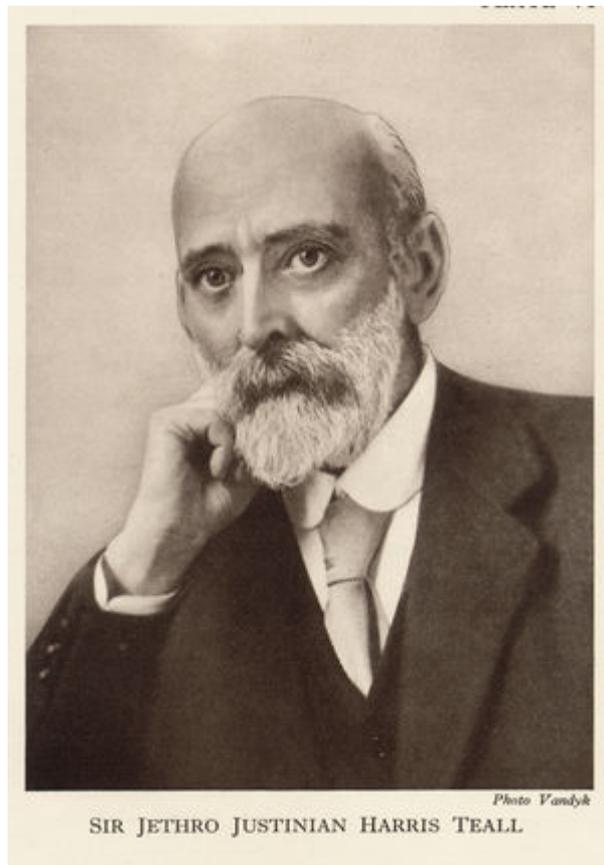


Geological Survey under Sir Jethro Justinian Harris Teall, 1901-1914

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From: Flett, J.S. 1937. [The History of the Geological Survey of Great Britain](#). London: His Majesty's Stationery Office.



Sir Jethro Justinian Harris Teall (From a photograph by C. Vandyk Ltd., London.)
Plate IV.

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VI. The Geological Survey under Sir Jethro Justinian Harris Teall

In 1901 the changes recommended by the Wharton Committee's report were duly effected. The Director who succeeded Sir Archibald Geikie was Jethro Justinian Harris Teall. Both from his eminence as a scientist and his skill in administrative work he undoubtedly had the first claim to the post, and the appointment was unanimously approved by his colleagues and by the general public interested in the work of the Geological Survey. The Assistants to the Director were Woodward in England and Horne in Scotland. Although Peach was senior to Horne, and even more eminent in scientific work, he spontaneously waived any claim to promotion, as he preferred field service to duties in an office. The five District Geologists were Fox-Strangways, Strahan and Reid in England and Peach and Gunn in Scotland. Lamplugh was also made District Geologist and went to Dublin to take charge of Survey work in Ireland. Newton continued as Palaeontologist, and Flett, who was Lecturer on Petrology in Edinburgh University, was appointed Petrographer in succession to Teall. In the same year Nolan, Cameron and Jukes Browne retired; Egan and Blake died; Howe, Thomas, Maufe and Wright joined the staff.

The Royal Commission on Britain's Coal Resources, appointed in 1901, met 47 times to take evidence and brought in its Final Report in 1905. It runs to thousands of closely printed pages of double columns and contains a great deal of matter not strictly geological. A special Geological Committee, however, was set up to report on the probable resources of the concealed coalfields. A vast amount of highly skilled labour was spent on this investigation and the result corrected the statistics that had been arrived at by the previous Commission which reported in 1871. The estimates of reserves which were drawn up for this Commission were prepared in some cases by officers of the Geological Survey and its other cases by mining engineers specially well informed regarding certain coal-fields. Recourse was had at every step to the Survey's published maps and sections, and it became clear that in many districts these were imperfect and out of date. Although no special recommendation was made by the Royal Commission, it was impressed on the authorities that much labour and expense would have been saved if the Survey's publications on British coalfields had been more detailed and complete. A great stimulus was given to the investigation of the geology of the coalfields and it is very largely in consequence of this stimulus that since that date all programmes of work for the Geological Survey have given special prominence to the survey of our coalfields.

We find accordingly that in the allocation of staff and the field programmes promulgated by Teall in 1901 rather more than half the strength of the Survey was to be addressed to the mapping of districts of economic importance. In South Wales Strahan continued the coalfield mapping, which by that time was almost half completed. Fox-Strangways and the staff working under him started to revise the Midland coalfields, Nottingham, Leicester and Derby, while Gibson was busy completing the account of the North Staffordshire coalfield. Reid, who was sent to Cornwall to prepare new maps of the mining districts, began work at Mevagissey, apparently in the hope of settling the much discussed question of the geological age of the Cornish clay-slates or 'killas.' Ussher continued in Devonshire and East Cornwall. A young mining engineer, MacAlister, was specially employed in copying and reducing to uniform scale the old plans of Cornish and Devonian mines. He spent several years on this work and also compiled all the available statistics of the output of mines in this province since the earliest times. The staff working in the south-west under Reid were Ussher, Hill, MacAlister, Dixon, Dewey and Wilkinson.

In Scotland also revision of the coalfields was taken in hand. The conditions of work in Scotland are peculiar, because it is impossible to survey for more than a few summer months in many Highland districts. In early spring the high ground may be covered with snow. In autumn the shooting tenants

take possession of all the remoter districts and the public is rigidly excluded. Hence in Scotland the ground allotted to a geologist for his year's work is usually of two kinds, low ground for spring and autumn survey, and high ground for summer months. It was decided that the low ground should consist mostly of coalfield areas, and in 1902 a start was made in Midlothian, where the current maps were nearly forty years old. At a later period work was also begun in the Glasgow district. Gunn retired in 1902 and Clough succeeded him as District Geologist.

Although great emphasis was thus put on the necessity for improving the maps of coalfields and mining districts, it is not to be supposed that other interests were neglected. The Wharton Committee had been much impressed with the value of the Survey's work in relation to public health and agriculture. In both respects the south and east of England was a district of prime importance, and it was decided to re-survey the London area on the scale of 6 inches to one mile. Woodward took on himself the superintendence of this work, along with the general control of the English staff, and two geologists were assigned to him, T. I. Pocock and Howe.

In the Highlands of Scotland four districts were under survey. Gunn, and afterwards Clough, supervised field work in Sutherland and Ross; Peach and his staff worked in Argyllshire and Inverness-shire. Horne superintended the mapping of parts of Aberdeenshire, and Harker and Barrow continued work on the Inner Hebrides (Rhum and Eigg). This wide dispersion of staff was necessary in order to finish certain maps that had been long in hand and were not yet completed.

The projected schemes of work in Ireland were of great interest. It had been recognized that the principal service which the geological surveyors could do there was to improve the maps for the use of the agriculturist. The original Irish Survey had mapped Drifts but only in a generalized manner, and all the Glacial deposits had been grouped together. A detailed survey, separating gravels, sands and clays, was really essential if the maps were to be of practical value, and Lamplugh was sent over to Dublin to initiate a revision with full mapping of Drift. For this task he was specially competent, as he was a well-known authority on Glacial deposits. He began in the Dublin district and finished that Sheet in 1901 with a staff consisting of Kilroe, McHenry, Seymour, Wright and Maufe. In 1902 he started revision in the neighbourhood of Belfast, and in 1903 he passed on to the survey of the country round Cork. The rapidity with which his work was carried out is extraordinary, and it is generally acknowledged that the maps were of a very high standard and much superior to any maps of the same kind that had previously been published in Great Britain.

Progress under Teall

The appointment of Teall as Director inaugurated a period of very great activity and progress. All his officers in charge of departments, except the Petrographer, were men who had had long experience of the work they had to control. A rigid series of programmes of work was drawn up and this, combined with thorough inspection of the mapping and very careful training of the young recruits, rapidly effected a great improvement in the mapping. The writing of the descriptive memoirs also was carried on in a more systematic manner and there was less delay in their publication. By the addition of numerous draughtsmen to the staff the field geologists were relieved of the onerous task of preparing maps for engraving during the winter and could give more time to literary work and to research. It was made a standing rule that during the winter season the field staff should work in the headquarter offices in London and Edinburgh under the direct control of their superior officers. Hitherto many men had worked in country quarters the whole year round and except for an occasional visit of inspection had seen little of the senior officers and had made very little use of the library and laboratories. Great delay had also taken place in writing the memoirs, in correcting proofs and in getting the maps drawn up and passed to the engraver.

Cartography

From this period also dates the general colour-printing of the maps on the one-inch and smaller scales. In this matter the British Survey had lagged behind and the change was long overdue. All the new maps were now engraved and printed by the Ordnance Survey, and the very high quality of their work was at once evident. Some of the English one-inch maps which had been issued, hand-coloured, during the years immediately preceding 1900 were colour-printed as rapidly as possible. In Scotland, however, colour-printing passed through a period of trial and experiment, because the Scottish maps are much larger than the English, and, owing to the complexity of the geology and the abundance of igneous rocks, the number of colours required was often very great. The new Irish Drift maps produced by Lamplugh and his staff were at first colour-printed at the Ordnance Survey Office in Dublin.

The feature of these new programmes which is most significant is the consolidation of the work and the concentration of the staff. Many of the programmes of Geikie were continued. As has been said, work was in hand before 1900 in South Wales and North Staffordshire, in Cornwall and in the south-eastern counties of England, but the scattered members of the field parties were now working in closer contact. Harker and his group went on with the mapping of the Inner Hebrides, and in the Highlands an effort was made to finish the maps that had been in hand for many years before breaking new ground. It is possible to argue that the revision of the Scottish coalfields was really started about 1894, when Grant Wilson began to collect the borings and examine the mine plans of the Fife coalfield. But the new work was of a very different character and involved an elaborate investigation of all the evidence on a scale not hitherto attempted. The revision of the Midland coalfields in England under Fox-Strangways was carried out in the same thoroughgoing manner. In this connexion it is important to note that the publication of six-inch maps of coalfields was resumed. For nearly twenty years this had been practically discontinued. The new maps were issued in Quarter-sheets, fully indexed and sometimes with measured vertical sections. They were designed to be completely intelligible in the uncoloured condition. Very few six-inch maps have been colour-printed, but strangely enough some Irish six-inch maps were published in this form before any English ones. This was not done, however, before 1917. No English six-inch maps were colour-printed till the London maps appeared in 1933. It has been found that the sale of uncoloured six-inch maps far exceeds the sale of hand-coloured copies. The reason is that they are much cheaper, being 2s 3d., while the coloured copies cost about 15s. 0d., and the plain maps serve the purpose quite well when they are being used by geologists and mining engineers. The new six-inch Quarter-sheets also are usually fully contoured and there is no difficulty in drawing horizontal sections across them. Consequently, the publication of measured horizontal sections has been discontinued since 1894, though all the old ones are still on sale. Vertical Sections, however, illustrating the strata of coalfields, are still being published. If they show actually measured sections or mine shafts or borings they never lose their value and are never out of date.

Publications

The great 'Stratigraphical Memoirs' were practically discontinued. Jukes-Browne's memoir on the Cretaceous appeared in three volumes (1900-1904) and was the last of them. The great 'District Memoir' on the North-west Highlands made its appearance in 1907; during its long preparation it had gone through many stages of editing and reduction, and only the unremitting industry of Horne could have seen it completed. No small 'Sheet Memoirs' were published on that country. The North Staffordshire coalfield had a separate memoir by Gibson (1905), but the area was small and circumscribed, and there was also a Sheet Memoir of smaller compass dealing with Stoke-on-Trent. This has now gone through three editions. The results of the Survey's work in South Wales and Cornwall were published as promptly as circumstances permitted in small memoirs each descriptive

of a single Sheet.

A development of some interest was the preparation of chemical memoirs on British mineral resources. Dr. Pollard had been appointed Chemist to the Survey (nominally a geologist) in 1898 and was executing analyses, though under the most depressing conditions from lack of accommodation and apparatus. He made some analyses of silicate rocks and minerals, and was soon launched on a scheme for preparing a systematic study of South Wales coals with especial reference to the origin of anthracitization. This investigation lasted several years and the results appeared in a well-known book, 'The Coals of South Wales,' by Pollard and Strahan (1908, 2nd edition 1915). It is interesting to reflect that this was a revival of research work which had been started as long ago as 1845 when De la Beche began his investigation into the coals suited to the Steam Navy, the results of which were published in 1848 in the second volume of the 'Memoirs of the Geological Survey.'

Museum of Practical Geology

In the Museum of Practical Geology fairly extensive alterations were carried out in the years succeeding the appointment of Teall as Director. Following the recommendations of the Wharton Committee the exhibits of porcelain and ceramics were mostly dispersed. This had been a striking and valuable collection containing many specimens of English pottery that in course of time had become rare and precious. Many notable donations had added to its resources and it was a very representative though not very large collection. Rudler, the Curator, took special interest in it, and his descriptive catalogue was well known and authoritative. The best of the specimens went to the Victoria and Albert Museum, and the others mostly to the Bethnal Green Museum. Only a few specimens of bricks, tiles and earthenware remained at Jermyn Street. At the same time many exhibits of iron work and artistic work in metals were sent to other museums. The metallurgical and some of the mining models and apparatus were finally disposed of in various ways, and the Jermyn Street Museum became a general exposition of British stratigraphical and economic geology. The ideal which had inspired De la Beche when he first installed his exhibits in Craig's Court in 1837 was to assemble as complete a series as possible illustrative of the applications of geology to industry and the arts. In the sixty-four years that had elapsed other museums had sprung up incorporating many of the subjects which De la Beche had under consideration, and having much better space and more ample resources than the Museum of Practical Geology. De la Beche's scheme had not failed, but had expanded on a scale which probably even its author never contemplated. The intentions of the Great Exhibition of 1851 had been fulfilled by permanent institutions of the first rank, of which the Jermyn Street Museum was only one and not the most considerable. The imperative demand for additional space for more purely geological exhibits made these changes very welcome. The growth of the Survey collections of fossils, rocks and minerals had reached a point when it was absolutely necessary to get rid of all material that was not closely connected with the work and purposes of the Geological Survey.

In 1902 Rudler retired, after serving in the Museum for forty-one years with the exception of a short period when he was Lecturer in Natural Science at Aberystwyth. In his retirement, however, he did not cease to take an interest in the Museum, and he prepared a special exhibit of British Minerals arranged according to their geographical distribution. These minerals were mostly taken from the Ludlam collection, and the descriptive handbook which Rudler wrote has been much used by students of British mineralogy. This was the principal addition to the exhibits at this date. Rudler's successor, J. Allen Howe, who had been mapping in the London district under Woodward, prepared an exhibit of British clays and roadstones, and several new geological models were constructed to show British districts of special geological interest such as the North-west Highlands and the Isle of Purbeck. Attempts were also made to exhibit a larger series of British photographs.

The space liberated by the transfer of the pottery collections was used for the series of British rocks.

The old rock room was handed over to the drawing staff and the petrologists. The new rock room, on the main floor, accommodated the old collections which had been got together by Ramsay, Geikie and Rutley, and considerable additions were made to the exhibited series in order to illustrate the districts in which new discoveries were being made, such as the Scottish Highlands, Skye and Cornwall.

The rooms on the Piccadilly front which had contained the mining models and apparatus were converted into offices for the Director, the Assistant Director and the clerical staff, while Sir Archibald Geikie's room was given to the Curator. Unfortunately, insufficient space was available at this period for the expansion of the library, and 12,000 more volumes were handed over to the Science Library at South Kensington.

For many years a small house in Jermyn Street on the west side of the Museum had been assigned to the geologists who were working at headquarters during the winter. The lease, however, had expired and the whole block of buildings between the Museum and St. James's Church in Piccadilly had been acquired for the purpose of building a restaurant and business premises. Fortunately, it proved possible to secure the top flat of a portion of the new buildings for working rooms for Survey officers, and in this manner the District Geologists, the Geologists and the Petrographer obtained new quarters. At the same time more space was provided for the chemical laboratories, which were placed in a suite of rooms in the new flat. This effected a great improvement in the conditions under which the field staff worked in the winter season and even made it possible for young geologists from Scotland to spend some time each year in London studying the petrology of the districts which they had mapped.

The principal change, however, which took place in the Museum at this time was the disappearance of the Lecture Hall. In this way the last trace of the connexion between the Survey and the School of Mines finally vanished. The hall which had been the scene of so many brilliant addresses by Ramsay, Geikie, Frankland, Huxley, Tyndall, Hofmann, Stokes, Warrington Smyth, Percy and many others hardly less famous, was no longer necessary. By means of a new floor, a continuation of the main floor of the Museum, it was converted into two spacious rooms. The lower story became an addition to the crypt or basement in which the unexhibited collections of fossils and rocks were housed. The upper story provided room for part of the collection of British and European maps in the library, and became known as the Map Room. A large table for the use of visitors who wished to consult the maps was one of the features of this addition to the library, and around the room bookcases were erected to take the large, rapidly growing series of British and foreign maps which was always open to the public for reference. The rest of the new space afforded was used principally for an exhibit of geological models and the Maw Collection of clays. Although by no means ideally adapted for these purposes, these rooms allowed a certain amount of expansion which was very much needed both by the library and the Museum. The basement storage was sufficient for the acquisitions of several years and helped to relieve the congestion in the working quarters occupied by the staff, where specimens had accumulated to a most undesirable extent.

Transfer of the Geological Survey of Ireland

On 1st April, 1905, the Geological Survey of Ireland was transferred to the Department of Agriculture and Technical Instruction for Ireland. Lamplugh came back to the English staff. He went on a voyage to South Africa and prepared a report for the British Association on the geology of the Victoria Falls. About the same time Maufe, who had been on the Irish Survey, was lent to the Government of East Africa to report on the prospects of finding a water-supply for the Uganda railway. Wilkinson, who had been taken from the Irish to the Scottish staff in 1890, had been transferred to Ireland in 1904 at his own request. Lamplugh had completed his Drift surveys of

Dublin, Belfast, Cork and Limerick. They were meant for the use of agriculturists, and whether they served that purpose or not there is no doubt they were excellent Drift surveys. The Irish staff retained its head office in Dublin, with the Irish collections and maps, and the majority of the Irish rocks and fossils that were in London were sent back to Ireland. Thus terminated a connexion that had existed for nearly seventy years.

Work programmes

England

Changes in the staff were very numerous in these years. The recruits who joined the Survey in 1901 were followed in 1902 by Scrivenor, Bailey and MacAlister, and by Anderson, Sherlock, Jones, Carruthers and Graham in 1903. These men were mostly recruited under the system of competitive examination and had good University degrees, and often some experience of research in petrology and palaeontology. A much shorter period of preliminary training was needed by them, and the standard of work both in maps and memoirs began to improve. In petrology there was a marked advance, and Thomas, Bailey and Scrivenor soon made a reputation for themselves in this field of work. The opportunities for research work were increased by the practice of bringing all the young geologists to headquarters in the winter season, where they were under the supervision and training of the senior members of the staff.

The coalfield mapping also became more detailed and more exact every year. At first in South Wales progress was rapid, but both petrology and palaeontology received little attention. As they worked westward this unit entered country more involved and difficult and the work became much slower. The geologists engaged were Gibson, Cantrill, Dixon, Thomas and Jones and the standard maintained was excellent. The petrology in particular, which was entrusted to Thomas, was brilliantly done. The final one-inch maps, those of the Pembroke district, were not published till 1921, so that the re-survey of this coalfield lasted for nearly twenty-five years. Before that date, however, some of the earlier maps had been published in revised editions. Much interest was taken in the geological mapping of South Wales and several of the memoirs were sold out in a few years.

In the Midland coalfields also the work was very efficiently conducted, at first by Fox-Strangways but after 1905 by Lamplugh, who succeeded him as District Geologist. The Leicester Sheet appeared in 1903, Loughborough in 1905, Derby and Nottingham in 1908. A second edition of the Stoke-upon-Trent map was also issued, and was accompanied by a second edition of the memoir.

In Cornwall the first of the new maps to be published were Falmouth, Scilly and Newquay (1906); they were followed by Mevagissey and Land's End (1907). They showed a great improvement on the old maps of De la Beche, and the detail with which the elvans, lodes and cross courses were mapped has rendered them of the utmost value. Unfortunately, except for a brief period during and shortly after the War, tin, lead and copper mining in Cornwall have had little prosperity.

Scotland

The impetus given to geological work by the reorganization of the Survey in 1901 was probably more marked in Scotland than in any other district. Up to 1907 Peach and Horne were still engaged in preparing the North-west Highlands memoir and seeing it through the press, but every summer an active campaign was carried forward in the Highlands. Many Sheets which were unfinished when Geikie retired were brought to completion, and as the new geologists were keen petrologists, while only Barrow had hitherto taken interest in the microscopic characters and structures of Highland rocks, much new light was thrown on problems of Highland geology. The only Highland memoir of

importance that had been published during Geikie's directorship was Clough's Cowal (1897), a book little appreciated when it appeared but subsequently recognized as a classic contribution to Scottish geology. Under the energetic leadership of Horne the investigation of the Highlands was actively prosecuted, and though the publication was impeded by the necessity of giving prime attention to the mapping of the coalfields, and by the slow process of engraving the large, complicated Highland Sheets, the materials were being collected for numerous Highland memoirs. Both in the country north of the Great Glen and in the regions to the south of it every year showed important additions to the surveyed ground, and it was being studied more closely and completely.

In this connexion the strange result emerged that the more the Highlands were investigated the less agreement there was between the geologists concerned. To the west of the Moine Thrust there had been a general uniformity of opinion, at least on the main points involved. The structures there were on the whole evident and well known. The sequence of rocks had been clearly established at an early date and their geological age was known. It was otherwise in the Eastern and Southern Highlands.

Probably the first example of this discordance in interpretation was furnished by the mapping of Islay. Peach had always expressed the firm conviction that the Moine and Dalradian rocks represented altered Torridonian and Cambrian. He believed that he was sure to find Cambrian fossils in the Islay limestones. After the most careful scrutiny of the rocks and the most detailed mapping he was compelled to admit failure, and with his hypotheses none of his colleagues, Wilkinson, Clough and Horne, was willing to agree. When the memoir was published in 1907 no definite conclusions could be maintained, and undoubtedly this had the result of making Horne very cautious in deciding disputed questions of Highland geology.

In the Eastern Highlands Barrow was at variance with his colleagues, Cunningham-Craig and Grant Wilson, on many important points. With Peach also he thoroughly disagreed, and he maintained his positions with much dexterity and tenacity. In these controversies Hinxman took a neutral attitude, but Clough and Barrow differed also in their interpretation of the Highland Border structures, and Peach held strong opinions on the age of these rocks that were not generally accepted. Subsequently Peach, Jehu and Campbell found fossils in the Aberfoyle and Stonehaven cherts that proved that the Highland Border Series was of Lower Palaeozoic age.

Matters became still more complicated when, in 1910, Bailey published his conclusions that in the Ballachulish district there were great recumbent folds and invisible thrusts or slides. His senior colleagues maintained an attitude of incredulity which became more marked when he extended his hypotheses to include the whole Southwestern Highlands. When Carruthers in 1912 carried on the survey of Lochaber and Glen Spean, he praised: the accuracy of Bailey's mapping of the adjacent ground but refused to accept his major conclusions. At a subsequent stage it was proved that some of Carruthers's criticisms were well founded. Read had been sent to Banffshire to complete the mapping of some ground previously surveyed by Horne, and in 1916 he arrived at the conclusion that some important boundary lines were powerful thrusts, while Horne maintained that they were ordinary faults. Their interpretation of the geological structure and correlation consequently differed widely.

These controversies have attracted a good deal of attention among British geologists, and the Southern Highlands are now a field where research is being carried on by numerous amateur and academic geologists. Professor Gregory wrote a most interesting book on Dalradian Geology in which he discusses all the evidence. He agrees with none of the views previously advocated, but no working Highland geologist is prepared to accept his alternative explanations. In fact, the non-official geologists are not in better accord than the official surveyors. The correlation, the sequence, the tectonics and the metamorphism are all discussed at great length and there are almost as many views as there are investigators. These problems' are as attractive as they are

elusive, and Highland geology becomes more fascinating as the years go by.

The men who were at work on Carboniferous ground experienced less difficulty. In the coalfields there was, as a rule, abundance of evidence from mines, shafts and borings, and this increased every year. They had the skilful assistance of Kidston in determining the fossil plants and of Wheelton Hind with the lamellibranchs. Subsequently Vaughan's zoning of the Carboniferous Limestones was widely used in the western parts of South Wales. The long-standing controversy regarding the pre-Cambrian rocks of Pembrokeshire was cleared up by Cantrill, Jones and Thomas, and Flett produced a map and memoir on the Lizard district of Cornwall that obtained general acceptance. Hill, however, claimed certain Cornish rocks as Ordovician that Reid and Ussher had been inclined to regard as Devonian. This point is not yet settled, but it is now known that some of Hill's Ordovician contains Devonian plants.

Petrology

In the knowledge of British petrology great advances were made. Harker's account of Skye, Eigg, Rum and Muck takes a very high place in the literature of British geology. Bailey made intensive studies of the Carboniferous igneous rocks of Scotland. The Southern Highlands were a happy hunting-ground for students of petrology. In Cornwall also many discoveries were made that attracted the notice of petrologists.

Palaeontology

In palaeontology no memoirs had been published by the Survey since 1878 except Newton's 'Pliocene Vertebrata' (1891). A new series of monographs was started in 1908 with Peach's 'Higher Crustacea of the Carboniferous Rocks of Scotland,' and the series was continued by Ivor Thomas and G. W. Lee with volumes on other groups of Carboniferous fossils.

Staff transfers to Colonial or Dominion Surveys

In addition to the inevitable losses through death and retirement, the Geological Survey had parted with a number of its most capable young men, who had gone to Colonial or Dominion Surveys or who had taken up professional work. In 1903 Kynaston went to the Transvaal, after eight years' service, to become Director of the Geological Survey of the Transvaal. In 1905 Scrivenor, after three years' service, became Government Geologist to the Federated Malay States. In 1906 Grabham, after three years' service, was appointed Geologist to the Sudan Government. Maufe left in 1910 after nine years' service and became Director of the Geological Survey of Southern Rhodesia. Lightfoot followed him in 1911, after two years' service, and is now Director of that Survey. Cunningham-Craig, after a period in Government service in Trinidad, took up consulting work in 1907, and Bosworth followed in his footsteps in 1909. Ivor Thomas, a brilliant young palaeontologist, became an Inspector of Schools in 1912. O. T. Jones resigned in 1910 on his appointment as Professor of Geology at Aberystwyth, and is now Woodwardian Professor at Cambridge. MacAlister, who had done excellent work on the mining industry in Cornwall, resigned in 1911.

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