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### On the achievements of Scotsmen during the nineteenth century in the fields of geographical exploration and research

Arthur Silva White F.R.S.E. <sup>a</sup>

<sup>a</sup> Secretary to the Royal Scottish Geographical Society ,

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they go, they clearly show that (as might have been expected) the effects are greater on the small bulk of water in the estuaries than on the greater bulk out at sea. They also show that during the period from May to September inclusive, the general effect of the heat of the day is greater than that of the cold of night, which of course agrees with the permanent rise of temperature during that period.

Estuaries differ from the more open sea in many very important particulars besides temperature; but, at the same time, it appears to me that the facts I have described suffice to explain some characteristic peculiarities in the local distribution of marine animals and plants which cannot be explained by the variation in the amount of salts in solution, or by difference in exposure to the action of the waves.

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## ON THE ACHIEVEMENTS OF SCOTSMEN DURING THE NINETEENTH CENTURY IN THE FIELDS OF GEOGRAPHICAL EXPLORATION AND RESEARCH.

A REPORT TO THE PARIS GEOGRAPHICAL INTERNATIONAL CONGRESS OF 1889.

BY ARTHUR SILVA WHITE, F.R.S.E.,

*Secretary to the Royal Scottish Geographical Society.*

(Conclusion.)

### EUROPE AND GENERAL.

HAVING briefly reviewed, under convenient geographical divisions, the achievements of Scotsmen in the various parts of the world, excepting Europe, I shall conclude by grouping under the above heading what remains to be chronicled. In the brief time allowed for the preparation of this Report, it is not in my power to notice adequately the leading contributions of Scotsmen to the progress that has been made during the present century in our geographical knowledge of the British Isles, or of the Empire as a whole; far less am I able to enter on the fruitful field of geographical progress in Europe or into the various departments of literary research. In some respects it is almost impossible to separate the work of Scotsmen from that of others in the same fields, or, even, to eliminate their work at home from their work relating to foreign countries. Within more restricted limits, therefore, I shall endeavour to record some of the most notable geographical achievements of Scotsmen in Europe, especially in Scotland, which may most conveniently be grouped under the one general heading.

One of the first names that occurs to one is that of SIR RODERICK MURCHISON (1792-1871), whose eminence as a geologist was world-wide, and whose interest in geography, especially in the latter part of his career, was fruitful in good results. He wrote his first geological

paper in 1825, and more than one hundred papers afterwards. His travels were extensive; he personally examined the geology of not only every district in Great Britain, but of almost every country in Europe, and of some parts of Asia. His most important works are *The Silurian System* (1839); *The Geology of Russia and the Ural Mountains* (1845); and *Siluria* (1854). He defined the Silurian System and the Permian System, and established the fact of a graduated transition from secondary to tertiary rocks in the south-east Alps, etc.; he was the first to recognise that the gneissic rocks of the north-west Highlands of Scotland are the oldest in Britain; and he inferred the presence of auriferous deposits in Australia long before their discovery by Count Strzelecki was announced. Murchison was pre-eminent for the skill with which he could read the geological structure of a country. He also paid great attention to Australian geography, but his name is chiefly associated with Arctic and African discovery, in the cause of which he rendered many valuable services. He was mainly instrumental in founding, in 1830, the Royal Geographical Society of London; his anniversary addresses and loyal labours as President of that body were of a highly important character. He, moreover, founded the Chair of Geology in the University of Edinburgh. JOHN PLAYFAIR (1748-1819) was a disciple of Dr. James Hutton,<sup>1</sup> author of the celebrated *Theory of the Earth*, which may be said to have laid the foundation of the modern system of Physical Geology. Playfair's well-known *Illustrations of the Huttonian Theory* (1822) not only gave a great impetus to the pursuit of physical geology, but is still studied and cited as a standard authority on denudation and the origin of the surface-features of the land. He was the first to discuss the glacial origin of the large erratics from the Alps which are scattered over the Jura, and thus anticipated the later generalisations of Charpentier and Agassiz. One of Playfair's associates was SIR JAMES HALL (1761-1832), who aided in the promulgation of Hutton's views as to denudation and earth-sculpture, but who is best known as the founder of Experimental Geology, in which branch of inquiry MM. Delesse and Daubr e are now the greatest authorities. In 1826 DR. JOHN MACCULLOCH (1773-1835) was commissioned by Government to prepare a geological map of Scotland, which was not published till after his death. This map was the first that had any pretensions to general accuracy, and, as the work of one man, is a notable production. In his *Description of the Western Islands of Scotland* (1819) he sketched very clearly the general physical features of regions which at that time were imperfectly known. SIR CHARLES LYELL (1797-1875) was the author of many papers and works on various branches of geology; but I mention only his great *Principles of Geology* (1830), the leading ideas of which had already been promulgated by Hutton and Playfair. Lyell, however, may be said to have popularised them for the first time, and the publication of his *Principles of Geology* doubtless marks an epoch in the progress of the science. DR. HUGH FALCONER (1808-1865) deserves mention, as well for his many contri-

<sup>1</sup> Hutton was also a Scotsman, but his decease in 1797 places him outside the limits of this Report.

butions to our knowledge of the flora of India, to which I have already referred, as for his palæontological discoveries and researches in that country and in Europe. Principal JAMES DAVID FORBES (1809-1868) the well-known physicist, contributed also largely to physical geology, his researches on glaciers and glacial motion being well known. He seems to have been the first to recognise and depict upon a map the true plateau-character of the Scandinavian uplands. Professor JAMES NICOL likewise deserves mention, as being the author of the first general *Guide to the Geology of Scotland* (1844). SIR ANDREW CROMBIE RAMSAY, late Director-General of the Geological Survey of Great Britain and Ireland, is the author of numerous works dealing principally with physical geology. He is an advanced supporter of the views advocated by Hutton and Playfair as to the sculpturing of the earth's surface by epigene agents of change, and it is owing largely to his influence that these views are so generally adopted by geologists. One of his most remarkable papers is that which attributes the origin of many rock-basins—such as the lake-basins of the Alps, Scotland, etc.—to glacial erosion. His most popular work is the *Physical Geology and Geography of Great Britain* (1863). The geological publications of HUGH MILLER were many and valuable. His brilliant powers of description, as exemplified in his treatise on the *Old Red Sandstone*, and in other works, went far to bring Geology into prominence in Scotland, and to popularise its study as a science. The DUKE OF ARGYLL has devoted much attention to the Geology of Scotland. From his observations he has been led to differ from other authorities as to the origin of the scenery of Scotland, and maintains his theory of the Geological Geography of Scotland by reference to the configuration of the Western Highlands. CHARLES MACLAREN, the journalist, known chiefly from the fact of his having written an account of the geology of Fife and the Lothians (1838), wrote one of the best accounts of the site of Troy in the *Plain of Troy Described* (1863).

Of writers who in the first half of the century did much to elucidate the geology of their native land—many of them having contributed elaborate monographs on special districts of Scotland—mention may be made of the following:—THOMAS ALLAN, the author of many papers treating of the geognosy of Scotland, described the rocks of the Farøe Islands. GEORGE ANDERSON was the author of papers on the descriptive geology of various parts of Scotland. The REV. JOHN ANDERSON, palæontologist and geologist, confined his labours chiefly to Scotland. ROBERT BALD, physicist and geologist, was the author of admirable accounts of the Scottish coal-fields. DR. GEORGE BUIST, physicist, geologist, and geographer, the author of many papers dealing with the geology and physical geography of India, Egypt, the Red Sea, etc., wrote an excellent essay on the geology of a part of Perthshire. PETER CHALMERS was the author of an account of the coal-fields of Dunfermline. ROBERT CHAMBERS, author of the well-known *Vestiges of Creation*, wrote much also on the geology of the superficial formations of Scotland, Norway, Farøe Islands, etc. JOHN CRAIG, geologist, described some of the coal-bearing tracts of Western Scotland. R. J. HAY CUNNINGHAM

was the author of several admirable monographs on the physical geology of various counties of Scotland. The REV. J. FLEMING, naturalist, the author of works on zoology and botany, wrote many papers dealing with the descriptive geology of Scotland. LORD GREENOCK also wrote some papers on descriptive geology. SAMUEL HIBBERT, who contributed papers on physical geology and palæontology, was the author of a work on the Shetland Islands, and of a *History of the Extinct Volcanoes of the Lower Rhine*, etc. J. IMRIE wrote papers on the geology of Scotland, and on the geology of Gibraltar. PROFESSOR ROBERT JAMESON, the author of papers and general treatises dealing with mineralogy and zoology, wrote also numerous papers on the geognosy of various parts of Scotland. DAVID LANDALE was the author of various reports on the Scottish coal-fields. SIR G. STEWART MACKENZIE was the author of a work on Iceland, and papers on the geology of the Farøe Islands, the physical geology of some districts of Scotland, and other subjects. THOMAS MACKNIGHT wrote papers on the petrology and physical geology of various districts in Scotland. JOHN MARTIN was the author of a good description of the geology of Morayshire. DAVID MILNE-HOME has written papers on descriptive geology, amongst which his account of the coal-fields of Mid-Lothian and East-Lothian is the most important. He was instrumental in getting complete reports of the distribution of erratic boulders in Scotland. WILLIAM MONTGOMERY was the author of an account of the geology of Renfrewshire and North Ayrshire. WILLIAM RHIND was the author of a geological map of Scotland, and a general treatise on geology. WILLIAM STEVENSON wrote papers on the geology of the south-east of Scotland. All the preceding began to write early in the century, and only one or two survive.

Of authors who have dealt with descriptive geology in the latter half of the century, it is hardly necessary to give a list. The work of most has been strictly specialised, and seldom travels beyond the limits of geological science and physical geography. Indeed, so large a part of Scotland has been mapped by the Government Ordnance and Geological Surveys that observers now restrict themselves very much to the study of local details. Of those who have been engaged on the Geological Survey of Scotland, most have been Scotsmen, and some of them have obtained a world-wide reputation. By far the best known are the first two names I have to mention. DR. ARCHIBALD GEIKIE, who succeeded Sir A. C. Ramsay as Director-General of the Geological Surveys of the United Kingdom, is esteemed not only as a diligent worker in geology, but also as a writer on geographical subjects. His most important geological papers are those dealing with the volcanic and Palæozoic rocks of his native land. An earnest disciple of Hutton and Playfair, he has also largely contributed to our knowledge of the origin of the surface-features of the land, his views being set forth particularly in his charming work on the *Scenery and Geology of Scotland* (1865 and 1889). They are likewise treated of in his elaborate *Text-book of Geology* (1882), and in many papers and essays in various journals and reviews. He is editor of a new series of geographical works which are now being issued by Messrs. Macmillan—a series to which he contributed a general introductory volume

and a short *Geography of the British Isles*. His brother, PROFESSOR JAMES GEIKIE is known as an enthusiastic and eminent geologist, and a sound geographer, and has taken pains to point out the bearing of geology on geographical science—a bearing which, although fully recognised abroad, is almost ignored in this country. On this subject he has contributed several valuable papers to the *Scottish Geographical Magazine*, of which he is the Honorary Editor. In addition to the maps and memoirs prepared by him for the Geological Survey, he has written many papers on physical and descriptive geology, the more important of which treat of Palæozoic and glacial geology. His chief works are the *Great Ice Age and its relation to the Antiquity of Man* (1873 ; 1877)—a work in which he was the first to maintain that Palæolithic man was of glacial and interglacial age, and did not reappear in Europe after glacial conditions had passed away : and *Prehistoric Europe* (1881), which gives a somewhat detailed sketch of the geographical and climatic changes<sup>1</sup> that characterised our continent in Pleistocene, Postglacial, and recent times.

Other Scottish members of the Geological Survey who may be specially mentioned are Messrs. BENJAMIN N. PEACH and J. HORNE, who have written in conjunction some admirable papers on descriptive geology, and who have likewise been united in working out the geological structure of the north-west Highlands,—perhaps one of the most complicated regions in the world, and the final unravelling of which forms an epoch in the geological investigation of our Islands. Another prominent name in connection with the same Survey is that of JAMES CROLL, author of *Climate and Time* (1875), *Climate and Cosmology* (1885), *Stellar Evolution* (1889), etc., and many papers dealing with physics and physical geology. His views on the changes of climate, of which geology affords so much evidence, are so well known that I need only refer to them here. MR. H. M. CADELL has recently thrown some light on the origin of mountains by his experiments on the crumpling of strata of dissimilar rocks. It would be impossible to cite the names of all Scottish geologists who have enriched science with their contributions during the latter half of the century ; but I must not omit to mention PROFESSOR LAPWORTH, whose labours among the older rocks of Scotland have been most important. He shares with Messrs. Peach and Horne the credit of unravelling the complicated structure of the north-west Highlands.

Of Scottish physicists and chemists,<sup>2</sup> the following may be mentioned in connection with the subject of this Report. SIR JOHN LESLIE (1766-1832) was distinguished for his investigation of the Principles of Radiant Heat, the results of which were published in his *Experimental Inquiry into the Nature of Heat*. He was the inventor of the differential thermometer, a hygrometer, etc., and author of the famous experiment of freezing water

<sup>1</sup> See also "The Geographical Evolution of Europe," *Scot. Geog. Mag.*, vol. ii. p. 193, *et seq.*

<sup>2</sup> I am indebted for some of the records of Scottish physicists and naturalists to *Viri Illustres*, the useful little handbook published at the time of the Tercentenary Meeting of the University of Edinburgh.

by the cold resulting from its own evaporation. SIR DAVID BREWSTER (1781-1868), whose experimental researches in physical optics were so important in their results to science, made some inventions, and numerous improvements, in optical apparatus. JAMES CLERK MAXWELL (1831-1879) was distinguished for his mathematical treatment of physical problems. He contributed several valuable memoirs, and greater works on Heat, Electricity, and Magnetism. His work on *Electricity and Magnetism* (1873) is said to be "one of the most splendid monuments ever raised by the genius of a single individual." His *Theory of Heat* was published in 1871, and *Matter and Motion* in 1877. PROFESSOR P. G. TAIT, equally eminent as a physicist and author of numerous treatises and text-books on mathematical and physical subjects, has made a thorough investigation of the influence of pressure at great depths in the sea on the density of sea-water and on the readings of thermometers. He is the joint author with Dr. Buchan of the comprehensive Report, elsewhere alluded to, on Oceanic Circulation, which is shortly to be published in the *Challenger Reports*.

Of Scottish naturalists, whose contributions to geography were considerable, the name of ROBERT BROWN (1773-1858), whom Humboldt designated *facile princeps botanicorum*, already occurs under "Australasia." EDWARD FORBES (1815-1854) investigated the fauna and flora of Algiers, Styria, the Ægean Sea, Lycea, and other regions visited by him, and was the first to investigate systematically the bathymetrical range of marine organisms, being one of the earliest students of distribution. HENRY GOODSIR had made discoveries of some importance on Franklin's ill-fated expedition before perishing with his gallant leader. SIR CHARLES WYVILLE THOMSON (1830-1882) was specially identified with that series of investigations of the fauna of the deep sea which culminated in the voyage of the *Challenger* (1872-76), of which expedition he was Scientific Director. He discovered many new forms of animal life during this and previous expeditions. His *Depths of the Sea* (1873) contains an account of the cruises of the *Lightning* and the *Porcupine*. He was engaged up till his death in editing the *Scientific Results* of the voyage of the *Challenger*, to which he was also a literary contributor. DR. JOHN MURRAY accompanied as naturalist H.M.S. *Challenger* on her famous scientific expedition, during which he closely studied the physical conditions of the oceans and their deposits. He specially directed his attention to coral reefs, and the result of his observations led him to believe that Darwin's theory of subsidence could not sufficiently account for all the phenomena presented in connection with those vast concretions. On the return home of the *Challenger*, Dr. Murray continued on the staff, and on the death of Sir Wyville Thomson was appointed Director of the Commission. His theory regarding the origin and structure of coral reefs was formulated in a paper read before the Royal Society of Edinburgh (Session 1879-80), but it did not at first command the attention it deserved. More recently, however, it has been supported by a mass of evidence from independent observers, and has been adopted by a large number of geologists and physicists. To Dr. Murray is mainly due the great and increasing interest taken in the science of

oceanography; and his forthcoming report on the deep-sea deposits collected by the *Challenger* and other surveying vessels will be of the highest interest. The important papers published by him in the *Scottish Geographical Magazine*<sup>1</sup> have commanded universal attention. He established and equipped the Scottish Marine Station at Granton, with a branch on the Clyde, for scientific research, his own work in connection with which has resulted in several discoveries relating to the geographical distribution of marine animals; and he took a leading part in the foundation of Ben Nevis Observatory. He was the first to determine the true properties of *Bathypbius*. MR. J. A. HARVIE-BROWN was, together with Mr. John Cordeaux, the first to institute systematic investigations into the migratory movements of birds as observed on the British coasts. This work was afterwards taken up by the British Association; nine Annual Reports were issued, to which Mr. Harvie-Brown contributed the statistics for the Scottish coasts. He is, however, best known for his work in connection with the detailed and systematic investigation of the vertebrate fauna of Scotland, to which he has latterly devoted himself. In collaboration with Mr. Buckley, he has published *The Vertebrate Fauna of Sutherland, Caithness and Cromarty* (1887), *The Vertebrate Fauna of the Outer Hebrides* (1889), Papers in *The Ibis* on the European avifauna, and a volume on the *Capercaillie in Scotland*, wherein the old records of the bird, both as an indigenous species, and as an introduction, after its extinction, are exhaustively treated. PROFESSOR COSSAR EWART, in connection with the Fishery Board of Scotland, has done much to elucidate the distribution of marine animals, especially of food-fishes. W. MACGILLIVRAY (*d.* 1852) was the author of *History of British Birds* (1836); GEORGE JOHNSTONE (*d.* 1855) wrote a *History of British Zoophytes* (1838); SIR WILLIAM JARDINE (*d.* 1874), the ornithologist, was the editor of *Naturalist's Library*; HEWETT COTRELL WATSON was a geographical botanist of merit.

Of Scottish meteorologists, the name of DR. ALEXANDER BUCHAN, whom the Americans style "the father of Meteorology," stands out in remarkable and deserving prominence. Dr. Buchan's work comprises very many important contributions to the meteorology of Scotland from 1860 down to the present time, and very many valuable original contributions to general meteorology. Among the latter may be mentioned the construction for the first time of maps of the isobars and prevailing winds of the globe; rainfall of the British Isles; the weather and health of London; the horary range of the barometer over the globe; the discussion of the meteorological observations on board H.M.S. *Challenger*, in which he was assisted by MR. H. N. DICKSON, and which includes a revision of the isobars and prevailing winds

<sup>1</sup> *Drainage Areas of the Continents, and their Relation to Oceanic Deposits* (vol. ii.); *The Exploration of the Antarctic Regions* (vol. ii.); *On some recent deep-sea Observations in the Indian Ocean* (vol. iii.); *On the total Annual Rainfall on the Land of the Globe, and the Relation of Rainfall to the Discharge of Rivers* (vol. iii.); *On the Height of the Land and Depth of the Ocean* (vol. iv.); *On the Effects of Winds on the Distribution of Temperature in the Seas and Fresh-water Lochs of the West Coast of Scotland* (vol. iv.) and *On Marine Deposits in the Indian, Southern, and Antarctic Oceans* (vol. v.).

of the globe up to date; new isothermals for the globe for each month; and many other important contributions to meteorology. His *Handy Book of Meteorology* (1867) is a standard work. The important article *Meteorology* which he contributed to the *Encyclopædia Britannica* is worthy of special mention. Of other notable contributions to meteorology by Scotsmen the following may be mentioned:—(1) on the mean temperatures of the globe and mean hourly temperatures at Leith, Inverness and Kingussie; isothermals of the north-west of America; and polarisation of the atmosphere, by SIR DAVID BREWSTER; (2) report on progress of meteorology, climate of Edinburgh, temperatures of hot springs, earth-temperatures at Edinburgh, the climate of Palestine, etc., by PRINCIPAL J. D. FORBES; (3) on the barometric gradient by MR. THOMAS STEVENSON; (4) on weather and health, Scottish prognostics, and ozone observations, by SIR ARTHUR MITCHELL; and on weather and clouds, by MR. RALPH ABERCROMBY. The self-denying perseverance of MR. R. T. OMOND in personally superintending the Meteorological Observations of the Ben Nevis Observatory, the only high-level station in the British Isles, has resulted in some noteworthy additions to our knowledge of the higher regions of the atmosphere.

Of Scottish geographers and cartographers, the most eminent has been DR. KEITH JOHNSTON (1804-1872). He merits the distinction of having done more than any previous writer to popularise the study of Geography; and he practically introduced the study of physical geography. His masterpiece was *The Physical Atlas of Natural Phenomena* (1848), which for so long was the basis of the whole English literature on this subject. His first large work was the *National Atlas*, the best at its time; his *Dictionary of Geography* (1850) was an original work; and his *Royal Atlas of Modern Geography* (1861), commenced in 1855, is still (1889) the best British Atlas published. Some of his other publications I have noted elsewhere. MR. JOHN BARTHOLOMEW is also well known as one of the most active cartographers of the present time. In addition to the preparation of numerous atlases and miscellaneous maps, he has done much towards the improvement of topographical maps, by introducing orographical contour colouring. I understand it can be shown by statistics that Edinburgh produces more maps than any other city in the world, the firms of MESSRS. JOHNSTON and BARTHOLOMEW being the largest map-producers of the present time.

The work of other Scotsmen, among the many whose pursuits or whose interests have led to notable contributions to the geographical progress of the century, may be briefly, though imperfectly, recorded here. SIR ROBERT CHRISTISON made contributions to the subject of the determination of the different chemical qualities of our lakes and rivers. SIR JAMES CLARK ROSS, whose achievements have been noted elsewhere, was employed by the Admiralty (about 1836) in the Magnetic Survey of Great Britain and Ireland. The EARL OF CRAWFORD AND BALCARRES is a distinguished astronomer; his work in the Transit of Venus Expedition (1878) was important; he recently presented to the city of Edinburgh the instruments of his observatory at Dunecht, one of the most thoroughly equipped of private observatories, and known extensively

from the Dunecht circulars of comets. MR. J. Y. BUCHANAN, chemist and physicist to the *Challenger* Expedition, has made interesting investigations in Ocean Circulation. His subsequent researches on the nature of the slope separating continents and oceans brought many new facts to light regarding the existence of submarine mountains and river cañons. DR. HUGH ROBERT MILL, whose temperature and other observations on Scottish rivers and lakes have been of value, has more recently become an exponent of Commercial Geography. MR. HUGH A. WEBSTER has contributed important geographical articles to the last edition of the *Encyclopædia Britannica*, and was for some time the Honorary Editor of the *Scottish Geographical Magazine*.

The Royal Scottish Geographical Society was founded in Edinburgh in 1884 through the initiative of MR. J. G. BARTHOLOMEW, MR. and MRS. A. L. BRUCE and MR. HUGH A. WEBSTER. With branches in Glasgow, Dundee, and Aberdeen, and a membership (July 1889), numbering 1165, it is the national Geographical Society of Scotland. A new force has thus been introduced into Scotland for the public discussion of geographical questions, and for the promotion of geographical education, exploration and research. Through the medium of its journal, the *Scottish Geographical Magazine*, published monthly, the Society has consistently endeavoured to treat, from the geographical standpoint, some of the international questions of the day; but its special functions have been to deal with the scientific application of geography, in its practical as well as technical aspects, to popularise its study, and to provide a more or less comprehensive record of geographical progress. What little the Society has as yet been able to do for the promotion of geographical exploration, is recorded elsewhere in this report; its Education Scheme, though modest, has already been productive of good results.

#### BIBLIOGRAPHY: EUROPE AND GENERAL.

In the foregoing, I have already referred to, and sufficiently commented on, the following works:—SIR RODERICK MURCHISON'S *The Silurian System* (1839), *The Geology of Russia and the Ural Mountains* (1845), and *Siluria* (1854); JOHN PLAYFAIR'S *Illustrations of the Huttonian Theory* (1822); DR. MACCULLOCH'S *Description of the Western Islands of Scotland* (1819); SIR CHARLES LYELL'S *Principles of Geology* (1830); JAMES NICOL'S *Guide to the Geology of Scotland* (1844); SIR ANDREW RAMSAY'S *Physical Geology and Geography of Great Britain* (1863); HUGH MILLER'S *Old Red Sandstone*; CHARLES MACLAREN'S *Plain of Troy described* (1863); ROBERT CHAMBERS'S *Vestiges of Creation*; SAMUEL HIBBERT'S *History of the Extinct Volcanoes of the Lower Rhine*; DR. ARCHIBALD GEIKIE'S *Scenery and Geology of Scotland* (1865), *Text-book of Geology* (1882), *Geography of the British Isles* (1889), etc.; PROFESSOR JAMES GEIKIE'S *Great Ice Age and its Relation to the Antiquity of Man* (1873), and *Prehistoric Europe* (1881); JAMES CROLL'S *Climate and Time* (1875), *Climate and Cosmology* (1885), and *Stellar Evolution* (1889); SIR JOHN LESLIE'S *Experimental Inquiry into the Nature of Heat*; JAMES CLERK MAXWELL'S *Electricity and Magnetism* (1873), *Theory of Heat*

(1871), and *Matter and Motion* (1877); SIR C. WYVILLE THOMSON'S *Depths of the Sea* (1873); HARVIE-BROWN'S *Vertebrate Fauna of Sutherland, Caithness, and Cromarty* (1887), *Vertebrate Fauna of the Outer Hebrides* (1889), and *Capercaillie in Scotland*; MAGILLIVRAY'S *History of British Birds* (1836); GEORGE JOHNSTONE'S *History of British Zoophytes* (1838); SIR WILLIAM JARDINE'S *Naturalist's Library*; DR. BUCHAN'S *Handy Book of Meteorology* (1867); KEITH JOHNSTON'S *Physical Atlas* (1848), *National Atlas, Dictionary of Geography* (1850), and *Royal Atlas* (1861).

To attempt anything like a comprehensive bibliography under this section of my Report would be out of the question; but the following additions may be made:—

The old *Statistical Account of Scotland* (21 vols.; 1791-9), which was first planned and subsequently edited by SIR JOHN SINCLAIR from the accounts by the ministers of the respective parishes, saw a new edition in 1845 (15 vols.), which fell short of the excellence of its original. A short but good *Geographical and Statistical Description of Scotland* (1819) was published by JAMES PLAYFAIR. JOHN R. MACCULLOCH was the author of a standard work entitled *A Statistical Account of the British Empire*, which went through four editions between 1837 and 1854. The *Physical Geology and Geography of Great Britain*, by A. C. RAMSAY, another successful work, went through five editions between 1863 and 1878. MRS. MARY SOMERVILLE wrote the first scientific *Physical Geography* in the English language. Of archaeological works, *The Archaeology and Prehistoric Annals of Scotland* (1851) by DANIEL WILSON, *The Early Races of Scotland and their Monuments* (1866) by FORBES LESLIE, and *Arthurian Localities* (1869), with a map of Arthurian Scotland, by J. S. S. GLENNIE, are all books of geographical interest and importance. The *Beauties of Scotland* (1805-8) by ROBERT FORSYTH, *Caledonia* (1807-24) by G. CHALMERS, *The Pictures of Scotland* (1827) by ROBERT CHAMBERS, are works of value to the geographer. Notes on, and lists of, the *Fauna and Flora of the West of Scotland*, and notices of some of the principal manufactures of the same district, were published in Glasgow for the 1876 Meeting of the British Association. MR. GEORGE G. CHISHOLM has published, besides his geographical text-books, *The Two Hemispheres* (1881), which was enlarged and republished under the title *The World as it is* (1883-4). MR. J. SCOTT KELTIE, the editor of *The Statesman's Year-Book*, carried out an extensive inquiry for the Royal Geographical Society of London into the teaching of geography, upon which he reported, and which led to important results.

*The Book of British Topography* (1881), by J. P. ANDERSON, a classified catalogue of the topographical works in the British Museum, was the first attempt at a complete catalogue as regards Scotland; it contains all, I presume, of the county guides and books, to which no reference can be made here.

Some admirable gazetteers have been published in Scotland. The *Ordnance Gazetteer of Scotland* (1885), by FRANCIS H. GROOME, and the *Gazetteer of the British Isles* (1887), by JOHN BARTHOLOMEW, the most recent publications, are quite the best of their kind. I may also mention

*The Imperial Gazetteer of Scotland* (1854-7), by REV. J. M. WILSON; *The Gazetteer of England* (1836-37), by JAMES BELL; *Chambers's Gazetteer of Scotland* (1832); and the *Imperial Gazetteer* (1855), by DR. W. G. BLACKIE, who has also made other notable contributions to Geography, such as the *Imperial Atlas* (1855) and the *Comprehensive Atlas and Geography* (1880).

The standard encyclopædias, which are so valuable as books of geographical reference, are all of Scottish origin. The most famous, the *Encyclopædia Britannica*, was in the ninth and last edition edited by Professor Spencer Baynes and DR. ROBERTSON SMITH. Then we have the more popular, but in its current edition equally useful, *Chambers's Encyclopædia*, edited by MR. DAVID PATRICK. The *Encyclopædia Metropolitana*, first published in London, was subsequently obtained by a firm in Glasgow; the *Globe Encyclopædia* and the *Popular Encyclopædia* complete the list.

Some of the leading geographical text-books have been published by Scotsmen. Of these may be mentioned the works of PROFESSORS ARCHIBALD GEIKIE, MEIKLEJOHN, and JOHN CLELAND; DRs. JAMES CLYDE, ALEXANDER STEWART, A. REID, A. MACKAY, and HUGH R. MILL; and MESSRS. ROBERT ANDERSON, KEITH JOHNSTON, junior; THOMAS EWING, and GEORGE G. CHISHOLM.

IN CONCLUSION, I cordially thank those of my correspondents who have been good enough to revise the proof-sheets of certain sections of this Report.

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## REPORT TO COUNCIL ON THE BRITISH ASSOCIATION MEETING AT NEWCASTLE, 1889.

BY HUGH ROBERT MILL, D.Sc., F.R.S.E., *Delegate*.

THE meeting of the British Association at Newcastle was successful so far, that many fairly popular papers were read in comfortable rooms, and the inhabitants were extremely hospitable. The attendance of members was not large, nor was much original scientific work communicated.

Signs of approaching change in the Association appeared in the unprecedented action of the General Committee refusing to ratify an appointment by the Council. The opportunity of reform thus presented is one which should not be allowed to pass without a reconsideration of the objects of the Association, and the means by which these can best be carried out at the present time. It is questionable whether science is perceptibly advanced by the annual meetings conducted as at present. The local literature evoked by the gathering was of the usual kind. The *Handbook of Industries* edited by Mr. Wigham Richardson is the best which has been compiled for the Association for many years. It comprises thirty articles by specialists describing the leading industries of Tyneside, with historical notes and statistics. A series of good agricultural, railway, and district maps completes an excellent epitome of the commercial geography of the Great Northern Coal Field of England.