

DISCUSSION

AND

INFORMAL COMMUNICATIONS

This department is maintained in order to afford to those interested in questions relating to economic geology an opportunity for informal discussion or communication. Contributions are cordially invited either in the form of discussion of more formal papers appearing in earlier numbers or bearing upon matters of geologic interest not previously treated. Letters should be directed to Alan M. Bateman, Editor, Yale University, New Haven, Conn. The full name of the author should be attached to all communications.

THE VEINS OF COBALT, ONTARIO.

Sir: Geology is being split up into highly specialized departments and it is hardly to be expected that men admirably equipped in one department should be familiar with the later developments of other departments. A man may be an excellent mining geologist and yet be unfamiliar with the known conditions of glaciation.

Some time ago I had to criticize the statements of W. L. Whitehead (*ECON. GEOL.*, Vol. XV., p. 539), opposing the glacial origin of the Cobalt conglomerate, and showed what all glacial geologists are agreed upon regarding its formation. In your number for December, 1921, A. R. Whitman came to the defense of his assistant, but did not improve matters from the glacial point of view. After mentioning that residual soils in some places underlie the Cobalt conglomerate, he states that "Residual soil of Preglacial age is thus far unreported from the surface overridden by the Pleistocene glaciers of Ontario; and the till which they produced is less in thickness than that produced by the supposed Huronian glaciers."

Residual soil has been found in a number of places in Ontario; it has been mentioned, for instance, from Slate Island, and Michipicoten, Lake Superior, where thousands of feet of ice are

known to have filled the basin. Residual soil is described by Taylor¹ at Niagara; and no glaciated surface, only weathered shale, has been found under the boulder clay at Toronto. The fact is that geologists have been impressed by striated rock surfaces, but have seldom paid attention to weathered materials in glaciated regions. From the dynamical point of view glaciers scour only under suitable conditions; they deposit near their borders, and the greater their load of boulder clay the less ability they have to erode or striate rock surfaces. Glaciers, like rivers, deposit materials instead of removing them where their motion slackens. Where boulder clay, ancient or modern, is thick, striated rock surfaces are not to be looked for. For example, the northern Dwyka conglomerate is thin and overlies *moutonnées* surfaces, but over thousands of square miles toward the south, where the tillite is thick, no polished or striated rock surface has been found. Much of the thick tillite of Permo-carboniferous age in Australia has no striated surface beneath it; and the same is true in southern Brazil, where weathered material underlies the tillite. No striated surface has been found by Howchin under the thick early Cambrian tillite of south Australia.

Miller and myself have found smoothed rock surfaces under the Cobalt tillite, but no striæ have been reported. One may close this part of the discussion by saying that a striated surface beneath a tillite is welcome evidence of ice action, but that weathered and unstriated floors afford no evidence against ice action, particularly when the boulder clay is thick.

Whitman's suggestion that the Timiskaming mountains provided sufficient slopes for torrents to form the hundreds of square miles of Huronian tillite seems entirely without geological support. There were Timiskaming mountains, but all the evidence shows that they had been destroyed and the surface reduced to a peneplain before the Cobalt conglomerate was formed. Wherever this conglomerate has been found, at Cobalt, at Timagami, on the shore of Lake Timiskaming, at Chibougamau, at Sudbury, or in the original Huronian region, it rests on the upturned edges of

¹ U. S. Geol. Surv. folio—Niagara, p. 16.

the more ancient rocks. Over all the thousands of square miles where large areas or small patches of Cobalt conglomerate are found the floor on which they rest has a flat or gently undulating surface. The mountains down which the torrents were to flow had ceased to exist before the Cobalt ice sheet began its work.

Neither of the two lines of argument brought forward to oppose the glacial origin of the Cobalt boulder conglomerate has any weight. On the other hand, every feature of the tillite and its associated "varve" shales is exactly repeated by the later ice ages, especially those of the Permo-carboniferous and the Pleistocene. Hand specimens and thin sections of the Cobalt tillite are indistinguishable from those of the South African Dwyka or the tillite of Sierra de la Ventana in Argentina. If Messrs. Whitehead and Whitman will do me the honor to call, I shall be glad to show them evidence that has satisfied all the glacial geologists who have studied the materials at the Royal Ontario Museum, Toronto.

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CANADA.

Sir: The paper by John W. Gruner, "Paragenesis of the Martite Ore Bodies and Magnetites of the Mesabi Range," in *ECON. GEOL.*, Jan.-Feb., 1922, describes some features of the early history of the district that are of interest to the student of iron ores in general as well as of the Lake Superior deposits in particular. That magnetite has played a considerable part in the development of the hematites on the Mesabi range through its contribution of material to the formation of the high-grade blue ores, which are essentially pseudomorphic martite, puts a somewhat different aspect on the methods of ore concentration as worked out in the earlier reports, if it does not call for a material modification of theory.

The large-scale alteration of magnetite to martite described by Mr. Gruner is a problem in itself, about which perhaps the final word has not yet been said. Instances of the kind are rare, even very exceptional, if we consider the wide distribution of the min-