The second paper, entitled 'The Mesabi Iron Range,' was presented by Mr. C. K. Leith.

Mr. Leith discussed certain new developments in the geology of the Mesabi iron range of Minnesota. He showed that the Keewatin series of the Minnesota Survey comprises two distinct series—an igneous 'basement complex' and a sedimentary series. The former is classed as Archean and the latter as Lower Huronian by the United States Geological Survey. The district therefore shows a complete succession from the Archean through the Lower Huronian into the Keewenawan, and in the fullness of the succession and in the clear-cut unconformities the Mesabi may be regarded as the type of Pre-Cambrian district of the Lake Superior region.

The iron ores result from the alteration of certain peculiar rocks composed of aggregates of minute green granules. The granules were called *glauconite* by Spurr, and were supposed to be of organic origin. The present investigation, however, shows them not to be glauconite. They are composed essentially of ferrous iron and silica, and lack potash, a constituent essential to glauconite. The granules, it is believed, were developed in much the same manner as the iron carbonates, which are the original iron-bearing rocks of the older iron districts. The iron (derived from the disintegration of older basic rocks) was carried in a ferrous form into the ocean, which was depositing iron formation material, and was there precipitated as hematite or limonite, and at the bottom of the ocean was again reduced by organic matter to a ferrous form, and then combined with silica, giving the substance we now find. The occurrence of the substance in granules is due to the same causes as the oolitic structure in limestone. After the iron formation, thus formed, emerged from the sea, weathering and the concentration of the ore began. The ferrous silicate was broken up and the iron oxidized. As the work was done through the agency of percolating underground waters, the position of the ore deposits was determined by the laws of flowage of such waters. The deposits are now found in gently pitching troughs formed by the gentle folding of the iron formations and bottomed by slaty layers, or their altered equivalents, the paint rock, in the iron formation.

Dr. Whitman Cross then made some comments on an article by Mr. Bailey Willis dealing with stratigraphic classification. Dr. Cross expressed the belief that a geologic map should express as much of geologic development as practicable; that a map whose cartographic units were discriminated solely on the lithologic characters of the so-called 'lithologic individuals' was not entitled to be called a geologic map. It was really a lithologic map. He contended that in order to express geologic development the units of cartography must be established with due regard to all classes of available facts, and that restrictions were both undesirable and unnecessary.

ALFRED H. BROOKS,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE ENDOWMENT OF RESEARCH.

TO THE EDITOR OF SCIENCE: In SCIENCE of February 8, 1901, N. S., Vol. XIII., p. 201, there is an article by Professor E. C. Pickering remarking on and requesting suggestions in regard to the reasons why there is so little demand for grants from various funds which are available for research. I had hoped that some one with wide experience would have some suggestions to offer on this subject. But since no one, so far as I am aware, has published a reply, I am moved to offer a few thoughts of my own. I feel inclined to do so at this time because Mr. Carnegie has just endowed research on a magnificent scale, and, as some of the difficulties which have confronted Professor Pickering will doubtless confront the trustees of this fund, a discussion of the matter seems particularly desirable.

The lack of requests for research funds is not because there is lack of desire to do research work. There are plenty of students eager to investigate questions in which they are interested. More than a dozen have mentioned such a desire to me within the last ten years. Two or three of these were Harvard or Technology graduates, amply prepared by training to carry on such researches. I have

told all of them of the different research endowments with which I was acquainted and mentioned especially the two funds in which I know Professor Pickering is interested as a trustee. However, I think not one of these persons applied for an appropriation from these funds.

I have sought the reasons for this, and I believe the chief one is that each person feels that in case such funds are granted he will be expected to give in return some tangible result or discovery, and who can tell when entering an unknown country whether anything will be discovered worthy of the name? The student may be compared to De Soto entering a new country in search of gold. He may find nothing but seemingly interminable forests, passage through which is beset by pain and even danger, and he may return discouraged without the expected gold, his work being regarded by himself and by the friends who helped him as an absolute failure. And yet, as De Soto discovered a land the great forests of which returned more value in gold than the wildest dream of the explorer, and where fertile valleys now support a population whose total wealth must be counted by millions of dollars, so a student seemingly finding nothing may really have discovered facts which a succeeding generation will consider of inestimable value. Even negative results are frequently of great value in pointing out the true road to the subsequent explorer. In my opinion, then, research funds should be administered in the broad spirit that all results are valuable, and while the funds should made to feel that all that is required of him is be granted judiciously, the student should be an earnest effort in quest of truth and a guarantee that such an effort has been made.

The feeling that the trustees of these funds expect definite results has, I know, in my own case, except in one instance, deterred me from asking for grants. Many lines of investigation suggest themselves to me, and some of them I feel might be approved by the trustees, but I cannot be sure that the results will be what I had hoped or even worthy of publication; so I refrain from asking for grants, preferring to spend my own money, however inadequate, in order that I may be free to publish results when I have any worthy of publication, and refrain when I have none.

Another reason why students do not apply for research endowments is because they are usually granted in sums so small as to be entirely inadequate for the work. No one can estimate exactly, and usually not even approximately, how much money it will take to penetrate an unknown region or attain an unknown result. He may find that if he accepts a small amount it will prove only adequate to allow him to learn the difficulties of the situation, and yet insufficient to allow him to obtain any results whatever. A remedy would be to give larger and less numerous amounts, or assure the student of more if the preliminary study is promising.

A third reason why many students do not apply is that most of the grants stipulate that no money must be spent for personal expenses. If a student is not wealthy this requirement means that he must give his best thought and spend the main part of his energy in earning a living, a duty which he cannot shirk, and give to research only the remaining fragments of his time, and perhaps a weary brain. Few care to undertake it. This aspect of the case, from the teacher's standpoint, is given by Professor E. L. Nichols in the article in Science which immediately follows that of Professor Pickering (Vol. XIII., p. 203). He says, "The tax upon the nervous system of the proper teaching of science is very great, and it is more often the want of surplus energy with which to carry on an investigation, than lack of actual time or of the necessary equipment that defeats us."

If the student has wealth he does not need endowments and usually does not ask for them, but prefers instead to give them. If all men with equal opportunities were equally capable of research, as is frequently, but erroneously, assumed, this restriction of research funds would not matter since the work of research could be left to the classes having wealth and leisure, while the others could do the necessary daily work of the world. But the talents of men are diverse. The military

genius of a Grant may be associated with an inability to acquire or even retain wealth. Inventions which have added enormously to the wealth of the nation have been made by men so poor that they were obliged to borrow money for living expenses. A prominent patent attorney with much experience recently said to me that he thought inventors as a class were without business ability, that is, without the ability to turn advantageously the product of their brains into money by means of which they could have leisure to do other work. No one can say how much the world has lost by the inability of the properly qualified men to give their best thought to discovery and invention. Had such a fund as that given for research by Mr. Carnegie been available in the past and been properly administered, the human race would in my opinion have been transformed into something immensely better than we have at present.

Hence, I believe that research funds, instead of prohibiting the payment of the personal expenses of the investigator, should be mainly devoted to the payment of such expenses, so that the investigator might be allowed to devote his whole time and his best thought to the investigation, even if for only a short time.

The funds thus administered would have plenty of applicants, and much work would be thrown on the trustees in seeing that the appropriations were made to the proper persons and properly used, but this is a task I think the trustees ought to assume.

H. H. CLAYTON.

HYDE PARK, MASS.,
Jan. 21, 1902.

A RARE 'WHALE SHARK.'

TO THE EDITOR OF SCIENCE: The National Museum has obtained a skin of a rare 'whale-shark,' *Rhinodon,* from an eighteen-foot specimen found on the beach three miles north of Ormond, Florida, January 25, 1902, this being the first record of the occurrence of the genus on the Atlantic coast of America. The Museum is indebted to Messrs. Anderson and Price, managers of the Hotel Ormond, who telegraphed the discovery to the Smithsonian Institution and later had the skin removed and shipped to Washington under instructions from Dr. F. W. True, Head Curator, Department of Biology.

Rhinodon typicus was first figured and described by Dr. Andrew Smith in his illustrations of the zoology of South Africa, in 1841, the type being a sixteen-foot example found at the Cape of Good Hope.* Another one of this species taken at the Seychelle Ids. is known from the teeth only.†

A genus related to *Rhinodon* was described by Dr. Theodore Gill in the proceedings of the Academy of Natural Sciences of Philadelphia, 1865, p. 177, under the name *Micristodus,* from jaws, vertebræ and notes, received by the Smithsonian Institution in 1858, from Captain Stone, and taken from a twenty-foot shark captured in the Gulf of California, where it was known as the *'Tiburon ballenas,'* or 'Whale Shark.'

BARTON A. BEAN.

U. S. NATIONAL MUSEUM,
WASHINGTON, D. C.,
Feb. 8, 1902.

RECENT PROGRESS IN GLACIOLOGY.

OUR knowledge concerning glaciers past and present is gradually being extended by local studies in various parts of the earth. For several years, systematic effort has been made to record observations on the movements of existing glaciers for the sake of determining the conditions and laws governing their advance and retreat. Harry Fielding Reid has published a number of articles bearing on this general topic in recent years. The last of these articles‡ presents a summary of existing knowledge on the present phases of glacier movement in various parts of the world, with reference to advance and retreat.

Most of the glaciers of the Swiss Alps are retreating. In the eastern Alps about one half are retreating, while about one fourth are stationary, and nearly as many advancing. In

* Preserved in the Museum of the Jardin des Plantes, Paris.

† British Museum.

‡ 'Variations of Glaciers,' *Journal of Geology,* Vol. IX., pp. 250–254.