Dr. J. B. Tyrrell. FRSC
With the writer's kind regards
& thanks

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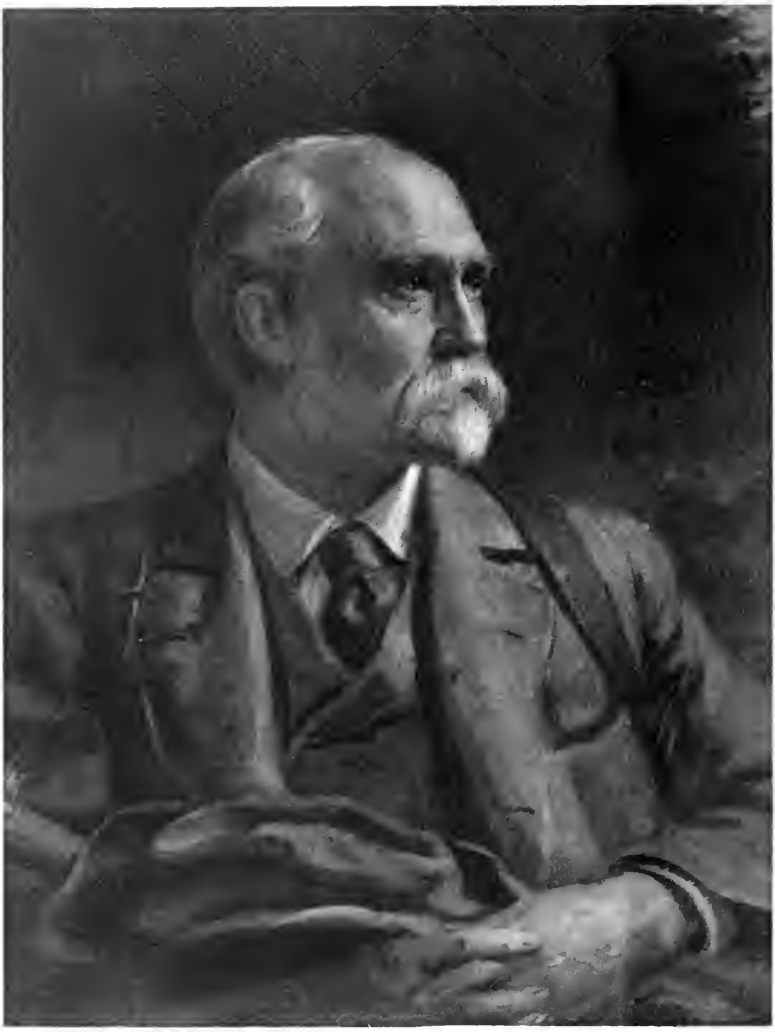
1852—1939



A. P. Coleman

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ARTHUR PHILEMON COLEMAN, the son of Francis Coleman, a Methodist minister, was born at La Chute, Quebec, in 1852, and graduated from Victoria University, Cobourg, Ontario, in 1876. After teaching for three years in the Cobourg Collegiate Institute he entered the University of Breslau, where he took his doctor's degree in 1881 for a thesis on the geology of an area in Silesia. Returning to Canada he became Professor of Natural History and Geology at the Victoria University until it was affiliated with the University of Toronto in which he was appointed Professor of Metallurgy and Assaying. While thus engaged he wrote many reports for the newly constituted Ontario Bureau of Mines, and in 1894 was formally nominated as its Geologist and Mineralogist. In 1901 he was transferred to the Chair of Geology at Toronto and served the University in that capacity till his retirement in 1922.

Coleman's first researches in Canada were naturally on microscopic petrology, a subject then much in vogue in Germany. He combined this study with field and laboratory work not only in his papers on Anorthosite and those on Nepheline and other Syenites, but in his work on the gold-bearing rocks of the Rainy Lake Region, and on other occurrences of such ores as iron, copper, cobalt, and silver, in Northern Ontario, which he carried out for the Bureau of Mines.

Undoubtedly his chief work on the economic side of geology was his exhaustive study of the nickel-bearing deposits of Sudbury, which began in 1902, occupied him for many years, and was much in his thoughts throughout his long life. He was the first to realize that these deposits crop out in an oval ring round

a large intrusive mass of 'norite', while his chemical and microscopic work convinced him that the ores had segregated out of the molten 'norite' magna, thus supporting the original suggestions of Barlow and Walker and extending them to include the differentiation of the primary igneous magna into layers of graded composition becoming more basic towards the lower part of the mass, where the ores are aggregated. Although disputed by many later observers, who advocated the origin of the ores by metasomatic replacement under the influence of solutions in the solid rocks, Coleman held to his theory. That the theory has stood the test has been shown by a very thorough re-examination of the case by Collins and his colleagues on the Geological Survey of the Dominion. In their paper they say: "Reasons follow in this article for believing with Walker and Coleman that the norite and micropegmatite were formed in place by gravitative separation from a single body of molten rock matter (magna) that was homogeneous when intruded"; and again "Further differentiation of the norite layer . . . Sulphides of copper, nickel and other metals, representing about ·04 per cent. of the whole igneous mass, settle to the bottom; . . . a residue of about ·15 per cent. remains in solution to crystallize as pyrrhotite and pyrite, the pyrrhotite in the norite layer and the pyrite in the micropegmatite layer. Crystallization proceeded, but the molten sulphides concentrated at the bottom apparently reacted with the immediately adjacent noritic material to convert the latter into offset magma and to lower its temperature of crystallization".

Before he left Europe in 1881 Coleman had given attention to two subjects which were to exercise a dominating influence on his life's work. Travelling in Scandinavia and Finland he had opportunities of studying Pre-Cambrian and Palaeozoic rocks, and also the phenomena of glaciers and characteristic results of their action. Thus, as was his wont, he trained himself in an area where conditions were ideal, for work on deposits and rocks which he knew would claim his attention in Canada.

Shortly after his return he began a long series of papers on

the Pre-Cambrian rocks, dealing in turn with the Laurentian, with the great Huronian series of sediments and igneous rocks, and with the unconformities and classification of these ancient rocks. Some of this work he summed up in his address on "The Canadian Shield" as President of Section C at the meeting of the British Association at Sheffield in 1910.

At the same time he became much interested in the abundant evidences of Pleistocene glaciation in Ontario, Alberta, and elsewhere, and especially in the neighbourhood of Toronto. He was impressed by the proofs that the Glacial Epoch comprised a long and complicated history, with its interglacial interludes, and he did much useful work on the great lakes formed by obstruction by ice-sheets of the pre-glacial drainage of North America, which have left such tangible evidence of their existence in the beaches and sediments that form so remarkable a feature of the geology of Ontario. In this work he made use not only of his experiences in lands now glaciated, but also of his competent knowledge of botany and zoology in the interpretation of fossil evidence.

In an unexpected fashion the two main lines of Coleman's research began to converge with the discovery that breccias and conglomerates interbedded among the Pre-Cambrian sediments showed incontrovertible signs of having been transported by and deposited from moving ice-sheets. The evidence consisted of glacial striations upon the coarser fragments in these deposits, of the transport of such fragments from great distances and their deposit in fine-grained material so as to constitute a rock like a hardened glacial 'till', of striated surfaces on which the deposits are sometimes seen to rest, and, most remarkable of all, of the association with these 'tillites' of finely laminated deposits laid down by fluctuating waters. These last correspond in structure and occurrence with the 'varved' deposits which De Geer, in Scandinavia, had proved to be laid down in front of retreating ice-sheets by melt water that varied in volume and transporting power according to the variation of the sun's power in summer and winter, and from which he had been able to

estimate in years the time occupied in the successive retreats of the ice-front.

The interest thus aroused in ancient "fossil glaciations" was increased by the discovery in Australia, South Africa, India, and elsewhere, of evidence of glaciation in Permo-Carboniferous times over an area and on a scale far surpassing that of the Pleistocene Period. These discoveries fired Coleman's enthusiasm and imagination, and drove him to travel all over the world to examine the evidence for himself wherever it had been proved or inferred that glaciation had occurred in pre-Pleistocene times. He visited or revisited northern Europe, Australia, India, South Africa, and South America, besides exploring many parts of North America, and, as a result, published a long series of papers the substance of which formed the basis of his book *Ice Ages Recent and Ancient* which he published in 1928. In this he re-examined or reviewed the evidence for five major Glacial Epochs, three in Pre-Cambrian time, one in Cambrian, and one in Permo-Carboniferous time. The evidence, collected by many observers but tested whenever possible by himself, which he marshalled showed conclusively that the ice action of these epochs was not that of mere mountain glaciers but of great ice-sheets, covering vast areas of land and reaching nearly to the margins of the seas.

In addition to these major glaciations he pointed out that there exists a certain amount of evidence, perhaps not in all cases conclusive, of glaciation in seven other of the Periods into which the geological record is divided. Although not strongly stressing these latter examples, Coleman felt bound to point out that many coarse-grained deposits have as yet no other satisfactory explanation, and that deposits of unweathered gritty material may sometimes have to be attributed to the influence of cold climates. Further he urged the well-known fact that the chances are heavily loaded against the survival of deposits formed on land, especially glacial detritus, when the time comes for that land to be submerged under the sea for the formation of the marine deposits that provide the chief data on which the geological record is

founded. In the book a number of instances are given to show the powerful influence on the evolution of plant and animal life which has been exerted by periods of cold climate at the localities where they occurred. No satisfactory explanation of the origin of glacial periods is found by Coleman, and he remained to the end a sceptic of the hypothesis of continental drift.

Professor Coleman was an admirable lecturer and speaker, rejoicing in debate on the subjects on which he had worked and felt strongly. He wrote well and clearly, and was able to bring his considerable artistic skill in water-colours to the illustration of his science. Although short in stature and slender in build Coleman was remarkably strong, active and vigorous. Filled with the true spirit of the pioneer and explorer he was a living exponent of the vital importance of travel to the geologist, and a loyal pupil of the injunction to "go and see". Every opportunity to travel that fell to him was accepted, and he grudged no expenditure of time or energy in making the fullest possible use of his chances. There were few parts of the world he had not visited, penetrating often to places difficult of access and scanty in accommodation. Nor did he reach his conclusions without detailed and minute observation, or without extracting all the available evidence from the facts at command. Whether pioneering in the Rocky Mountains, sweltering in the heat of India, or climbing Table Mountain, as the writer saw him at the age of seventy-seven, outpacing many younger colleagues, he was brimming over with the energy of bodily fitness and scientific enthusiasm. This lasted with him to the very end, for, even within a few weeks of his death at eight-seven, he was preparing for a new expedition into South America.

In 1900 Professor Coleman was elected a Fellow of the Royal Society of Canada, of which he became President in 1921, receiving the Flavelle Medal in 1928. He was President of the Geological Society of America in 1915 and was awarded its Penrose Medal in 1936. The Geological Society of London gave him its Murchison Medal in 1910 and the Royal Geographical Society the Victoria Medal in 1932. He was elected into the Royal Society in 1910.

He received honorary degrees from the Queen's University, the University of West Ontario, and the University of Adelaide; and his own University of Toronto awarded him the honorary D.Sc. in 1922.

For many of the particulars given in this notice the writer is indebted to an article prepared by Dr J. B. Tyrrell for the Royal Society of Canada, and kindly placed at his disposal. The portrait accompanying this notice is from a painting by J. R. L. Forster, of which a copy was kindly lent by Miss Coleman and sent through the Royal Ontario Museum of Geology by Professor Moore.

W. W. Watts