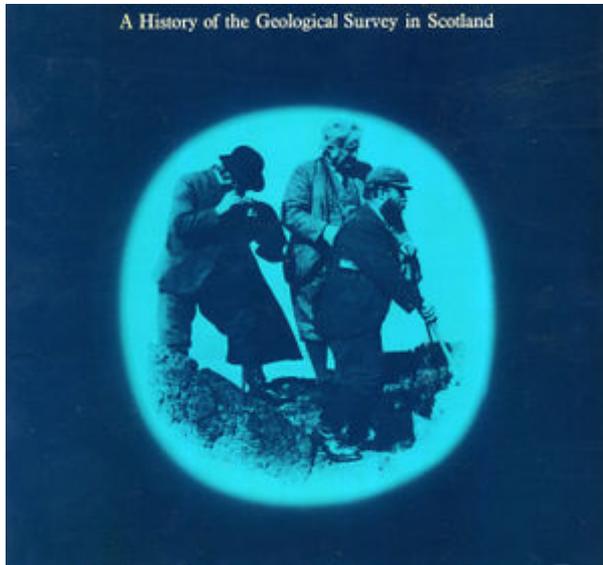


History of the Geological Survey in Scotland

From Earthwise

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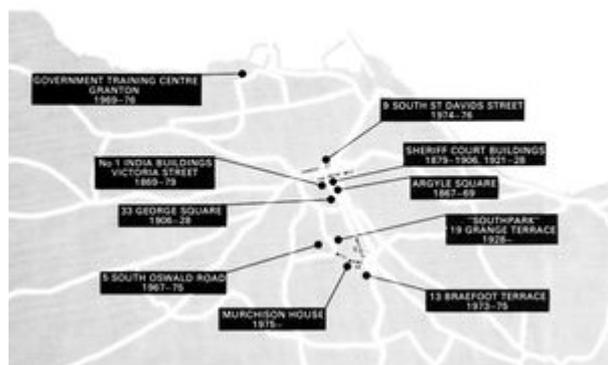


Front cover. From: Wilson, R.B. A history of the Geological Survey in Scotland. NERC, IGS, 1977.

No. 1 India Buildings, Victoria Street.



No.1 India Buildings, Victoria Street.. From: Wilson, R.B. A history of the Geological Survey in Scotland. NERC, IGS, 1977.



Map of Edinburgh showing sites of offices. From: Wilson, R.B. A history of the Geological Survey in Scotland. NERC, IGS, 1977.

Assistant Directors, Scotland.

Sir A. Geikie
H. H. Howell
Dr J. Horne



Sir J. S. Flett
Dr W. Gibson
Dr M. Macgregor
T. H. Whithead
Dr A. G. MacGregor

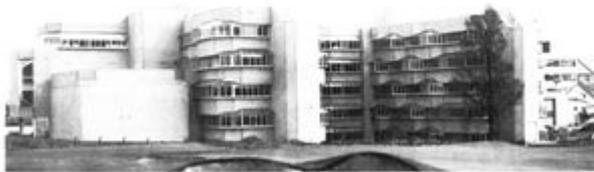


Dr G. H. Mitchell
J. A. Robbie
R. A. Eden



Assistant Directors, Scotland. Sir A. Geikie
H. H. Howell, Dr J. Horne, Sir y. S. Flett, Dr
W. Gibson, Dr M. Macgregor, T. H.
Whithead, Dr A. G. MacGregor, Dr G. H.
Mitchell, J. A. Robbie, R. A. Eden. From:
Wilson, R.B. A history of the Geological
Survey in Scotland. NERC, IGS, 1977.

Murchison House



Murchison House. From: Wilson, R.B. A
history of the Geological Survey in Scotland.
NERC, IGS, 1977.



Sir Roderick Impey Murchison (1792-1871). Sir Roderick Impey Murchison (1792-1871) was born at Tarradale, Rosshire and was educated at Durham Grammar School and the Royal Military College, Great Marlow. He obtained a commission in the army and served under Wellington in the Peninsular War. On leaving the army after the war he became interested in geology and geography and from 1825 until his death he published 111 scientific papers or books and 13 others in joint authorship. His most famous works are the Silurian System, published in 1839, and Siluria in 1854. He travelled extensively in Europe studying geology, his most celebrated trip being to Russia in 1841 on the invitation of Emperor Nicholas. He was responsible for naming and defining the Silurian and Permian systems of rocks in the stratigraphical column and also the Devonian System in conjunction with Sedgwick. He served as Director-General of the Geological Survey of Great Britain from 1855 until his death during which period the Geological Survey in Scotland was formally constituted. From: Wilson, R.B. A history of the Geological Survey in Scotland. NERC, IGS, 1977.



Scottish Survey staff in 1958. Back Row D. I. Smith, G. I. Lumsden, R. B. Wilsoll, I. H. Forsyth, W. G. E. Graham, W. A. Read, E. H. Frallicis, G. A. Goodlet, N. S. Crichton. Centre Row P. Skea, W. Fisher, D. J. P. Cairns, A. Davies, J. McCall, P. J. Brand, D. K. Graham, G. S. Johnstone, W. Mykura, W. Tulloch, M. Armstrong, R. W. Lucas, R. Turnbull, D. R. Rintoul. Seated J. Paterson, E. F. Inkster, W. Manson, J. Knox, A. G. MacGregor, G. H. Mitchell, T. R. M. Lawrie, J. Phemister, Miss S. M. France, Mrs. E. B. Tupman. From:

Wilson, R.B. A history of the Geological Survey in Scotland. NERC, IGS, 1977.



Scottish Survey staff in 1868. Standing, (left to right) I. Geikie, J. Horne, J. Croll, C. R. Campbell, B. N. Peach, D. R. Irvine, T. M. Skae, and R. L. Jack. Seated, E. Hull and A. Geikie. From: Wilson, R.B. A history of the Geological Survey in Scotland. NERC, IGS, 1977.



Horne, B. N. Peach and C. T. Clough in the field. From: Wilson, R.B. A history of the Geological Survey in Scotland. NERC, IGS, 1977.



Southpark, 19 Grange Terrace in 1930.
From: Wilson, R.B. A history of the
Geological Survey in Scotland. NERC, IGS,
1977.

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A History of the Geological Survey in Scotland

Introduction

The Geological Survey of Great Britain has its origins in the early work of the Ordnance Survey and in the research of eminent members of the Geological Society of London. In the early part of the 19th century accurate maps of the British Isles were being produced by the Ordnance Survey. In some areas the surveyors coloured their maps to depict the boundaries of the various rock formations observed, but the geology thus shown was of a very general nature. The value of accurate geological information was becoming apparent not only as a basis for research but as an aid in assessing the national mineral wealth and in formulating land utilisation policies. Consequently in 1835 the Geological Survey of Great Britain was established by the government for the purpose of producing geological maps of the country to be based on the Ordnance Survey maps as they became available. At the same time it was expected that accompanying memoirs would be published explaining in detail the geology shown on the maps.

Field Staff

The early years

For the first 4 years H. T. De la Beche, a Vice-President of the Geological Society, was the only

geologist on the staff. Previously he had been engaged in making a geological map of Devon and he now continued this work in an official capacity. After 1839 the number of staff gradually increased but for the first 20 years the work was confined to southern Britain, limited by the availability of Ordnance Survey maps.

In the 1850s maps of Scotland began to be published, on the scale of 6 inches to one mile, the first of them being of the Lothians area. In the autumn of 1854, A. C. Ramsay, a Scot from Glasgow who had joined the Survey in England in 1841, began mapping the geology of the Dunbar area. He spent about 3 months surveying the Carboniferous and Old Red Sandstone rocks there and then returned to London.

He never resumed the task but the following year two men were appointed to continue the work. One was H. H. Howell who had joined the staff in England 5 years previously, at the age of 16, and the other was Archibald Geikie, then aged 20 and already a recognised geologist.

These two proceeded to survey large tracts of Berwickshire, the Lothians and Fife and by 1859 the geological sheet of the Edinburgh district, on the one-inch-to-one-mile scale, was published in a hand-coloured edition. Also, many 6-inch sheets of the coalfields had been prepared and were available for public consultation. The first memoir, which described the Edinburgh district, appeared in 1861. In the economic field, as early as 1858, Geikie was able to show the main outcrops of oil-shale in West Lothian to James Young who was then founding the oil-shale industry in the area.

In 1861 Howell returned to England and was replaced by two recruits from Edinburgh. These were James Geikie, the younger brother of Archibald, and John Young who held a medical degree but had become interested in geology. B. N. Peach, son of the famous naturalist C. W. Peach, joined in 1862. Young remained in the Survey till 1866 when he resigned to become Professor of Natural History at Glasgow. He was the first of many throughout the history of the Survey who, after gaining experience as field geologists, left to take up academic posts or joined geological surveys overseas.

About 1861 it was decided to map the superficial deposits in addition to the solid rocks and to show them on published maps. These 'drift' deposits, which blanket much of Scotland and are composed of clay, sand and gravel, were laid down in relatively recent times during and after the melting of the Ice Age glaciers. This addition to the maps made them more useful, especially for agricultural purposes, but it entailed resurveying ground already covered and slowed the progress of subsequent work.

R. I. Murchison succeeded De la Beche as Director-General in 1855 and held office until he died in 1871, aged 79 years. Towards the close of his directorship, a Royal Commission inquired into the national coal reserves and, learning that large parts of the coalfields in northern Britain remained to be surveyed, recommended a large increase in staff. Murchison acted upon the recommendation quickly and the resulting influx of recruits led to a radical change in the organisation of the Survey in Scotland.

First Reorganisation

In 1867 the Survey in Scotland was given a separate identity with a headquarters office in Edinburgh and A. Geikie was made Director. Under him, E. Hull, an experienced officer from England, was appointed as District Surveyor, a new supervisory post. Hull left after 2 years to be Director in Ireland and was replaced by J. Geikie. The influence of the Geikie brothers on Scottish geology was considerable. In 1871, Archibald, in addition to his Survey post, became the first Professor of Geology at Edinburgh, a new chair which was founded by Murchison. In 1882, when he went to London to become Director-General, his brother James resigned from the Survey and

succeeded him as Professor. The chair was occupied by the Geikies for the first 43 years of its existence.

Between 1867 and 1870 the Scottish field staff was more than doubled. The recruits included J. Horne, D. R. Irvine, R. L. Jack and H. M. Skae. Jack served for 10 years before leaving to found the Geological Survey in Queensland. Irvine, only 16 years old when he joined, stayed until 1882 when he went to Canada.

One recruit of the period is worth special mention as he was regarded by many as a genius. J. Croll was the son of a Perthshire crofter and had suffered ill health most of his life. Although self educated he had written many books and papers on science, philosophy and religion. One paper, on the causes of climatic changes during geological history, caught the attention of geologists and Geikie offered him the post as manager of the new office in Edinburgh. About this time recruits had to pass an examination in English and arithmetic before being given permanent employment. Croll failed in arithmetic but as it was acknowledged by Lord Kelvin that he had calculated the precession of the equinoxes over the last 10 million years, his mathematical ability was accepted. Croll managed the day to day administration of the office until he retired in 1881 by which time he was a Fellow of the Royal Society of London and had been honoured by learned bodies at home and abroad. His intellectual ability had a profound influence on the geological theories of many of his colleagues, especially in the field of glacial deposits.

In the first 20 years of the Survey's activities in Scotland, practically all of the central and southern parts of the country had been surveyed on the 6-inch scale and manuscript copies of the field maps made for public reference. Maps and memoirs of the main coalfield areas had been published and many of the one-inch sheets of non-coalfield areas had appeared. Not all of the sheets had been accompanied by an explanatory memoir however, the principal reason for this omission being lack of time.

The Survey was under constant pressure to cover as many square miles of ground as possible every year. The government envisaged the mapping as being a simple, progressive operation which only required to be undertaken once, and the sooner the better. The rate of progress made in the first 20 years was only achieved by the geologists being in the field most of the year. What little time remained for indoor work was occupied mainly in making clean copies of the maps and in writing memoirs on the coalfield areas. The preparation of memoirs was made more difficult by the transfer or resignation of men resulting in the loss of their unique knowledge of their mapping areas.

In 1875 with the southern third of the country disposed of, attention was turned towards the Highlands. For the attack, the Director had a very experienced team comprising J. Geikie, Horne, Irvine, Jack, Peach and Skae. They were soon joined by the recruits J. S. Grant Wilson and J. Linn. For the first few years the work was concerned with the Old Red Sandstone along the southern margin of the Highlands but soon men were stationed at various points around the Grampians, including the Moray Firth area, and were advancing towards the higher ground.

In 1882 A. Geikie was promoted to Director-General and Howell was made Director in Scotland but Geikie, although now based in London, kept control of Highland work. His ambition was to have the primary survey of Britain completed during his term of office and the Highlands formed a stumbling block. About 1881 he tried a change of policy by having some mapping done on the one-inch scale in order to speed up the surveying. This did not last long as the scale did not allow sufficient detail to be recorded and only some parts of Aberdeenshire were mapped in this manner. His next plan for increasing the annual return of ground covered, was to augment the work force as much as possible.

In 1884 when the primary survey of England was nearing completion, much of it mapped on the one-

inch scale, he transferred G. Barrow, C. T. Clough, J. R. Dakyns, W. Gunn and H. Miller from northern England to the Scottish staff. Most of them later achieved fame in the investigation of Highland geology. Before the end of the century H. M. Cadell, E. H. Cunningham-Craig, E. Greenly, J. B. Hill, L. W. Hinxman and H. Kynaston were recruited to help with the Highland mapping.

Despite this application of man power, it was not possible to achieve the same rate of progress as had been made in the Lowlands. The nature of the terrain, the prevailing weather and the complexities of the rock types and structures made progress slow. Suffice it to say that there are still parts of the Highlands awaiting primary survey and some of the structural problems are not yet completely solved.

Although the initial mapping was in the Grampians, it was not long before part of the team was diverted to the North-West Highlands. The nature of the succession and structure of the rocks there had given rise to a controversy, dating from about 1860, between Murchison and Professor Nicol of Aberdeen. Professor Lapworth of Birmingham had also examined the problems and given his interpretation. Geikie considered that if the problem of the NW Highlands was resolved, the solution might be applicable to the difficulties being encountered farther south. To examine the evidence, he sent his most able men, Peach and Home who were joined later by Clough, Hinxman, Cadell and Gunn. By 1884 it was announced that Murchison's interpretation of a simple succession of strata was untenable. In agreement with Lapworth, it was shown that the uppermost rocks had been pushed many miles over the lower ones along a low-angled thrust fault. This fundamental discovery initiated a survey of the whole belt affected by this structure which stretches from Cape Wrath south to Skye. Subsequently this area, particularly the Assynt district, became a Mecca for visiting geologists from all over the world.

Considerable physical demands were made on the men engaged on this work. Much of the higher ground was deer forest and access to it was restricted to a short summer season between the time the snows melted and the shooting season began. Full advantage had to be taken of the long daylight hours of midsummer and much of the ground could only be reached on foot. During the 1880s there was a period of particularly bad summers in the Highlands. In 1886, in order to save time climbing before starting the day's work, a tent was pitched in a high corrie on Ben More Assynt. The experiment had to be abandoned however as drenching rain was continuous and the tent was blown down. The health of even the most seasoned campaigners suffered at this period. In 1887 Peach and Home did not do much field work as the former had sciatica and the latter suffered from what was described as inflammation. In 1889 Skae died aged 42, Dakyns suffered blindness from exposure and lost the sight of one eye and Miller was ill most of the year.

As work in the mountains was restricted to the summer, the field seasons were arranged so that lower ground was surveyed during spring and autumn. In addition to the Highland work, other demands on time were being made. Mining operations for oil-shale and coal had been providing much new information which showed that the original maps of Central Scotland were inaccurate in places. In 1892 Grant Wilson started to collect new coalfield information in Fife with a view to revising the map of the area.

The Southern Uplands presented an even more time-consuming problem. Subsequent to the first survey, which had been done very rapidly, Lapworth had established that graptolites held the key to deciphering the succession of the folded and faulted Lower Palaeozoic rocks in the region. A revision of the Survey's maps was required and between 1888 and 1898 Peach and Home resurveyed the area, the work being done mainly in winter months. Revised maps were published and the revision was summarised in a memoir which appeared in 1899, dealing with the whole region. This work behind them, Peach and Home then set about the description of the North-West Highlands. The resulting historic memoir was published in 1907, edited by Geikie in his retirement.

A new feature of memoirs of this period was the introduction of photographs illustrating geological features. These were the work of R. Lunn who had joined the staff as a boy porter, aged 14, in 1874. He was recruited because a man could not be found to act as porter for the annual salary of £27. Lunn was later promoted to General Assistant and in 1891 he started to take geological photographs in the field. Many of these became well known and prints from the original glass negatives are still in demand.

Towards the close of the century, large tracts of the Highlands had been surveyed but little or no attention had been paid to the islands. In the 1890s a start was made when A. Harker of Cambridge University was employed to map the volcanic rocks of south Skye and H. B. Woodward, a senior officer of the English Survey, was sent to map the Jurassic rocks of Skye and Raasay.

Geikie retired from the post of Director-General in 1901. His abiding interest in Scottish geology had not waned. At this period he added two memoirs on Fife to the extensive list of books, memoirs and papers which had flowed from his pen.=== Second reorganisation ===

Two events, which more or less coincided with Geikie's retirement, had a profound effect on the future of the Survey. The first was that in 1901 another Royal Commission reviewed the national coal reserves. Unlike the first one, which had found that many of the coalfields had not been mapped, this one reported that the existing maps were seriously out of date. This situation had to be rectified. A change of policy was adopted which resulted in more than half the staff working in areas of economic importance. In Scotland work in the Highlands was confined to the summer months allowing a full scale revision of the coalfields to be started.

The other event was the appointment of a government committee to enquire into the organisation and staffing of the Survey. This arose from discontent voiced both outside and within the Survey. In many parts of the country there had been complaints that no satisfactory geological maps were available. This came about partly from the cessation of publication of 6-inch maps in 1881 as all of the staff effort had been concentrated on trying to complete the Survey of the country and partly because the number of staff had been decreasing.

Between 1867 and 1900 the scientific staff in Great Britain had shrunk from 65 to 41 and the senior posts had not been filled. The number of Directors had fallen from 3 to none and that of District Surveyors from 4 to 2. The promotion prospects of the geologists were almost non-existent, some of them having been Temporary Acting Geologists for over 20 years with no pension rights. The committee found that most of the complaints were justified and recommended improvements which resulted in the conditions of service and promotion prospects of the staff being brought into line with the rest of the Civil Service. At this time the post of Director-General was changed to Director and that of Director was renamed Assistant to the Director. The rank of District Surveyor was replaced by District Geologist and the grade Assistant Geologist was dropped.

J. J. H. Teall succeeded Geikie in 1901 and instituted a programme of beneficial changes in organisation and policy. He insisted that the field staff return to headquarters in the winter and this resulted in their having more contact with senior officers and colleagues. He introduced colour printing of one-inch maps and caused the resumption of publication of 6-inch maps of selected areas. Numerous draughtsmen were recruited to prepare maps for publication. This freed the geologists from this task and gave them more time to write memoirs. Teall's aim was to publish the map and memoir of an area simultaneously and in some cases this was achieved.

In Scotland Home was made Assistant to the Director as he had been 'acting Director' since 1899 when Howell retired. Under him he had Peach and Gunn as the District Geologists. He encouraged them to tackle the widespread Highland areas still under survey so that maps and memoirs could be

published in an organised manner. Peach retired in 1905 after 43 years service in a career which had taken him into nearly every part of Scotland and brought him world-wide recognition as an outstanding field geologist. By this time Clough and Hinxman were the District Geologists and the Scottish staff had been augmented by E. M. Anderson, E. B. Bailey, R. G. Carruthers, C. B. Cranipton, G. W. Grabham and H. B. Maufe.

Work in the Highlands and the Western Isles continued every summer and no less than 13 memoirs on Highland areas appeared during Home's term of office. A detailed revision of the coalfield areas commenced in 1902. In 1906 the first edition of the memoir on Scottish oil-shales was published, incorporating information gathered by Cade11 although he was no longer on the Survey staff. By 1910 revised maps and detailed memoirs had been published on the Edinburgh and East Lothian districts and the following year the first comprehensive account of the Glasgow area was issued.

Horne retired in 1911, the last serving member of the team which had mapped the south of Scotland and had begun on the Highlands. He was replaced by J. S. Flett as Assistant Director in Scotland. Flett, an Orcadian, had taken medical and natural history degrees at Edinburgh, having studied geology under J. Geikie. He lectured on geology at Edinburgh before joining the Survey as Petrographer in London in 1901. His forceful personality ensured that work in Scotland progressed rapidly and in an orderly fashion. Resignations and retirements had reduced the staff but the deficit was made up by C. H. Dinham, M. Macgregor, J. E. Richey, H. H. Read and G. V. Wilson being recruited between 1909 and 1914.

1914-1918

The First World War called a halt to the normal programme of work. Of the Survey's staff in Scotland, 12 were on active military service, Bailey and Richey being decorated for bravery. Those that remained were engaged on tasks of economic importance. The work on the coalfields was intensified and a widespread search for minerals which were normally imported, was carried out. The Raasay Ironstone which had been discovered by Woodward in 1893 was assessed and as a result was worked by German prisoners of war. The economic importance of the valuable refractory Ayrshire Bauxitic Clay was recognised by Anderson in 1915 and exploitation of the deposit started 2 years later. In addition to numerous small enquiries related to the war effort, major investigations were carried out on projects such as the proposed Mid-Scotland Ship Canal and suitable sites for hydroelectric schemes. All of the staff who served in the armed forces survived and returned to the Survey, but Clough was accidentally killed by a train while working in a railway cutting in 1916.

Between the Wars

The mass of new information which started to accumulate with the pre-war coalfield revision was greatly augmented during the wartime period. The details were published in the new series of Economic Memoirs, the first of which was issued in 1916. Further impetus to the work in the coalfields was given by a wartime committee which once again found the maps of these areas out of date and recommended that the staff should be increased to carry out a satisfactory revision. Recruits to the Scottish field staff in the immediate post-war years were J. K. Allan, D. Haldane, J. Knox, A. G. MacGregor, J. Phemister, G. Ross and J. B. Simpson. W. Q. Kennedy joined later in 1928.

In 1920 Flett was promoted to Director and was replaced by W. Gibson of the English staff. In that year a regional office was opened in Newcastle, providing easier access to their ground for staff working in north-east England. Carruthers was appointed as District Geologist in charge and Dinham was also posted there from Scotland for a few years. This office was administered by the Assistant Director in Scotland until it closed in 1959.

In 1919 Bailey and M. Macgregor were the District Geologists in Scotland, each in charge of a field unit with both Highland and Lowland areas of work. Bailey's unit resumed work in the West Highlands and in the Inner Hebrides and was also involved in a revision of Ayrshire. Macgregor's unit returned to mapping in north-east Scotland and continued to work in the Central Coalfield. This concentration of effort on field work did not last long however, as there was a mounting back-log of work for publication, particularly in the coalfield areas. In 1924 and 1925 field work was confined to the Midland Valley in order to finish sheets which had been partly surveyed during coalfield work.

In 1924 the famous memoir on the Tertiary Igneous Complex of Mull was published, the main contributor being Bailey. The field work had started in 1907 but the extremely complex geology and the war years had delayed the project. Study of the similar complex in Ardnamurchan started in 1920 and the memoir, mainly written by Richey, appeared 10 years later.

M. Macgregor succeeded Gibson as Assistant Director in Scotland in 1925, occupying the post for 20 years. During his career he became the acknowledged expert on Scottish Carboniferous stratigraphy and his Presidential Address to the Geological Society of Glasgow, published in 1930, was a milestone in the investigation of the subject. In 1926 an Act of Parliament gave the Survey powers of access to the logs and specimens of all boreholes and sinkings over 100 feet deep. Information from boreholes etc. had been collected by the Survey since its formation but the new Act made the task a full time job. In Scotland, W. Manson was entrusted to carry it out and he did so with great efficiency until 1960 when he retired. At present the Survey files in Edinburgh contain the details of over 100 000 boreholes sunk in Scotland, the majority of them in the coalfield areas.

Fieldwork in the Highlands was resumed in 1926 in a rather dramatic fashion. In the north, only a small part of Sutherland remained to be surveyed but the area was relatively inaccessible. A blitz policy was adopted by having a hutted encampment erected on the ground in the spring for the accommodation of the staff. Richey directed the work of the geologists involved who were Haldane, Phemister, Read and Ross from the Scottish staff and W. Anderson, L. H. Tonks and G. V. Wilson from England. The mapping was completed by the 1st of August.

The transfer of some staff from England for short summer seasons in the north of Scotland was continued until 1934. Staff involved included S. Buchan, W. Edwards, R. C. B. Jones and J. V. Stephens who helped with the mapping of the Orkneys and Shetlands where work started in 1927. The relatively simple geology of the Orkneys was completed in 3 years and the memoir appeared in 1935. Work was transferred to the Shetlands but the extremely complex geology there and the transfer of some of the staff postponed publication of the results. In 1935 attention was turned to north Skye and work there was still being done in 1939. Scottish staff who took part in surveying these islands included Allan, Haldane, Knox, Phemister and Read directed by Wilson. Work in the West Highlands was also proceeding but fewer staff were involved. Under Richey's direction, Kennedy, A. G. MacGregor and Simpson carried out most of the work.

Between the wars there was a steady flow of published maps, sheet memoirs and economic memoirs dealing with both Highland and Lowland areas. Some of the areas mapped, however, did not feature in the published material. This arose partly from the ever present pressure from official sources to complete the survey of the country. Consequently, new areas were mapped before the previous work had been written up. The other principal reason was the numerous changes in staff caused by transfer, resignation and retirements. Of the 8 experienced geologists in post after the war only M. Macgregor, Richey and Wilson were on the Scottish staff in 1931 and the last named had been in England for 5 of the intervening years. Notable losses were Bailey and Read who had become professors at Glasgow and Liverpool respectively. E. M. Anderson retired on health grounds in 1928 but continued to do most useful indoor work on a part time basis. He is perhaps best remembered for his book on the Dynamics of Faulting. Dinham, V. A. Eyles and T. Robertson served on the

Scottish staff for varying periods before returning to England.

J. G. C. Anderson was recruited in 1937 and T. R. M. Lawrie was transferred from England in 1939.

The long-awaited opening of the new headquarters office and museum in South Kensington took place in 1935. In the new museum, a series of exhibits was set out illustrating the geology of the various regions of the country. Scotland was divided into 5 regions and guides to them were written and published in 1935 or the following year. Scottish staff were involved in the preparation of the exhibits and in 1934 Kennedy, A. G. MacGregor and Phemister were engaged on this task. Phemister, who had taken part in early geophysical work by the Survey between 1926 and 1931, was transferred to London in 1935 to be Chief Petrographer. In 1936 A. G. MacGregor spent 4 months in Montserrat and Martinique, in the West Indies, investigating recent volcanic activity on behalf of the Colonial Office.=== 1939-1945 ===

In 1939 Lowland field work was concentrated to the west of Glasgow, in Fife, the Lothians and the Kelso area while north Skye and the Mallaig district were under survey in the summer season. At the outbreak of war this programme was superseded by one devoted to matters of economic or strategic importance. The staff were placed in a reserved occupation and not allowed to join the armed forces.

Work in the coalfields was intensified and particular attention was paid to areas where coal could be worked by opencast methods. A search for minerals in short supply was carried out and deposits of potash and mica were discovered, assessed and exploited, the latter material being of great importance in aircraft production. There was also an intensive investigation into the resources of baryte, chromite, diatomite, dolomite, peat, limestone, brick clay, sand and gravel, etc. Reports on the reserves of such materials were published in 36 Wartime Pamphlets and in addition 8 reports on the underground water resources of various districts were issued. Enquiries regarding sites for hydroelectric schemes and numerous small matters related to the war effort were also dealt with.=== The post-war years ===

In the period immediately after the Second World War sweeping changes affected the staff in Scotland. M. Macgregor, Richey and Wilson retired, T. H. Whitehead became Assistant Director and A. G. MacGregor and Simpson were promoted to be the District Geologists. Allan resigned to become the Geologist to the newly formed National Coal Board and J. G. C. Anderson and Kennedy left to become professors at Cardiff and Leeds respectively. By 1949 only 4 of the pre-war staff were in post in Scotland and of these Lawrie was seconded to help form a geological survey in Travancore, India.

To bring the staff up to strength, I. H. Forsyth, E. H. Francis, G. S. Johnstone, G. I. Lumsden, W. Mykura, W. A. Read, W. Tulloch, H. S. Walton, H. E. Wilson and J. E. Wright joined the Survey between 1945 and 1950. In 1952 A. G. MacGregor became the Assistant Director and Knox was promoted to District Geologist. To make up for losses by retirements, resignations and transfers some more recruits joined in the 1950s including M. Armstrong, A. Davies, A. L. Harris, M. F. Howells, F. May and D. I. Smith.

The post-war recruits were allocated to units with definite boundaries to work within, the eventual arrangement being of two Lowland units and one covering the Highlands and Islands. In the Lowlands the coalfield revision which started before the war was continued and extended. In the 1950s the National Coal Board sank a large number of deep exploratory boreholes and Survey staff examined most of the cores obtained. A vast amount of new information was acquired which resulted in revised maps and descriptions being published. Also at this time the first boreholes to be commissioned by the Survey in Scotland were drilled. These were put down to provide underground information in critical areas where the succession of rocks was poorly known.

Highland work in the immediate post-war era was mainly concerned with logging the many miles of tunnels excavated during the construction of hydroelectric schemes. The few staff members available also gave advice on the suitability of sites for such projects. In 1950 work on the still unmapped part of the Great Glen area was resumed.

In 1954 Simpson retired and was replaced by G. H. Mitchell as District Geologist of the South Lowlands Unit. In 1957 Lawrie was promoted to District Geologist of the Highlands and Islands district. This brought the number of District Geologists in Edinburgh up to 3, a repetition of the situation which had existed for a few years in the 1920s. In the following year Knox retired and supervision of the North Lowlands district passed to J. R. Earp.

In 1959 Mitchell succeeded MacGregor as Assistant Director and R. A. Eden took charge of the South Lowlands Unit. In 1963 Earp returned to England, Lawrie was transferred to the North Lowlands Unit and Johnstone became the District Geologist for the Highlands and Islands. In recent times, J. A. Robbie was transferred from Northern Ireland in 1967 to become Assistant Director on Mitchell's retirement. Since then, the Assistant Director in

Scotland has been administratively responsible for staff in Northern Ireland.

Robbie retired in 1975 and Eden was promoted to Assistant Director. Lumsden replaced Eden in 1970 when the latter was transferred to Continental Shelf work and E. G. Poole succeeded Lawrie in 1973. All through the 1960s to the present there have been numerous minor changes of staff but the net result has been a gradual increase in numbers of the field staff to meet the ever growing commitments.

In 1965 a major administrative change took place. The Department of Scientific and Industrial Research, which had been the parent body of the Survey since 1919, ceased to exist. The Geological Survey of Great Britain was amalgamated with Overseas Geological Surveys to form the Institute of Geological Sciences under the control of the newly formed Natural Environment Research Council. Since the formation of the IGS the number of staff employed increased rapidly by the formation of units working on many branches of earth science. In 1967 the formal grade of Geologist was dropped in favour of Scientific Officer, the former title having been used since 1840. In 1971, following the recommendation of the Fulton Report, the former Experimental Officer class was incorporated into the Scientific Officer class.

In 1969 a new unit was formally set up in Edinburgh to study the geology of the continental shelf around Scotland. This activity had been initiated by Eden some years previously but the discovery of hydrocarbons under the North Sea lent impetus to the work. The new unit, Continental Shelf II, was composed of Eden as District Geologist with a total staff of 10 appointed to work under him. Subsequently the staff complement has increased considerably. Administratively the unit was originally part of the direct responsibility of the Assistant Director, Scotland but in 1974 it was transferred to the Continental Shelf and Geophysical Division of IGS. Since its inception, the unit has been studying the submarine geology of the area around Scotland by using various sampling and geophysical techniques, and numerous maps and reports have been produced.

From 1960 to the present the field staff in Scotland have continued to pursue their primary commitment of keeping the geological maps of the country up to date and publishing descriptive matter on the geology. In the South Lowlands district, published works include a map and memoir of the Langholm area and new maps and descriptive papers concerning large parts of Ayrshire, the Douglas, Muirkirk and Sanquhar coalfields. Revision mapping of East Lothian and Berwickshire has also been completed. In the North Lowlands area, large parts of Fife, Perthshire, Kinross and the Central Coalfield have been mapped and memoirs and numerous papers have been published. The

Highlands and Islands Unit has continued the primary survey in the Great Glen area but difficulty of access and short field seasons, in addition to other commitments, have hindered progress. The Elgin district was surveyed in 3 years and a descriptive memoir published. The geology of the Shetlands was revised and work on the Outer Hebrides is in progress.

In recent years the time spent by the staff on advisory work, both for the government and public, and in the collation of new information from boreholes and excavations, has increased steadily. Although these activities reduce the time available for normal mapping programmes, the information gained adds appreciably to the accuracy of future maps as has been shown throughout the history of the Survey. Staff members have acted in an advisory capacity on such projects as sites for dams, reservoirs, power stations, underground storage, major sewage schemes, new towns and buildings of all kinds, quarries, tunnels and routes for major roads and pipe lines. Throughout the last 120 years, the demands on the experience and accumulated information of the Geological Survey in Scotland have never been greater than at the present time.== Palaeontology ==

The services of palaeontologists were called upon almost from the start of the Survey in Scotland. In 1858 J. W. Salter, the Palaeontologist in London, visited East Lothian and Fife to study the fossils and help with the correlation of the Carboniferous strata. In the Edinburgh District Memoir of 1861 he contributed a list of Silurian and Carboniferous fossils found in the area. Up to 1871 palaeontological work was based in London and crates of specimens were sent there for identification. In that year R. Etheridge jun. was appointed to deal with such matters in Scotland because A. Geikie had asked for speedier service in this field. Etheridge jun. worked in the Edinburgh office for 7 years during which time he did an amazing amount of work on Silurian and Carboniferous fossils. He supplied lists of fossils for publication in memoirs and described numerous new species in a great many papers. The specimens he studied were collected mainly by J. Bennie and A. Macconochie, the official Fossil Collectors, both of whom made many significant discoveries during their careers. Etheridge jun. resigned in 1878, eventually becoming Director of the Australian Museum.

From 1879 to 1905 Peach carried out the palaeontological duties in Scotland in addition to his many field commitments. He relied on outside specialists for identification work but found time to produce his famous monograph on Carboniferous crustacea. For a short period after Peach's retirement the duties were shared by Crampton and Carruthers, the latter conducting his research on zaphrentid corals at this time. In 1907 G. W. Lee joined the staff as palaeontologist. A zoologist by training, he had been working on specimens collected by the Challenger Expedition. His Survey work dealt with Carboniferous fossils initially, including a monograph on bryozoa. During the First World War he was occupied with the Jurassic rocks of Raasay in connection with the exploitation of the ironstone and wrote a memoir on the subject, published in 1920. Lee died in 1928, aged 48, and was replaced by J. Pringle who served in Scotland until 1935 when he returned to London as Chief Palaeontologist. Pringle's work touched on many fields but was mainly concerned with Carboniferous problems, especially the fauna and flora of the Sanquhar Coalfield. He was succeeded by F. W. Anderson who acted as palaeontologist in Edinburgh until 1953 except for the period of the Second World War when he was in the army. His work in Scotland dealt partly with Carboniferous fossils, especially ostracods, and was also concerned with the Jurassic of Skye. In conjunction with J. C. Dunham he wrote a memoir on Northern Skye. He was posted to London on promotion in 1953 and was replaced the following year by R. B. Wilson on transfer from the field staff in England. Wilson has worked mainly on Carboniferous faunas collected from surface exposures and boreholes. In recent years P. J. Brand has identified the faunas obtained from the Coal Measures and D. K. Graham has determined Quaternary forms from the mainland and the continental shelf. At present the work of the Palaeontological Department staff in Scotland includes providing a service to the field staff related to long term field projects and site investigation enquiries, curating the extensive

collections of Scottish fossils in their care and conducting specialist research.

Petrography

The history of early petrographical research on Scottish rocks by the Survey is obscure. In 1885 it is recorded that transparent thin sections of rocks were sent to London for microscopic investigation and 3 years later sections of English and Irish rocks were being made in Edinburgh. About this time some members of the Scottish field staff began to use petrological microscopes to identify the rocks from their mapping areas. This practice has continued to the present day and over the years many of the field geologists became recognised petrographers.

Major petrographical studies on the rocks of various parts of Scotland were carried out by the Petrographer in London. Significant contributions to Scottish memoirs were made by Teall, Flett and H. H. Thomas, sometimes in conjunction with field geologists. It was not until 1935 that a geologist on the Scottish staff was appointed to supervise petrographical work in Scotland. In that year A. G. MacGregor, who had previously proposed a petrographical classification of the Scottish Carboniferous basalts, was selected for this task. He continued to serve in this role, in addition to his other duties, until he retired in 1959. In the following year R. W. Elliot was transferred from the London office to carry out petrographical duties in Scotland and remains in post, now supported by a staff of four. As well as supplying the field staff with identification of rocks, the work also involves dealing with rock aggregates for potential use as suitable road metal or for use in the production of concrete.== Accommodation ==

From 1854 to 1867 the geologists working in Scotland were based in London but visits there were infrequent. A. Geikie worked for 6 years before visiting headquarters. The staff worked from their various field quarters all the year round but there was a temporary store in Edinburgh for maps and specimens in the Industrial Museum of Scotland. The name of the museum was changed to that of Science and Art in 1864 and, 3 years later, when the Geological Survey of Scotland was formed, its office was in this Museum in Argyle Square. The property was demolished in 1869 to make way for the new museum building and the Survey moved to No. 1 India Buildings, Victoria Street, a building still in existence. This remained the office until 1879 when the staff moved across the George IV Bridge to accommodation in the Sheriff Court Buildings.

Although the bulk of the rock and fossil collections were housed in the Museum of Science and Art, later the Royal Scottish Museum, conditions at Sheriff Court became cramped and a move was made in 1906 to 33 George Square. This was a large house built in 1786 for a merchant of the East India Company and had been the home of Sir Noel Paton, a famous Scottish artist. He had built a studio at the foot of the garden connected to the house by a covered pathway and the general collections of the Survey were housed in the studio.

The influx of recruits after the First World War made conditions at George Square inadequate and some of the staff returned to offices in the Sheriff Court Buildings, the site of which is now occupied by the Scottish National Library. The George Square building was owned by the university which terminated the lease in order to use the property for a student hostel. The building was demolished during the recent reconstruction of George Square by the University. In 1928 the staff from George Square and Sheriff Court moved to Southpark, 19 Grange Terrace, a large Victorian mansion in the southern suburbs of the city. Two large storage annexes for housing the collections were added by 1931 thus releasing space so that the library could be arranged in an orderly fashion. Pressure on office space caused by post-Second World War recruitment and expansion of the collection led to further building on the site in 1954-55. A new rock-store, drawing office, photographic department and some offices were added.

In the early 1960s office and storage accommodation was again causing concern and in the summer of 1964 DSIR authorised the building of a new office for the Edinburgh staff. The following year NERC, the new parent body, accepted this inherited undertaking and began a search for a suitable location. In 1967 an agreement was reached between the Director, K. C. Dunham, and the University of Edinburgh that a part of the north-west corner of the University's King's Buildings site be leased to IGS.

About this time the Geomagnetism Unit and the Global Seismology Unit were incorporated into NERC and became component parts of IGS. The former unit was formed by staff engaged on geomagnetism work at Herstmonceux and Hartland Point, administered by the Royal Greenwich Observatory, and in Edinburgh, Eskdalemuir and Lerwick, administered by the Meteorological Office. Staff of the Global Seismology Unit had previously been working at Edinburgh and Eskdalemuir, under the control of the Meteorological Office, and at the Royal Observatory, Edinburgh. Staff of both units had office accommodation at 6 South Oswald Road in Edinburgh.

The plans for the new building had to provide for these units and also for the Continental Shelf Unit which occupied a building in the Government Training Centre at Granton from 1969. In 1968 it was planned that field staff working in the north of England would be based in the new Scottish headquarters but later, the space originally allocated to them was given to the Marine Geophysics Unit. This unit was formed in 1968 and moved from London to temporary quarters in Edinburgh in 1973, at first at 13 Braefoot Terrace and later overflowing to accommodation at 9 South St David's Street. At a later stage in the planning, accommodation was also provided for that part of the Computer Unit which moved in 1974 from London to temporary accommodation in Edinburgh at the Edinburgh Regional Computing Centre and at King's Buildings. In addition, rooms had to be provided for staff of the Mineral Assessment Unit which started work in Scotland in 1974.

Increased office accommodation was provided at Grange Terrace in 1968 by converting part of the rock store into three rooms and later, staff were housed in temporary mobile offices in the grounds. Meanwhile plans for the new building were being prepared and in 1970 working drawings were almost complete. The Treasury gave permission in 1971 for work to commence and the building operation started in the autumn. For varying reasons the construction took longer than anticipated but the new building, named Murchison House in 1972, was almost finished in 1975. In the autumn of that year, staff of the Marine Geophysics Unit moved into the top level and they were followed by staff from South Oswald Road later in the year. Those working at Grange Terrace and Granton, however, did not move to Murchison House until 1976, when the Grange Terrace premises were made available for staff primarily engaged on projects related to hydrocarbon geology.== Sources ==

The information from which this history has been compiled was drawn mainly from the published works and office records of the Survey and the two books, 'The First Hundred Years of the Geological Survey of Great Britain' by J. S. Flett (1937) and 'The Geological Survey of Great Britain' by E. B. Bailey (1952). The author is grateful to many of his Survey colleagues for information and help received.

Directors of the Geological Survey of Great Britain

| | |
|-----------|-----------------------|
| 1835-1855 | Sir H. T. De la Beche |
| 1855-1871 | Sir R. I. Murchison |
| 1871-1881 | Sir A. C. Ramsay |
| 1882-1901 | Sir A. Geikie |
| 1901-1914 | Sir J. J. H. Teall |
| 1914-1920 | Sir A. Strahan |

| | |
|-----------|------------------------|
| 1920-1935 | Sir J. S. Flett |
| 1935-1936 | Dr B. Smith |
| 1937-1945 | Sir E. B. Bailey |
| 1945-1950 | Dr W. F. P. McLintock |
| 1950-1960 | Sir W. J. Pugh |
| 1960-1967 | Sir C. J. Stubblefield |
| 1967-1975 | Sir K. C. Dunham |
| 1976- | Dr A. W. Woodland |

Assistant Directors of the Geological Survey in Scotland

| | |
|-----------|--------------------|
| 1867-1882 | Sir A. Geikie |
| 1882-1899 | H. H. Howell |
| 1901-1911 | Dr J. Horne |
| 1911-1920 | Sir J. S. Flett |
| 1920-1925 | Dr W. Gibson |
| 1925-1945 | Dr M. Macgregor |
| 1945-1952 | T. H. Whitehead |
| 1952-1959 | Dr A. G. MacGregor |
| 1959-1967 | Dr G. H. Mitchell |
| 1967-1975 | J. A. Robbie |
| 1975- | R. A. Eden |

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