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THE SCOTTISH SCHOOL OF GEOLOGY[1]

By Professor **FRANK D. ADAMS**

McGILL UNIVERSITY

THE celebration of the centenary of the Geological Society of Edinburgh must indeed be an occasion of very especial pleasure for any one who takes an interest in the development of the science of geology. For it was in this city that what has been called the Scottish School of Geology took its rise and for a brief half century, A. D. 1780 to A. D. 1825, made the city of Edinburgh one of the greatest centers of geological learning of the time.

Here it was that Hutton, who may fairly be called one of the founders of modern geology (A. D. 1726–A. D. 1797) was born, lived and wrote his epoch-making work, "The Theory of the Earth." It was here that Sir James Hall, the "founder of experimental geology," carried out his celebrated researches, which gave such valuable support and corroboration to Hutton's explanations of certain phenomena which he had observed in the field. And it was here that Playfair, professor of natural philosophy in the University of Edinburgh, wrote his "Illustrations of the Huttonian Theory," a work on which he bestowed much time and labor and which did so much to elucidate Hutton's views and to present his theory in such a clear and attractive form that it achieved a widespread acceptance.

These were the three great leaders of the Scottish School of Geology, but there were other men associated with them who occupied less important positions and of whose work it is impossible here to make further mention. Hutton being the chief exponent of the views held by this school, his explanation of the origin and structure of the earth came to be known as the Huttonian theory.

Another circumstance which gave an additional impetus to the study of geology in Edinburgh was that about the same time that Playfair was appointed to the chair of natural philosophy at the University of Edinburgh, Robert Jamieson received the appointment of regius professor of natural history at this

[1] Address given at Edinburgh on the occasion of the centenary celebration of the Geological Society of Edinburgh, September 3, 1934.

same seat of learning. Jamieson had studied geology at Freiberg under Werner and, being an able and active exponent of Werner's opinions, promulgated them in Edinburgh and in 1808 founded the Wernerian Natural History Society, in the publications of which Werner's views were set forth and strongly advocated.

There thus arose an active controversy between the supporters of the Huttonian and Wernerian Schools, which led to a close study and active scrutiny of the respective tenets of the two parties, especially as applied to the elucidation of the geology of Scotland. The views of Hutton prevailed over those of Werner in the end, and Jamieson is said to have frankly admitted his conversion to the views of his opponents.

So soon as in Europe the men who were directing their attention to the study of the origin and structure of the earth's crust ceased merely to speculate and turned to actual observation in the field, the course which their studies took was determined very largely by the character of the rocks which were exposed to view in their respective areas. Thus the early Italian geologists, studying the late Tertiary rocks of northern Italy, which contained an abundance of well-preserved fossils very similar in character to the shells of animals living in the adjacent sea, devoted a great deal of attention to the question of the origin of these fossils, whether they were really the remains of animals which had once been alive and if so how it was possible that they were now found high up on the tops of the mountains.

If they lived in southern Italy, the presence of Vesuvius and Etna forced them to consider the question of the nature and origin of volcanoes and their accompanying earthquake phenomena and the bearing of these on the question of the condition of the earth's interior. In like manner the early geologists of France came to devote their studies largely to paleontology, while Werner in northern Germany had his attention directed chiefly to the question of the nature and succession of the stratified sedimentary deposits and the constitution of the geological column, as well as to questions of the origin and classification of the ore deposits for which Saxony and the adjacent parts of Germany were renowned and where mining had been carried on for nearly a thousand years.

And so in Scotland, where undisturbed fossiliferous strata were seldom seen and where there were no volcanoes, the attention of the geologists of the Scottish School was devoted chiefly to the inorganic side of the science. The upheaved, broken and metamorphosed strata, consisting largely of very ancient rocks, often presenting distinct unconformities and penetrated in all directions by igneous intrusions, presented a complex whose study was beset with many difficulties, but which revealed clearly the fact that these rocks in their present form had been the result of a long succession of separate shatterings and upheavals, evidently connected in many instances with the action of deep-seated plutonic forces. Fire, or at least heat, had evidently played an important part in these successive "revolutions." At the same time the clear evidence of the continuous waste of land under the influence of the atmospheric forces, with the production of immense quantities of detritus washed down from the hillsides and eventually finding its resting place in the sea, where it built up new stratified formations which would in their turn be upheaved to form new lands, were to Hutton and his followers a conclusive demonstration that the forces of both fire and water had acted through immense vistas of past time, their succession presenting, to use his celebrated phrase, "no traces of a beginning and no prospects of an end."

The insistence on these views, which are now so well established that they seem almost self-evident, was Hutton's great contribution to the science of geology. They were set forth in his great work, "The Theory of the Earth," and the demonstration of their truth was the glory of the Scottish School of Geology. Incidentally, I may be allowed to narrate a rather amusing little incident in connection with Hutton's "Theory of the Earth." As is well known, it first appeared in the Transactions of the Royal Society of Edinburgh in 1788 and then, enlarged and extended, was published in book form under the same title in 1795. This book consists of two volumes, but the work was incomplete, the treatment of the subject being cut off abruptly at the end of the second volume, the intention being evidently to complete it in a subsequent volume or volumes. This third volume, however, was never published, although there was reason to believe that the manuscript had been prepared by Hutton. This manuscript, however, could not be found.

Upon the death of George Huntington Williams, the very brilliant young geologist who was the first to hold the chair of geology at Johns Hopkins University in Baltimore, his widow founded and endowed a course of lectures to be delivered annually at that university in his memory. Sir Archibald Geikie was invited to give the first course of these Williams lectures and chose as his subject "The Founders of Geology." These lectures were published as the second and enlarged edition of his book which bears that title.

I went to Baltimore to hear these lectures, but did not arrive until the evening of the day on which the first one had been delivered. At a dinner party given in honor of the lecturer on this evening, Dr. Clarke, Williams' successor in the chair of geology at Johns Hopkins University, remarked to Sir Archibald that

he had been much interested in what had been said in the inaugural discourse concerning the missing part of the "Theory of the Earth," and Sir Archibald then gave an account of the search which for years past he had made in every library in which he thought the manuscript might possibly have found a resting place but without being able to find any trace of it.

"Well, Sir Archibald," I said, "I can tell you where it is." Sir Archibald looked at me in blank astonishment and said, "Where is it?" and I replied, "In the library of the Geological Society of London at Burlington House standing on the shelf beside the two printed volumes of Hutton's 'Theory of the Earth,' and on the fly leaf is a statement to the effect that it was presented to the library by Leonhard Horner."

As a matter of fact when reading in this library a few months before the evening in question, on asking for Hutton's "Theory of the Earth" the attendant brought me the two printed volumes and with them a third rather shabby looking volume, remarking that he had found "this old thing" on the shelf beside the others and thought that possibly I might find something of interest in it. On examination it proved to be the long-sought-for manuscript, and I sent a letter to *Nature,* which appeared in the issue of October 10, 1895, announcing its discovery and making a brief reference to its contents. This had escaped Sir Archibald's notice. On his return to England, the Geological Society of London, at his suggestion, had the manuscript printed, and it appeared as Volume III of the "Theory of the Earth." It is to be noted, however, that this manuscript did not contain all the missing portion of the work—there are some additional chapters which are still missing and will indeed be a treasure trove if any one can find them.

It has been suggested that I should make some reference to the relation of British to Canadian geologists in the development of the science of geology.

The Scottish School of Geology played an important part in the development of our science in Canada, largely through the influence of Sir William Dawson and Sir William Logan.

Dawson was born of Scottish parents in the town of Pictou in Nova Scotia and received his preliminary education in the school and academy of that place. He early showed a keen interest in natural history and in 1840 came to Edinburgh, entered the university and became a student of Jamieson's. His experiences as set forth in his brief autobiography throw an interesting light on the conditions of travel and study at that time.

He left Halifax on a sailing ship loaded with timber and bound for Newcastle. The ship was nearly wrecked by a series of violent storms which it encountered and when the last of these subsided found itself off the historic island of Lindisfarne. From there it made its way to Newcastle. Dawson remained but one evening there and that he passed at a meeting of a debating society of young men to whom he had been introduced. He took some little part in the discussion and at the close of the debate, he tells us that he was congratulated on speaking English so well, a fact which recalls to mind a recent observation by Lord Ponsonby to the effect that a Scottish accent is an enormous advantage to a speaker. The members of the club presumably supposed that coming from Nova Scotia his native language was Chippewa, Micmac or some other Indian dialect.

There were no railways at that time in northern Britain, so that next evening Dawson proceeded to Edinburgh by stage and the following morning found himself in the High Street. Jamieson, who was his principal teacher, he says, devoted a large part of his earlier lectures to physical geography and the remainder to minerals and rocks. Dawson remarks that he was surprised later on to find how little even some of the more eminent English geologists of the day seemed to know of mineralogy and consequently how uncertain was their diagnosis in the field of rock masses. "At the same time," he goes on to say, "I regretted that I could not obtain any systematic instruction in paleontology, geological surveying and in some other important subjects." He, however, provided himself with Maclaren's excellent book on the local geology and made frequent excursions in the vicinity of the city.

"While in Edinburgh," Dawson writes, "I received much personal kindness and useful guidance from Jamieson, Forbes, Balfour and other leading men connected with the university. Also from Alexander Rose, an excellent mineralogist, being an authority on the minerals of Scotland and Ireland. It was through him that I was introduced to Mr. Sanderson, the lapidary, who sliced fossil wood for Witham and Nicol, from whom I learned something of the art of preparing transparent slices of rocks and fossils for the microscope which was afterwards of great advantage to me."

Having completed one academic session at Edinburgh, he was obliged to return to Nova Scotia, but went back to Edinburgh and resumed his studies in 1846.

Dawson, on his return to Nova Scotia, was appointed to a position as school inspector, which required him to pay repeated visits to every part of the province. In so doing he acquired a knowledge of the geology of the whole of what now constitutes the Atlantic Maritime Provinces of Canada, which he set forth in his great volume entitled "Acadian Geology." During this time he met two great geologists, both of whom had a marked influence on his later career; these were Lyell and Logan. Lyell, on

the occasion of his first visit to America in 1841, spent some time with him. With Dawson he visited the celebrated section through the coal measures exposed along the coast of the Bay of Fundy as well as other parts of the coast line of that province, where Lyell was especially anxious to study the action of shore ice, as he was a strong adherent of the theory that the Post-Pliocene glaciation was due to shore ice and had not been able to get any evidence in support of this theory in his examination of the interior portion of the continent, although he had diligently sought it everywhere.

Lyell tells us how delighted he was to find in the cliff at the foot of Cape Blomidon a great groove which had undoubtedly been made by floating ice.

The other geologist mentioned by Dawson as having greatly influenced his career was Logan. Logan was born in Montreal and received his earlier education in that city and in the high school at Edinburgh. He then entered the University of Edinburgh, where he graduated, with distinction in mathematics in A. D. 1817. In A. D. 1831 he became connected with the coal-mining industry in Wales and made a geological map of the South Wales coal areas which he presented to Sir Henry de la Beche and which was by him issued as a publication of the Geological Survey of Great Britain. Later Logan returned to Canada to undertake some geological work in the Gaspé Peninsula and eventually became the first director of the Geological Survey of Canada, having its headquarters in Montreal.

By his own untiring labors and with the assistance of his colleagues through a long series of years he made a most valuable contribution to geology in his description and classification of the ancient pre-Cambrian rocks of the Canadian Shield, giving to us the Laurentian and Huronian systems, but he also founded the Geological Survey of Canada, which has been continuously at work ever since and to which we are indebted for most of our knowledge of the geology of that greatly extended area which now constitutes the Dominion of Canada. Being, furthermore, a man of large private means in that day of small things when the Geological Survey of Canada was in its infancy, he provided from his own private purse a not inconsiderable part of the financial support required to maintain the Survey in question until the government came to recognize the great benefit which it was rendering to the country and provided adequately for its continuance.

In A. D. 1855 Dawson left Nova Scotia and went to Montreal to assume the position of principal and professor of geology in McGill University. He worked in close cooperation with Logan for many years, who, recognizing the necessity of training up young geologists to undertake the geological mapping of the Dominion, endowed the Logan chair of geology in McGill University held by Dawson and also made provision in other ways for the teaching of geology at this seat of learning.

And so it came about that in the early years of the Geological Survey of Canada it was Dawson's students who carried out much of the actual work of the Survey, and Sir William Dawson's son, George Mercer Dawson, at a later date became its director and continued with great distinction the work so ably inaugurated by Sir William Logan himself. Thus the influence of the Scottish School of Geology made itself directly and widely felt across the sea.

Sir William Dawson was an honorary fellow, and both Sir William Logan and Dr. George Mercer Dawson were foreign corresponding fellows of the Geological Society of Edinburgh.

In conclusion, the present speaker may perhaps be allowed to say that, having received his early training in geology from Sir William Dawson and having succeeded him in the Logan professorship at McGill University, he too is proud to feel that any small contributions which he has himself been able to make to geological knowledge have in some humble and remote way been influenced and inspired by the teaching of Jamieson and his colleagues in those far-off days when we might almost say that British geology took its rise here in Edinburgh.

SUMMARY STATEMENT OF THE WORK OF THE NATIONAL RESEARCH COUNCIL, 1933-1934

By ISAIAH BOWMAN
CHAIRMAN

THE work of the National Research Council during the past year has called for an extension of associative effort into a number of new fields. The details will be found in the Annual Report for the year 1933–34, which will be published at the customary time. It has been thought advisable to publish a brief preliminary account of some of the recent major enterprises of the council for the immediate information of the public. They fall into five main classes:

(1) Aid to research through organization.
(2) The advancement of specific pieces of research.
(3) The advanced training of talented personnel.