

SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS TO ANY PART OF THE WORLD, \$3.50 A YEAR.

To any contributor, on request in advance, one hundred copies of the issue containing his article will be sent without charge. More copies will be supplied at about cost, also if ordered in advance. Reprints are not supplied, as for obvious reasons we desire to circulate as many copies of SCIENCE as possible. Authors are, however, at perfect liberty to have their articles reprinted elsewhere. For illustrations, drawings in black and white suitable for photo-engraving should be supplied by the contributor. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers may go directly to them. The "Exchange" column is likewise open.

THE MESABI IRON RANGE.

BY E. P. JENNINGS, IRONWOOD, MICH.

THE discovery and development of this new source of iron ore within the last two years presents many points of interest. The deposits differ from all others in the Lake Superior district in being horizontal, and are only covered by the glacial drift.

The range is situated about 50 miles north of Lake Superior and extends from the Canadian line west to, and probably beyond, the Mississippi River, a distance of about 140 miles. The ore bearing belt is narrow, averaging about one mile in width.

The beds lie on the south flank of the Giant's Range—a chain of granite hills which form the watershed between Lake Superior and Hudson's Bay.

The rock series, according to Professor N. H. Winchell, is as follows:

First. The Archæan granite of the Giant's Range.

Second. Green Schists of the Keewatin-Archæan, dipping at high angles to the south.

Third. Quartzite, unconformable on first and second Taconic.

Fourth. Iron ore and taconite horizon Taconic.

Fifth. Slates and cherts—Taconic.

Sixth. Black slates—Taconic.

Seventh. The gabbro overflow which covers the eastern third of the range, and also appears to the south of the central part of the range.

Small bodies of banded titaniferous ore occur in the gabbro, but these deposits have no value and belong to a different horizon from the vast deposits of the so-called taconite horizon.

The taconite is a grayish, jaspery quartzite, enclosing narrow bands and masses of ore, and is somewhat similar in character to the banded jaspery ores of the Michigan Ranges. Where the conditions have been favorable the ore bodies have been formed by the solution and removal of the silicious rock through the agency of carbonated waters. The iron oxides, being insoluble in this reagent, have been left in various states of aggregation from hard specular and massive hematites to soft hydrated oxides.

The conditions favorable to the solution and removal of the silicious matter from the taconite or banded ore appear to be, first, that the taconite must not have been covered by other rock that would have preserved it from the action of the carbonated waters. So far no ore has been found in the taconite when covered with the black

slates. Second, that a free drainage to these waters was essential; when some barrier was interposed,—as, for instance, the green schists of No. 2 of the series, which in some cases cuts through the taconite, and so prevented the flow of the water saturated with silica,—no enrichment of the lean strata took place.

The quartzite under the taconite has also been acted upon by the carbonated water, for the layers immediately under the ore are disintegrated and have the appearance of a soft white or yellowish sand. Slight streaks of the same sand are also found in the ore, showing that in places the action of the water has not been complete.

About all the known ores of iron are found in these deposits, with the exception of carbonate, such as hard specular, massive hematite, soft blue black hematite, limonite, göthite and some magnetite. The latter can be separated by a magnet from the soft blue hematite. There is little or no pyrite in the ore, and in general the sulphur compounds are absent. The best ore is the so-called "blue" ore, a fine granular blue black hematite, which does not soil the hands as most of the soft ores do. This ore carries from 62 to 68 per cent iron, and phosphorus from .007 to .050 per cent, with small amounts of silica, lime, magnesia, and alumina, and is an ideal blast furnace ore.

Some of the ore basins are very large and show that the concentrating process has been on a very extensive scale. The basin at the Biwabec is about 3,000 feet in length by about 1,000 feet in width, with a depth along the axis of the deposit of 100 feet or more, the deposit gradually thinning out on the northern edge near the granite. This deposit is known to contain 20,000,000 tons of blue ore and possibly as much more of the yellow and brown ores that will run 60 per cent in iron. This is but one of many known basins.

The ore in these beds is nearly horizontal and varies from a few feet to over one hundred feet in thickness and is covered by the glacial drift from a few inches to one hundred feet in depth.

The operation of mining consists of first removing the "over-burden," which is done by steam shovels. Then railroad tracks are laid on this uncovered surface of the ore. The ore is loosened by light blasts of black powder and shoveled and hoisted on cars by steam shovels. Two thousand eight hundred tons of ore have been mined and loaded with a single shovel in a day of twenty hours.

The great hoisting and pumping engines of the deep mines of other districts are here replaced by the tools of a modern railroad contractor—the locomotive and steam shovel. As there is no pumping, no hoisting, no timbering, and as most of the work is done by machinery, no skilled miners are required and few men of any kind. The cost of mining is therefore very low.

Considering both the quality and quantity of ore and low cost of production, this new range is certainly one of the most wonderful discoveries of the century.

—Mr. Goldwin Smith in the preface to his latest book, "Oxford and her Colleges: A View from the Radcliffe," says: "The writer has seldom enjoyed himself more than in showing an American friend over Oxford. He has felt something of the same enjoyment in preparing, with the hope of interesting some American visitors, this outline of the history of the University and her colleges. He would gladly believe that Oxford and Cambridge having now, by emancipation and reform, been reunited to the nation, may also be reunited to the race; and that to them, not less than to the universities of Germany, the eyes of Americans desirous of studying at an European as well as at an American university may henceforth be turned."