., M.D., F.R.S.
1864–68. Robert Alfred Cloyne Godwin-Austen, B.A., F.R.S.
1868–73. Prof. David Thomas Ansted, M.A., F.R.S.
1873–90. Sir Warington Wilkinson Smyth, M.A., F.R.S.
1890–95. John Whitaker Hulke, F.R.S., F.R.C.S.
1895– Sir John Evans, K.C.B., D.C.L., F.R.S.

LIST OF
TREASURERS OF THE GEOLOGICAL SOCIETY

1807. George Bellas Greenough, F.R.S.
1807–16. William Hasledine Pepys, F.R.S.
1812–13. Samuel Solly, F.R.S.
1813–15. Samuel Woods.
1815–22. Daniel Moore, F.R.S.
1816–21. John Taylor, [F.R.S.]
1821–22. James Vine.
1823–43. John Taylor, F.R.S.
1843–52. John Lewis Prevost.
1852–53. Leonard Horner, F.R.S., (Interim Treasurer).
1853–56. Daniel Sharpe, F.R.S.

LIST OF MEMBERS AND FELLOWS WHO HAVE SERVED ON THE COUNCIL OF THE GEOLOGICAL SOCIETY

V.P. indicates that the individual has served as Vice-President.

The dates within parentheses refer to service on the Committee prior to the institution of the Council.

Acland, Sir Thomas Dyke, Bart., M.P., [F.R.S.], 1824–25.
Aikin, Arthur, (1808–10), 1810–20; 1822–25; 1826–31; 1840–43. **V.P.**
Allen, William, (1808–10).
Ansted, Prof. David Thomas, M.A., F.R.S., 1851–53; 1867–74.
Apsley, Alexander, 1811–14.
Argyll, George Douglas Campbell, Duke of, [K.T., D.C.L., F.R.S.], 1851–52; 1868–69; 1872–75.
Arnold-Bemrose, Henry Howe, M.A., J.P., 1906– .
Austen, [Godwin-Austen], Robert Alfred Cloyne, [F.R.S.], 1841–46; 1848–49; 1851–61; 1863–68; 1869–72; 1873–77. **V.P.**
Avebury, Rt. Hon. Lord, *see* Lubbock, Sir John.
Aylmer, George William, 1833–36.
Babington, William, M.D., F.R.S., (1808–10), 1810–13; 1822–24. **V.P.**
Baily, Francis, F.R.S., 1835–38; 1840–42.
Barclay, Arthur Kett, [F.R.S.], 1835–36.
Bather, Francis Arthur, M.A., Ph.D., 1902–06.
Bauerman, Hilary, 1874–80; 1881–88; 1894–98. **V.P.**
Beckles, Samuel Husbands, [F.R.S.], 1857–58.
Bedford, John, Duke of, 1824–25.
Bell, Prof. Thomas, F.R.S., 1843–45; 1856–57.
Bennet, Hon. Henry Grey, M.P., [F.R.S.], 1812–24; 1825–26. **V.P.**
Bicheno, James Ebenezer [F.R.S.], 1826–30.
Bigsby, John Jeremiah, M.D., [F.R.S.], 1852–56; 1858–65. **V.P.**
Blake, Rev. John Frederick, M.A., 1880–82; 1889–94.
Blake, William, F.R.S., 1813–19; 1821–22. **V.P.**
Blanford, William Thomas, [C.I.E., LL.D.], F.R.S., 1883–92; 1894–1905. **V.P.**
Boase, Henry S., M.D., F.R.S., 1838–39.
Bonney, Rev. Thomas George, M.A., [Sc.D., F.R.S.], 1876–88; 1889–94; 1895–1901; 1904–1907. **V.P.**

Bostock, John, M.D., [F.R.S.], 1818–25; 1826–30. **V.P.**
Bournon, James Lewis, Count de, F.R.S., 1810–13.
Bowerbank, James Scott, [LL.D.], F.R.S., 1846–50; 1852–55.
Brande, Prof. William Thomas, F.R.S., 1815–16.
Bright, Richard, M.D., [F.R.S.], 1820–21; 1825–26.
Bristow, Henry William, F.R.S., 1866–68.
Broderip, William John, [F.R.S.], 1826–38; 1855–57. **V.P.**
Brodie, Rev. Peter Bellinger, M.A., 1850–51.
Brooke, Henry James, [F.R.S.], 1817–24.
Brown, Horace T., F.R.S., 1895–97.
Buckland, Rev. Prof. William, [Dean of Westminster], [F.R.S.], 1818–20; 1821–26; 1828–47; 1849–50. **V.P.**
Bunbury, [Sir] Charles James Fox, [F.R.S.], 1846–54; 1861–63.
Bunbury, [Sir] Edward Herbert, M.A., M.P., 1841–45; 1848–49.
Bunbury, Sir Henry Edward, Bart., K.C.B., 1825–26.
Burrow, Rev. Edward John, [D.D., F.R.S.], 1811–13.
Burton, Decimus, [F.R.S.], 1829–30.
Burton, Henry, [M.D.], 1825–26; 1828–29.
Busk, [Prof.] George, F.R.S., 1863–64; 1874–75.
Caldcleugh, Alexander, [F.R.S.], 1824–25.
Campbell, John F., 1874–75.
Carpenter, William Benjamin, M.D., F.R.S., 1849–50; 1871–72.
Carruthers, William, [F.R.S.], 1870–74; 1875–78; 1880–86. **V.P.**
Carter, James, 1889–92.
Cautley, Col. [Sir] Proby T., F.R.S., 1855–57.
Chambers, Robert, F.R.S., 1862–66.
Champernowne, Arthur, M.A., 1887.
Chantrey, [Sir] Francis, D.C.L., F.R.S., R.A., 1830–31; 1833–34; 1841–42.
Chenevix, Richard, F.R.S., 1810–12.
Children, John George, F.R.S., 1811–14.
Clerke, Major Thomas Henry Shadwell, [F.R.S.], 1834–35.
Clift, William, F.R.S., 1824–26; 1831–33; 1836–38.
Colby, Capt. [Major-General] Thomas F., R.E., [LL.D., F.R.S.], 1815–18; 1819–20; 1822–25.
Cole, Viscount, [Earl of Enniskillen], [D.C.L., F.R.S.], 1832–34; 1837–39; 1840–42; 1850–52; 1854–56; 1861–63; 1866–68.
Colebrooke, Henry Thomas, F.R.S., 1817–22; 1823–27. **V.P.**
Colville, Sir Charles Henry, 1826–27.
Compton, Lord (Spencer Joshua Alwyne), [Marquis of Northampton], M.P., [Pres.R.S.], 1814–17; 1820–22; 1837–39; 1844–47. **V.P.**
Condamine, Rev. H. M. De la, M.A., 1854.

Conybeare, Rev. William Daniel, M.A., F.R.S., 1826–29; 1831–35. V.P.

Cox, Prof. Samuel Herbert, 1907– .

Crawfurd, John, F.R.S., 1828–29.

Crichton, Sir Alexander, M.D., F.R.S., 1824–27; 1830–31; 1836–37. V.P.

Darwin, Charles R., [M.A., LL.D., F.R.S.], 1837–51. V.P.

Daubeny, Prof. Charles Giles Bridle, M.D., F.R.S., 1833–35; 1837–40; 1841–43; 1846–47; 1848–49; 1857–59. V.P.

Davidson, Thomas, F.R.S., 1858–60.

Davies, Thomas, 1886–88.

Davis, James W., 1891–93.

Davis, Samuel, F.R.S., 1810–11; 1812–15.

Davy, [Sir] Humphry, Sec. R.S., (1808–09). V.P.

Dawkins, William Boyd, M.A., F.R.S., 1868–73; 1877–79; 1885–86; 1895–99.

De la Beche, [Sir] Henry Thomas, F.R.S., [C.B.], 1826–28; 1830–52. V.P.

Drew, Frederic, 1874–77.

Ducie, Henry, Earl of, F.R.S., 1856–58.

Duncan, Prof. Peter Martin, M.B., [F.R.S.], 1864–74; 1875–80; 1881–84; 1886–88. V.P.

Egerton, Lord Francis Leveson, M.P., [Earl of Ellesmere, K.G.], 1844–45. V.P.

Egerton, Sir Philip de Malpas Grey, Bart., M.P., [F.R.S.], 1831–40; 1841–52; 1854–57; 1860–61; 1862–64; 1865–72; 1873–78; 1879–82. V.P.

Englefield, Sir Henry Charles, Bart., F.R.S., 1812–14, 1818–19. V.P.

Enniskillen, Earl of, *see* Cole, Viscount.

Etheridge, Robert, [F.R.S.], 1864–69; 1872–79; 1880–84; 1892–94. V.P.

Evans, [Sir] John, [K.C.B., D.C.L., LL.D.], F.R.S., 1863–79; 1880–87; 1888–92; 1894– . V.P.

Everest, Capt. George, F.R.S., 1829–30; 1845–46.

Everest, Rev. Robert, M.A., 1862–66.

Fletcher, Lazarus, M.A., [F.R.S.], 1888–93. **V.P.**
Flower, John Wickham, 1869–72.
Forbes, David, F.R.S., 1867–77.
Forbes, Prof. Edward, F.R.S., 1845–55. **V.P.**
Foster, [Sir] C. Le Neve, D.Sc., B.A., [F.R.S.], 1891–93.
Franck, James, M.D., [F.R.S.], 1812–14.
Franklin, Sir John, R.N., [D.C.L.], F.R.S., 1830–31.
Galton, Capt. Douglas, C.B., F.R.S., 1870–75.
Garwood, [Prof.] Edmund Johnstone, M.A., 1899– .
Geikie, [Sir] Archibald, [D.Sc., D.C.L.], LL.D., Sec. R.S., 1883–84; 1885–94; 1896–97; 1902–. **V.P.**
Gibson, Thomas Field, 1855–59.
Gilbert, Davies, M.P., P.R.S., 1827–35. **V.P.**
Godwin-Austen, Lieut.-Col. Henry Haversham, [F.R.S.], 1880–82; 1884–85.
Godwin-Austen, R. A. C., *see* Austen, R. A. C.
Graham, Prof. Thomas, F.R.S., 1852–53.
Grant, Prof. Robert Edmund, M.D., [F.R.S.], 1832–33; 1839–40.
Granville, August Bozzi, M.D., [F.R.S.], 1816–18; 1822–23.
Green, Prof. Alexander Henry, M.A., F.R.S., 1889–91; 1893–96. **V.P.**
Green, Joseph Henry, [F.R.S.], 1845–46.
Greenough, George Bellas, M.P., F.R.S., (1807–10), 1810–55. **V.P.**
Gregory, [Prof.] John Walter, D.Sc., [F.R.S.], 1894–97; 1899–1900.
Greville, Rt. Hon. Charles Francis, F.R.S., (1807–09). Patron.
Groom, Prof. Theodore Thomas, M.A., D.Sc., 1901–05.
Gunn, Rev. John, M.A., 1872–73.
Hall, Capt. Basil, R.N., F.R.S., 1831–33.
Hallam, Henry, M.A., F.R.S., 1835–38.
Hamilton, William John, [F.R.S.], 1832–37; 1838–67.
Harker, Alfred, M.A., [F.R.S.], 1890–95; 1899–1905.
Harmer, Frederic William, 1896–1901.
Harrison, Thomas, F.R.S., 1816–17.
Harrison, Thomas Charles, [F.R.S.], 1821–22.
Hawkshaw, John Clarke, M.A., 1879–83; 1891–92.
Henderson, Alexander, M.D., 1820–22.
Henslow, Rev. Prof. John Stevens, M.A., 1839–40.
Herries, Robert Stansfield, M.A., 1895–1907. **V.P.**
Herschel, [Sir] John Frederick William, M.A., Sec. R.S., 1827–29; 1831–32.
Heuland, Henry, 1818–29.

Hicks, Henry, [M.D., F.R.S.], 1875–81; 1884–89; 1890–94; 1896–99. V.P.
Hill, Rev. Edwin, M.A., 1881–86; 1887–91; 1896–1901.
Hill, William, 1900–02.
Hinde, George Jennings, Ph.D., [F.R.S.], 1882–87; 1891–96; 1898–1900. V.P.
Holl, Harvey B., M.D., 1869–71.
Holland, [Sir] Henry, Bart., M.D., F.R.S., 1816–20.
Holmes, Thomas Vincent, 1893–97.
Hooker, [Sir] Joseph Dalton, M.D., [K.C.S.I., C.B., D.C.L., LL.D., P.R.S.], 1852–56; 1860–62.
Hooker, Sir William Jackson, K.C.B., LL.D., F.R.S., 1842–43.
Hopkins, William, M.A., F.R.S., 1839–41; 1847–48; 1850–54; 1856–58; 1860–61. V.P.
Hopkinson, John, 1884–87.
Horner, Leonard, [F.R.S.], (1809–10), 1810–14; 1828–32; 1837–64. V.P.
Horsfield, Thomas, M.D., [F.R.S.], 1823–26.
Hudleston, Wilfrid Hudleston, M.A., [F.R.S.], 1877–82; 1885–96; 1898–1900; 1901–03; 1907– . V.P.
Hughes, Prof. Thomas McKenny, M.A., [F.R.S.], 1875–76; 1877–81; 1883–85; 1886–90; 1891–93. V.P.
Hulke, John Whitaker, F.R.S., 1870–74; 1875–86; 1887–89; 1890–95. V.P.
Hull, Prof. Edward, M.A., LL.D., F.R.S., 1897–98.
Hume, Sir Abraham, Bart., M.P., [P.R.S.], (1809–10), 1810–14. V.P.
Hutton. Robert, 1836–41; 1842–49. V.P.
Huxley, Prof. Thomas Henry, F.R.S., 1858–64; 1865–67; 1868–72. V.P.
Ibbetson, Colonel Levett Landen Boscawen, 1850–51.
Jack, Robert Logan, LL.D., 1903–04.
Jaffray, Alexander, 1813–14.
James, Capt. [Sir] Henry, F.R.S., 1849–50; 1851–52; 1857–59; 1868–69.
Jeffreys, J. Gwyn, LL.D., F.R.S., 1864–85. V.P.
Johnson, Percival Norton, F.R.S., 1853–55.
Johnstone, Sir John Vanden Bempde, Bart., M.P., 1844–45.
Jones, Prof. Thomas Rupert, [F.R.S.], 1865–70; 1876–77; 1878–81; 1883–89.
Judd, Prof. John Wesley, [C.B., LL.D., F.R.S.], 1876–90; 1892–96; 1897–1902; 1903–06. V.P.
Kendall, Prof. Percy Fry, 1903–06.

Kitchin, Finlay Lorimer, M.A., Ph.D., 1906– .
Laird, James, M.D., (1807–10), 1810–15.
Lake, Philip, M.A., 1904–07.
Lamplugh, George William, F.R.S., 1906– .
Lansdowne, Henry, Marquis of, F.R.S., 1816–17; 1819–21. **V.P.**
Lapworth, Prof. Charles, LL.D., F.R.S., 1894–95; 1902–06; 1907– . **V.P.**
Laugel, M. Auguste, 1864–67.
Lemon, Sir Charles, Bart., F.R.S., 1826–27; 1838-40.
Levy, Armand, 1826–28.
Lewis, James, *see* Bournon, Count de.
Lindley, Prof. John, F.R.S., 1829–31.
Lowry, Wilson, F.R.S., 1810–12.
Lubbock, Sir John, Bart., [Lord Avebury, P.C., D.C.L., LL.D.], F.R.S., 1861–63; 1865–66; 1882–83; 1903–05.
Lydekker, Richard, B.A., [F.R.S.], 1886–89; 1893–98; 1905– . **V.P.**
Lyell, [Sir] Charles, [Bart., F.R.S.], 1823–46; 1847–54; 1855–65; 1866–75. **V.P.**
Macculloch, John, M.D., [F.R.S.], 1810–12; 1813–22. **V.P.**
McMahon, Lieut.-Col. [Gen.] C. A., [F.R.S.], 1888–91; 1893–98; 1899–1903. **V.P.**
McNeill, Bedford, 1904–07.
Majendie, Ashhurst, [F.R.S.], 1817–19.
Mallet, Robert, F.R.S., 1863–65.
Mantell, Gideon A., [LL.D., F.R.S.], 1825–26; 1841–44; 1847–52. **V.P.**
Marcet, Alexander J. G., M.D., F.R.S., 1810–13; 1814–17.
Marr, John Edward, M.A., [Sc.D., F.R.S.], 1885–99; 1901– . **V.P.**
Maskelyne, Prof. M. H. Nevil Story, M.A., [M.P., F.R.S.], 1857–59; 1879–83. **V.P.**
Maw, George, 1870–71.
Meryon, Edward, M.D., 1861–66; 1867–68. **V.P.**
Meyer, C. J. A., 1871–76.

Morris, Prof. John, 1848–49; 1853–57; 1859–67; 1868–73; 1876–83. V.P.
Moysey, Frederick, 1821–22.
Murchison, [Sir] Roderick Impey, [Bart., K.C.B.], F.R.S., 1826–63; 1864–69. V.P.
Murdoch, Thomas, F.R.S., 1814–15.
Mylne, Robert William, [F.R.S.], 1854–64; 1865–69; 1879–80.
Newton, Edwin Tulley, [F.R.S.], 1887–91; 1895–99; 1900–05. V.P.
Nicholl, Rt. Hon. Sir John, M.P., F.R.S., 1816–21. V.P.
Northampton, Marquis of, *see* Compton, Lord.
Northumberland, Hugh, Duke of, K.G., F.R.S., 1825–26.
Oxford, Bishop of, *see* Wilberforce, S.
Owen, Prof. [Sir] Richard, [K.C.B.], F.R.S., 1838–40; 1844–48; 1853–54; 1857–58. V.P.
Oxmantown, William, Lord [Earl of Rosse, P.]R.S., 1836–37.
Parish, [Sir] Woodbine [K.C.H.], F.R.S., 1834–41. V.P.
Parkinson, James, 1813–15.
Pattison, S. R., 1855–58; 1882–84.
Pendarves, Edward William Wynne, M.A., M.P., F.R.S., 1840–41.
Pepys, William Hasledine, F.R.S., (1807–10), 1810–19; 1820–28. V.P.
Percy, John, M.D., F.R.S., 1853–56.
Phillips, Prof. John, M.A., F.R.S., 1853–57; 1858–62. V.P.
Phillips, John Arthur, [F.R.S.], 1878–82; 1883–87. V.P.
Phillips, Richard, [F.R.S.], (1808–10), 1810–11.
Phillips, William, [F.R.S.], 1810–13.
Playfair, Lyon [Lord, G.C.B.], Ph.D., F.R.S., 1849–51.
Portlock, Lieut.-Col. [Major-Gen.] Joseph Elliston, F.R.S., 1849–50; 1852–62. V.P.
Pratt, Samuel Peace, F.R.S., 1844–59.
Prestwich, [Sir] Joseph, [F.R.S.], 1842–43; 1854–68; 1869–75; 1877–81; 1882–85; 1888–90. V.P.
Prevost, John Lewis, 1843–52.
Price, F. G. Hilton, 1878–79.
Pringle, Capt. John William, R.E., 1831–32; 1833–34.
Prior, George Thurland, M.A., [D.Sc.], 1900–1905.
Pusey, Philip, M.P., F.R.S., 1840–41.
Raine, Rev. Matthew, D.D., F.R.S., 1810–12.
Ramsay, Prof. [Sir] Andrew Crombie, [LL.D., F.R.S.], 1848–53; 1855–60; 1862–69; 1871–77; 1878–81. V.P.
Randolph, Rev. John Honywood, [M.A.], 1827–32.
Reid, Clement, [F.R.S.], 1892–95.

Rennie, George, F.R.S., 1839–41.
Rennie, John, F.R.S., 1819–20.
Ricardo, David, [M.P.], (1810), 1810–11; 1815–16.
Robe, Capt. Alexander, 1834–35.
Roget, Peter Mark, M.D., [Sec. R.S.], 1810–11; 1814–16; 1822–23; 1829–31.
Royle, Prof. John Forbes, [M.D., F.R.S.], 1835–39; 1843–44.
Rudler, Frederick William, [I.S.O.], 1881–85; 1889–92; 1899–1902; 1905– .
Rundell, Edmond Waller, 1817–18.
Rutley, Frank, 1893–97.
Sabine, Lieut.-Col. [Gen. Sir] Edward, [K.C.B.], R.A., [P].R.S., 1845–47.
St. Aubyn, Sir John, Bart., M.P., F.R.S., 1810–13. **V.P.**
Salter, John William, 1854–56.
Scott, Dukinfield Henry, M.A., Ph.D., F.R.S., 1902–03.
Scott, Robert Henry, M.A., F.R.S., 1871–74; 1877–79.
Scrope, George Poulett, [M.P., F.R.S.], 1825–27; 1859–63. **V.P.**
Sedgwick, Rev. Adam, M.A., F.R.S., 1824–25; 1827–44; 1845–48. **V.P.**
Seeley, Prof. Harry Govier, [F.R.S.], 1879–84; 1886–90; 1898–1904. **V.P.**
Selkirk, Dunbar James Douglas, Earl of, F.R.S., 1842–43; 1868–70; 1877–78. **V.P.**
Seward, Albert Charles, M.A., F.R.S., 1899–1900.
Sharp, Samuel, 1874–78.
Sharpe, Daniel, [F.R.S.], 1840–42; 1843–44; 1846–56. **V.P.**
Smith, James, of Jordanhill, F.R.S., 1841–42.
Smith, Thomas, F.R.S., 1820–25.
Smyth, [Sir] Warington Wilkinson, M.A., [F.R.S.], 1851–53; 1856–71; 1872–91. **V.P.**
Sollas, Prof. William Johnson, M.A., D.Sc., LL.D., F.R.S., 1898–1904; 1907– . **V.P.**
Solly, Samuel, [F.R.S.], 1811–19.
Somerville, William, M.D., F.R.S., 1820–21; 1832–34.
Sopwith, Arthur, M.Inst.C.E., 1902–03.
Sopwith, Thomas, M.A., F.R.S., 1860–62.
Sorby, Henry Clifton, [F.R.S.], 1856–57; 1875–76; 1878–82. **V.P.**
Spencer, Leonard James, M.A., 1905– .
Spratt, Capt. [Admiral] Thomas A. B., R.N., C.B., F.R.S.,

Strahan, Aubrey, M.A., [Sc.D., F.R.S.], 1896–1900; 1905– . **V.P.**
Strangways, Charles Fox, 1905– .
Strangways, Hon. William Thomas Horner Fox, [Earl of Ilchester, F.R.S.], 1820–21. **V.P.**
Strickland, Hugh Edwin, 1842–44; 1847–48.
Sykes, Lieut.-Col. William Henry, F.R.S., 1834–37.
Symonds, Rev. W. S., M.A., 1870–71.
Taylor, John, [F.R.S.], 1815–22; 1823–45. **V.P.**
Teall, J. J. Harris, M.A., [D.Sc., F.R.S.], 1884–88; 1890–99; 1900–04; 1906– . **V.P.**
Tennant, Prof. James, 1871–76.
Tennant, Smithson, F.R.S., 1813–16. **V.P.**
Tiddeman, Richard Hill, M.A., 1905– .
Topley, William, [F.R.S.], 1882–87; 1888–93.
Turner, Prof. Edward, M.D., [F.R.S.], 1830–37. **V.P.**
Turner, Samuel, [F.R.S.], 1814–16.
Tylor, Alfred, 1857–65; 1867–70.
Vandercom, Joseph Fitzwilliam, 1826–28.
Vetch, Capt. James, R.E., [F.R.S.], 1830–32.
Vetch, John, M.D., 1825–26.
Vigors, Nicholas Aylward, M.A., F.R.S., 1828–32.
Vine, James, 1821–22.
Vivian, John Henry, M.P., F.R.S., 1834–36.
Vyvyan, Sir Richard Rawlinson, Bart., M.P., F.R.S., 1828–29; 1835–36.
Wallich, Nathaniel, M.D., [F.R.S.], 1829–30.
Warburton, Henry, [M.P.], F.R.S., 1812–38; 1842–47. **V.P.**
Watts, Prof. William Whitehead, M.A., [M.Sc., F.R.S.], 1897– .
Weaver, Thomas, F.R.S., 1838–39.
Webb, Philip Barker, [F.R.S.], 1822–25.
Webster, Thomas, 1817–28.
Whewell, Rev. William, M.A., F.R.S., 1830–33; 1836–42. **V.P.**
Whidborne, Rev. George Ferris, M.A., 1887–91.
Whishaw, John, [F.R.S.], 1814–20.
Whitaker, William, B.A., [F.R.S.], 1873–77; 1895; 1896–1902. **V.P.**
Wilberforce, Samuel, Bishop of Oxford, D.D., F.R.S., 1850–51.
Wiltshire, Rev. Thomas, M.A., 1861–64; 1865–72; 1873–80; 1882–95. **V.P.**
Winwood, Rev. Henry Hoyte, M.A., 1885–86; 1887–90; 1892–96; 1897–1901; 1904–07. **V.P.**
Wollaston, William Hyde, M.D., F.R.S., 1813–24. **V.P.**
Wood, Searles Valentine, sen., 1847–54; 1860–61. **V.P.**

Wood, Searles Valentine, jun., 1868–70.
Woods, Henry, M.A., 1907– .
Woods, Samuel, (1809–10), 1810–15.
Woodward, Arthur Smith, [LL.D., F.R.S.], 1898–1901 ; 1906– .
Woodward, Henry [F.R.S.], 1867–73; 1874–78; 1881–83; 1884–89; 1890–98; 1902–1903. V.P.
Woodward, Horace Bolingbroke, [F.R.S.], 1892–96; 1900–02; 1904– . V.P.
Woodward, Samuel Pickworth, 1859–65.
Yates, Rev. James, M.A., [F.R.S.], 1829–30; 1832–36.
Yelloly, John, M.D., F.R.S., 1815–16.
Young, Thomas, 1827–28.

LIST OF PERMANENT OFFICIALS OF THE GEOLOGICAL SOCIETY

(The figures in brackets refer to dates of birth and death.)

The Society as early as 1809 appointed a housekeeper, and in 1810 also a clerk (Mr. Jones). From 1811 to 1819, Mr. Yeoman was 'collecting clerk,' to collect the annual contributions, and he was succeeded in 1820 by Mr. Harrison and others up to the year 1871.

1812–26. Thomas Webster (1773–1844).
Keeper of the Museum and Draughtsman. His attendance was then required on three days a week. In 1816 he was offered a residence in the house in Bedford Street, as an equivalent for his attendance on a fourth day in the week. In 1819 he was chosen as Secretary.

1824. — White.
Clerk.

1827. S. Taylor, Jun.
Clerk.

1829–42. William Lonsdale (1794–1871).
Curator and Librarian. In 1838 he was styled Assistant-

1839–45. Samuel P. Woodward, A.L.S. (1821–65).
Appointed Sub-Curator. Resigned on being appointed Professor of Natural History in the Royal Agricultural College, Cirencester. Author of 'Manual of the Mollusca.'

1839–60. Charles Nichols.
Clerk and Resident Officer. An excellent clerk. In his private capacity he was a popular society entertainer, acting (under the name of 'Charles Charles') 'Box and Cox,' &c.

1841–91. Isaac Charlton.
House Steward.

1842–44. Edward Forbes (1815–54).
Curator and Librarian. Resigned, 1844, on being appointed Palæontologist to the Geological Survey.

1844–47. Professor David T. Ansted (1814–80).
Appointed Vice-Secretary. He was then Professor of Geology at King's College.

1846–48. James de Carle Sowerby, F.L.S. (1787–1871).
Appointed Curator and Librarian. He was also Secretary of the Royal Botanic Society.

1847–50. James Nicol, F.R.S.E. (1810–79).
Assistant-Secretary and Librarian. Resigned after being appointed Professor of Mineralogy and Geology in Queen's College, Cork.

1850–62. Thomas Rupert Jones.
Assistant-Secretary, Librarian and Curator. Resigned on account of duties as Professor of Geology at the Royal Military College, Sandhurst.

1854–56. — Gawan.
Assistant in Museum.

1856–57. William Whitaker.
Gave voluntary aid in Museum, and arranged collections of recent and fossil Mollusca. Was afterwards temporarily engaged as Assistant in Museum and Library.

1858–59. John Wetherell.
Temporary Assistant in Museum and Library.

1859–68. Henry Michael Jenkins (1841–86).
Temporary Assistant in Library and Museum. Appointed in 1862 Assistant Secretary, Librarian, and Curator. Resigned on being appointed Secretary to the Royal Agricultural Society.

1860–65. George E. Roberts.
Clerk. Author of 'The Rocks of Worcestershire,' 1860, and of several story-books for children. Died 1865.

1860–64. Alfred Stair.
Temporary Assistant in Library and Museum. Resigned on obtaining appointment in the Inland Revenue Office at Somerset House.

1863–67. Horace Bolingbroke Woodward.
Temporary Assistant in Library and Museum. Resigned on being appointed Assistant Geologist on the Geological Survey.

1864–67. Ralph Tate (1840–1901).
Assistant in Library and Museum. Resigned in order to join an exploring expedition in Nicaragua. Was appointed in 1875 Professor of Natural Science in the University of South Australia.

1866. P. G. Ritchie.
Clerk.

1866–67. R. F. Fenton.
Clerk.

1867–86. W. W. Leighton.
Clerk.

1867–69. W. Stephen Mitchell, LL.B., F.L.S.
Assistant in Library and Museum.

1867–68. Sydney B. J. Skertchly.
Assistant in Library and Museum. Afterwards Assistant Geologist on the Geological Survey.

1869–72. Frederick Herschel Waterhouse.
Assistant in Library. Resigned on being appointed Librarian to the Zoological Society.

1869–90. William Sweetland Dallas, F.L.S. (1824–90).
Assistant-Secretary, Librarian, and Curator; from 1886, also Clerk. A distinguished naturalist. Author of 'A Natural History of the Animal Kingdom,' 1856; 'Elements of Entomology,' 1857, and other works.

1872. James Dallas.
Assistant in Library.

1872– William Rupert Jones.
Assistant Librarian.

1886–95. Francis Everard Brown.
Assistant Clerk. Died 1895, aged 37.

1890– L. L. Belinfante, M.Sc.
Assistant Secretary, Clerk, Librarian, and Curator.

1895– Clyde Henderson Black.
Assistant Clerk.

1900– Alec Field.
Library and Museum Assistant.

MEMORANDUM OF THE DATES OF PUBLICATION AND PRICES OF THE TRANSACTIONS OF THE GEOLOGICAL SOCIETY

			Price to Members and Booksellers £	s.	d.
Vol. i.	1811	. .	1	12	0[1]
ii.	1814	. .	3	0	0
iii.	1816	. .	2	17	0
iv. part 1, pp. 1–116,	1817				
part 2, pp. 117–476,	1817	. .	3	3	0
v. part 1, pp. 1–310,	1819	. .	2	12	0
part 2, pp. 311–664,	1821	. .	2	12	0

Second Series.

						Price to Public. £	s.	d.
Vol. i. part 1, pp. 1–174,	1822	. .	1	5	0	1	11	6
2, pp. 175–454,	1824	. .	1	14	0	2	2	0
ii. part 1, pp. 1–142,	1826	. .	1	4	0	1	10	0
2, pp. 143–336,	1827	. .	1	8	0	1	16	0
3, pp. 337–403,	1828	. .		13	0		16	0
supplement 404–421,	1828	. .		3	0		3	6
iii. part 1, pp. 1–240,	1829	. .	1	12	0	2	0	0
2, pp. 241–420,	1832	. .		16	0	1	5	0
3, pp. 421–530,	1835	. .		10	6		14	0

	Price to Members and Booksellers			Price to Public		
	£	s.	d.	£	s.	d.
Vol. vi. part 1, pp. 1–220, 1841 . .	1	2	6	1	8	6
2, pp. 221–600, 1842 . .	1	18	0	2	5	0
vii. part 1, pp. 1–52, 1845 . .		1	9		—	
2, pp. 53–84, 1845 . .		1	6		—	
3, pp. 85–174, 1846 . .		3	6		—	
4. pp. 175–252, 1856 . .		10	0		—	

LIST OF BENEFACTORS TO THE SOCIETY

[Besides the names contained in this list, there are many donors of books, specimens, portraits, &c., both public bodies and private individuals, whose names will be found in the Annual Reports. It would be impossible to give a full list here with the space at our disposal. Many Fellows have given their services gratuitously: *e.g.* Decimus Burton, in connection with alterations at Somerset House; Mr. T. Musgrave Heaphy, when the electric light was installed at Burlington House; and the late G. W. Ormerod, in the preparation of his Index. Considerable sums of money have from time to time been raised by subscription, as on the occasion of the removal to Burlington House, and in the founding of the Geological Relief Fund. Most of these are referred to in the body of the work.]

Acland, Sir Thomas Dyke, Bart., F.R.S.

1872. By will left 2*l.* 2*s.* to the Society.

Agassiz, Prof. Louis.

1858. Gave the whole of his unpublished drawings of fossil fishes.

Barlow, Dr. Henry Clark.

1876. By will left 500*l.* Consols in trust to found the 'Barlow-Jameson Fund;' and certain books.

Bigsby, Dr. John Jeremiah, F.R.S.

1877. Gave the die of a medal and 200*l.* in trust to found the 'Bigsby Medal.'

Bonney, Rev. Thomas George, F.R.S.

Bowerbank Testimonial Fund Committee.

1865. Presented marble bust of Dr. James Scott Bowerbank, in accordance with his wishes.

Brown, John (of Stanway).

1859. By will left 300*l.* to the Society.

Chantrey, Sir Francis Legatt, R.A.

1825. Presented the Seal on the incorporation of the Society.

Cooper, Sir Daniel, Bart.

1863. Presented two cases containing valuable collections, illustrating the alluvial gold deposits of New South Wales.

Ellesmere, 1st Earl of, K.G. (Lord Francis Egerton).

1843. Presented the original drawings of Agassiz's 'Poissons fossiles,' &c. These are kept in a case on the staircase of the Society's apartments.

Ellis, Sydney.

1879. By will left 1,000*l.* to the Society.

Evans, Sir John, K.C.B., F.R.S.

1896. Presented a portrait in oils of the late Professor Huxley.

Fischer, Dr. C. F. (of Auckland, N.Z.).

1871. Presented remainder of the copies (291 in number) of a translation made by him of Hochstetter and Petermann's 'Geology of New Zealand,' accompanied by six maps.

These books were placed on sale to the Fellows at a low price.

Greenough, George Bellas, F.R.S.

1855. By will left all his title to and interest in the geological map bearing his name, the copyright and copper-plates of which he had in 1840 assigned to the Society subject to

Hall, Captain Basil.

1834. Presented cabinet containing the results of experiments of the late Sir James Hall on the fusion of rocks.

Hamilton, Mrs.

1870. Presented a collection of pamphlets, the property of her husband, the late W. J. Hamilton.

Johnson, Percival Norton.

1845 and 1851. Presented palladium for striking the Wollaston Medal. His name was ordered to be added to the contributors to the 'Donation Fund.'

Lambert, Charles.

1876. By will left 25,000*l.* for distribution as gratuities to persons in his employment, and in gifts to scientific societies at the discretion of his son, Mr. C. J. Lambert, who allotted 500*l.* to the Geological Society.

Lyell, Mrs. Katherine M.

1892. Presented a crayon portrait of her father, the late Leonard Horner, and a bust of Sir Charles Lyell.

Lyell, Sir Charles, Bart., F.R.S.

1875. By will left the die of a medal and 2,000*l.* in trust to found the 'Lyell Medal and Fund.'

Macculloch, Mrs.

1858. By will left marble bust of her husband, the late Dr. John Macculloch.

Murchison, Kenneth R.

1871. Presented books from the library of the late Sir Roderick Murchison.

Murchison, Lady.

1853. Presented marble bust of her husband, Sir Roderick Murchison, by Richard Westmacott, R.A.

Philipps, Sir Thomas, F.R.S.

1846. Gave 5*l.* to the Society, which was appropriated to library expenses.

1859. Gave 20*l.* to the Society.

Pidgeon, Mrs. Jane Maria.

1902. Gave 1,000*l.* to found the 'Daniel Pidgeon Fund' in accordance with the wishes of her late husband, Daniel Pidgeon, died 1900, as expressed in his will.

Prestwich, Grace, Lady.

1897 and 1898. Presented a portrait in oils of the late Sir Joseph Prestwich; and 260 volumes of pamphlets, his property, in fulfilment of his wishes.

Prestwich, Sir Joseph.

1896. By will left 800*l.* in trust to found the 'Prestwich Medal and Fund.'

Sharp, Samuel.

1871. Presented a copy of the bust of William Smith in the church of St. Peter at Northampton.

Sharpe, Henry.

1856. Presented a collection of fossil shells in three mahogany cabinets, a valuable collection of fossils and thirty valuable books, the property of his brother, the late Daniel Sharpe.

Smith, William (of Cheltenham).

1880. Presented a portrait in oils of his great-uncle the late William Smith.

Topley, Mrs.

1898. Presented 156 memoirs, pamphlets, &c., from the library of her husband, the late William Topley.

Tylor, Alfred.

1861. Gave 52*l.* 10*s.* to the Society.

Vandercom, J. F.

1825. Gave his services as solicitor gratuitously in and about the obtaining of the Charter, also presented the press for the seal on the same occasion.

Weekes, Henry, R.A.

1846. Presented marble bust of Professor Sedgwick executed by him.

Whitaker, William, F.R.S.

1906. Gave 12*l.* 6*s.* to the Prestwich Fund and 6*l.* 13*s.* to the Geological Relief Fund, part of the award to him from the Prestwich Fund.

Willett, Henry.

1875. Presented portrait in oils of the late Prof. John Phillips.

Wollaston, William Hyde, F.R.S.

1828. Gave 1,000*l.* Three per cent. Reduced Bank Annuities to form the 'Donation Fund.'

Yates, Mrs.

1875. Gave 200*l.* to the Society in lieu of an intended bequest of her husband, the late Rev. James Yates, F.R.S., who died in 1871.

AWARDS OF THE WOLLASTON MEDAL

UNDER THE CONDITIONS OF THE 'DONATION FUND'

ESTABLISHED BY

WILLIAM HYDE WOLLASTON, M.D., F.R.S. (see p. 89)

1831. William Smith.
1835. Dr. Gideon A. Mantell.
1836. Louis Agassiz.
1837. Capt. Proby T. Cautley. Dr. H. Falconer.
1838. Richard Owen.
1839. Prof. C. G. Ehrenberg.
1840. Prof. A. H. Dumont.
1841. Adolphe T. Brongniart.
1842. Baron Leopold von Buch.
1843. Elie de Beaumont. P. A. Dufrénoy.
1844. The Rev. W. D. Conybeare.
1845. Prof. John Phillips.
1846. William Lonsdale.
1847. Dr. Ami Boué.
1848. The Very Rev. W. Buckland.
1849. Joseph Prestwich.
1850. William Hopkins.
1851. The Rev. Prof. A. Sedgwick.
1852. Dr. W. H. Fitton.
1853. Le Vicomte A. d'Archiac. E. de Verneuil.
1854. Sir Richard John Griffith.
1855. Sir Henry T. De la Beche.
1856. Sir William E. Logan.
1857. Joachim Barrande.
1858. Hermann von Meyer. Prof. James Hall.
1859. Charles Darwin.
1860. Searles V. Wood.
1861. Prof. Dr. H. G. Bronn.
1862. R. A. C. Godwin-Austen.
1863. Prof. Gustav Bischof.
1864. Sir Roderick I. Murchison.
1865. Dr. Thomas Davidson.
1866. Sir Charles Lyell.
1867. G. Poulett Scrope.
1868. Prof. Carl F. Naumann.
1869. Dr. Henry Clifton Sorby.
1870. Prof. G. P. Deshayes.
1871. Prof. Andrew C. Ramsay.
1872. Prof. James D. Dana.
1873. Sir Philip de M. Grey Egerton.
1874. Prof. Oswald Heer.
1875. Prof. L. G. de Koninck.
1876. Prof. Thomas H. Huxley.
1877. Robert Mallet.
1878. Dr. Thomas Wright.
1879. Prof. Bernhard Studer.

1880. Prof. Auguste Daubrée.
1881. Prof. P. Martin Duncan.
1882. Dr. Franz Ritter von Hauer.
1883. Dr. William Thomas Blanford.
1884. Prof. Albert Jean Gaudry.
1885. George Busk.
1886. Prof. A. L. O. Des Cloizeaux.
1887. John Whitaker Hulke.
1888. Henry B. Medlicott.
1889. Prof. Thomas George Bonney.
1890. Prof. W. C. Williamson.
1891. Prof. John Wesley Judd.
1892. Baron Ferdinand von Richthofen.
1893. Prof. Nevil Story Maskelyne.
1894. Prof. Karl Alfred von Zittel.
1895. Sir Archibald Geikie.
1896. Prof. Eduard Suess.
1897. Wilfrid H. Hudleston.
1898. Prof. Ferdinand Zirkel.
1899. Prof. Charles Lapworth.
1900. Prof. Grove Karl Gilbert.
1901. Prof. Charles Barrois.
1902. Dr. Friedrich Schmidt.
1903. Prof. Heinrich Rosenbusch.
1904. Prof. Albert Heim.
1905. Dr J. J. Harris Teall.
1906. Dr. Henry Woodward.
1907. Prof. William Johnson Sollas.

AWARDS

OF THE

BALANCE OF THE PROCEEDS OF THE WOLLASTON 'DONATION FUND'

1831. William Smith.
1833. William Lonsdale.
1834. Louis Agassiz.
1835. Dr. Gideon A. Mantell.
1836. Prof. G. P. Deshayes.
1838. Richard Owen.
1839. Prof. C. G. Ehrenberg.
1840. James de Carle Sowerby.
1841. Prof. Edward Forbes.
1842. Prof. John Morris.
1843. Prof. John Morris.
1853. Prof. L. G. de Koninck.
1854. Samuel P. Woodward.
1855. Drs. G. and F. Sandberger.
1856. Prof. G. P. Deshayes.
1857. Samuel P. Woodward.
1858. Prof. James Hall.
1859. Charles W. Peach.
1860. Prof. T. Rupert Jones, W. K. Parker.
1861. Prof. Auguste Daubrée.
1862. Prof. Oswald Heer.

1872. Dr. James Croll.
1873. Prof. John Wesley Judd.
1874. Dr. Henri Nyst.
1875. Prof. Louis C. Miall.
1876. Prof. Giuseppe Seguenza.
1877. Robert Etheridge, Jun.
1878. Prof. William Johnson Sollas.
1879. Samuel Allport.
1880. Thomas Davies.
1881. Dr. Ramsay Heatley Traquair.
1882. Dr. George Jennings Hinde.
1883. Prof. John Milne.
1884. Edwin Tulley Newton.
1885. Dr. Charles Callaway.
1886. J. Starkie Gardner.
1887. Benjamin Neeve Peach.
1888. John Horne.
1889. Arthur Smith Woodward.
1890. William A. E. Ussher.
1891. Richard Lydekker.
1892. Orville Adelbert Derby.
1893. John George Goodchild.
1894. Aubrey Strahan.
1895. Prof. William W. Watts.
1896. Alfred Harker.
1897. Francis Arthur Bather.
1898. Prof. Edmund J. Garwood.
1899. Prof. John B. Harrison.
1900. George Thurland Prior.
1901. Arthur Walton Rowe.
1902. Leonard James Spencer.
1903. L. L. Belinfante.
1904. Miss Ethel M. R. Wood.
1905. H. H. Arnold-Bemrose.
1906. Dr. Finlay L. Kitchin.
1907. Dr. Arthur Vaughan.

AWARDS OF THE MURCHISON MEDAL

ESTABLISHED UNDER THE WILL OF

SIR RODERICK IMPEY MURCHISON, BART., K.C.B., F.R.S. (see p. 247)

1873. William Davies.
1874. Dr. J. J. Bigsby.
1875. W. J. Henwood.
1876. Alfred R. C. Selwyn.
1877. The Rev. W. B. Clarke.
1878. Prof. Hanns Bruno Geinitz.
1879. Sir Frederick M'Coy.
1880. Robert Etheridge.
1881. Sir Archibald Geikie.
1882. Prof. Jules Gosselet.
1883. Prof. H. R. Gœppert.
1884. Dr. Henry Woodward.
1885. Dr. Ferdinand von Rœmer.
1886. William Whitaker.
1887. The Rev. Peter B. Brodie.
1888. Prof. J. S. Newberry.
1889. Prof. James Geikie.
1890. Prof. Edward Hull.
1891. Prof. Waldemar C. Brœgger.
1892. Prof. A. H. Green.
1893. The Rev. Osmond Fisher.
1894. William T. Aveline.
1895. Prof. Gustaf Lindstrœm.
1896. T. Mellard Reade.
1897. Horace B. Woodward.
1898. Thomas F. Jamieson.
1899. { Benjamin N. Peach. / John Horne.
1900. Baron A. E. Nordenskiœld.
1901. A. J. Jukes-Browne.
1902. Frederic W. Harmer.
1903. Dr. Charles Callaway.
1904. Prof. George A. Lebour.
1905. Edward John Dunn.
1906. Charles T. Clough.
1907. Alfred Harker.

AWARDS

OF THE

BALANCE OF THE PROCEEDS OF THE 'MURCHISON GEOLOGICAL FUND'

1873. Prof. Oswald Heer.
1874. Alfred Bell. Prof. Ralph Tate.
1875. Prof. H. Govier Seeley.
1876. Dr. James Croll.
1877. The Rev. John F. Blake.
1878. Prof. Charles Lapworth.
1879. James Walker Kirkby.
1880. Robert Etheridge.
1881. Frank Rutley.
1882. Prof. Thomas Rupert Jones.
1883. Dr. John Young.
1884. Martin Simpson.
1885. Horace B. Woodward.
1886. Clement Reid.
1887. Robert Kidston.
1888. Edward Wilson.
1889. Prof. Grenville A. J. Cole.
1890. Edward B. Wethered.
1891. The Rev. Richard Baron.
1892. Beeby Thompson.
1893. Griffith J. Williams.
1894. George Barrow.
1895. Albert Charles Seward.
1896. Philip Lake.
1897. Sydney S. Buckman.
1898. Miss Jane Donald.
1899. James Bennie.
1900. A. Vaughan Jennings.
1901. Thomas S. Hall.
1902. Thomas H. Holland.
1903. Mrs. Elizabeth Gray.
1904. Dr. Arthur Hutchinson.
1905. Herbert Lister Bowman.
1906. Dr. Herbert Lapworth.
1907. Dr. Felix Oswald.

AWARDS OF THE LYELL MEDAL

ESTABLISHED UNDER THE WILL AND CODICIL OF

SIR CHARLES LYELL, BART., D.C.L., F.R.S. (see p. 250)

1876. Prof. John Morris.
1877. Sir James Hector.
1878. George Busk.
1879. Prof. Edmond Hébert.
1880. Sir John Evans.
1881. Sir J. William Dawson.
1882. Dr. John Lycett.
1883. Dr. W. B. Carpenter.
1884. Dr. Joseph Leidy.
1885. Prof. H. Govier Seeley.
1886. William Pengelly.
1887. Samuel Allport.
1888. Prof. Henry A. Nicholson.
1889. Prof. W. Boyd Dawkins.
1890. Prof. Thomas Rupert Jones.
1891. Prof. T. McKenny Hughes.
1892. George H. Morton.

1893. Edwin Tulley Newton.
1894. Prof. John Milne.
1895. The Rev. John F. Blake.
1896. Dr. Arthur Smith Woodward.
1897. Dr. George Jennings Hinde.
1898. Prof Wilhelm Waagen.
1899. Lt.-Gen. C. A. McMahon.
1900. Dr. John Edward Marr.
1901. Dr. Ramsay Heatley Traquair.
1902. Prof. Anton Fritsch. / Richard Lydekker.
1903. Frederick William Rudler.
1904. Prof. Alfred Gabriel Nathorst.
1905. Dr. Hans Reusch.
1906. Prof. Frank Dawson Adams.
1907. Dr. Joseph Frederick Whiteaves.

AWARDS

OF THE

BALANCE OF THE PROCEEDS OF THE 'LYELL FUND'

1876. Prof. John Morris.
1877. William Pengelly.
1878. Prof. Wilhelm Waagen.
1879. Prof. Henry A. Nicholson. / Dr. Henry Woodward.
1880. Prof. F. A. von Quenstedt.
1881. Prof. Anton Fritsch. / G. R. Vine.
1882. The Rev. Norman Glass. / Prof. Charles Lapworth.
1883. P. H. Carpenter. / Ed. Rigaux.
1884. Prof. Charles Lapworth.
1885. Alfred J. Jukes-Browne.
1886. Daniel Mackintosh.
1887. The Rev. Osmond Fisher.
1888. Dr. Arthur H. Foord. / Thomas Roberts.
1889. Louis Dollo.
1890. Charles Davies Sherborn.
1891. Dr. C. I. Forsyth Major. / George W. Lamplugh.
1892. Prof. John Walter Gregory. / Edwin A. Walford.
1893. Miss Catherine A. Raisin. / Alfred N. Leeds.
1894. William Hill.
1895. Prof. Percy Fry Kendall. / Benjamin Harrison.
1896. Dr. William F. Hume. / Dr. Charles W. Andrews.
1897. W. J. Lewis Abbott. / Joseph Lomas.
1898. William H. Shrubsole. / Henry Woods.
1899. Frederick Chapman. / John Ward.
1900. Miss Gertrude L. Elles.
1901. Dr. John William Evans. / Alexander McHenry.
1902. Dr. Wheelton Hind.
1903. Sydney S. Buckman. / George Edward Dibley.
1904. Dr. Charles Alfred Matley. / Prof. Sidney Hugh Reynolds.
1905. E. A. Newell Arber. / Walcot Gibson.
1906. William G. Fearnsides. / Richard H. Solly.
1907. T. Crosbee Cantrill. / Thomas Sheppard.

AWARDS OF THE BIGSBY MEDAL,

FOUNDED BY

DR. J. J. BIGSBY, F.R.S., F.G.S. (see p. 252)

1877. Prof. Othniel Charles Marsh.
1879. Prof. Edward Drinker Cope.
1881. Prof. Charles Barrois.
1883. Dr. Henry Hicks.
1885. Prof. Alphonse Renard.
1887. Prof. Charles Lapworth.
1889. Dr. J. J. Harris Teall.
1891. Dr. George Mercer Dawson.
1893. Prof. William Johnson Sollas.
1895. Charles Doolittle Walcott.
1897. Clement Reid.
1899. Prof. T. W. Edgeworth David.
1901. George W. Lamplugh.
1903. Dr. Henry M. Ami.
1905. Prof. John Walter Gregory.
1907. Arthur W. Rogers.

AWARDS OF THE PRESTWICH MEDAL,

ESTABLISHED UNDER THE WILL OF

SIR JOSEPH PRESTWICH, D.C.L., F.R.S. (see p. 254)

1903. John Lubbock, Baron Avebury.
1906. William Whitaker.

AWARDS OF THE PROCEEDS OF THE 'BARLOW-JAMESON FUND,'

ESTABLISHED UNDER THE WILL OF

DR. H. C. BARLOW, F.G.S. (see p. 251)

1882. Baron C. von Ettingshausen.
[illegible]
1896. { Joseph Wright.
[illegible]

AWARDS OF THE PROCEEDS

OF THE

'DANIEL PIDGEON FUND,'

FOUNDED BY MRS. PIDGEON IN ACCORDANCE WITH THE WILL OF

DANIEL PIDGEON, F.G.S. (see p. 255)

1903. Prof. Ernest Willington Skeats.
1904. Linsdall Richardson.
1905. Thomas Vipond Barker.
1906. Miss Helen Drew.
1907. Miss I. L. Slater.

INDEX

Where brief biographic notices are given the fact is indicated by (biogr.) *after the page reference.*