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A MICROSCOPIC STUDY OF THE CUMBERLAND IRON ORE OF RHODE ISLAND.

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[ABSTRACT.]

It appears from a pamphlet published by the Rhode Island Society for the Encouragement of Domestic Industry, in 1869, that the Cumberland iron ore was worked as early as 1703, for the purpose of mixing it with the Cranston ore. The iron thus produced was employed in the casting of cannon. In part at least, "the cannon used in the celebrated Louisburg expedition, in 1745" were made from this iron. It seems to have been largely employed in the manufacture of charcoal iron in Massachusetts as late as 1834, and in 1869 it was extensively shipped to Pennsylvania to be mixed with other ores.

It was described by Dr. Charles T. Jackson in his report on the Geological Survey of Rhode Island in 1840, and later by Prof. Robert H. Thurston and others.

Its association with serpentine was noticed but it does not appear that its nature was ever suspected.

All pronounce it a valuable deposit of iron, and seem to regard it as a common form. Dr. Jackson thought it was eruptive and gave an analysis as follows.

SiO_2	23.00
Al_2O_3	13.10
Fe_2O_3	27.60
FeO	12.40
MnO	2.00
MgO	4.00
TiO_2	15.30
H_2O and Loss	2.60
Total	100.00

My attention was called to it by some specimens presented to me by Mr. H. B. Metcalf in the spring of 1880, and I afterwards visited the locality. It did not appear to me to be a common iron ore, but rather a basic eruptive rock containing much iron. Sections were made from it in order to ascertain its true character. It shows microscopically more or less connected spongiform masses of magnetite, while the cells and interspaces between the magnetite are filled with rounded grains of olivine. The olivine is cut through by numerous fissures, which generally show a ferruginous staining along their sides. Besides this staining the olivine is comparatively clear and shows little signs of alteration. It contains grains of magnitite. This ore, where it has been largely quarried, on one side of the hill, shows a porphyritic structure owing to the presence of large triclinic feldspar crystals. The feldspar is locally limited and gives character to a portion of the rock only. The feldspar shows well marked lines of cleavage and fracture and is somewhat kaolinized along these lines. It contains a few irregular flakes of biotite together with grains of olivine and magnetite. The order of crystallization appears to have been, first the magnetite, then the olivine, and lastly the feldspar. The olivine, with its alteration product surpentine, is the predominant mineral, the titaniferous magnetite being subordinate; that is, the ore is an *olivine rock* holding a variable proportion, sometimes comparatively little, of magnetite. This microscopic examination shows the rock to be a *peridotite*, similar to the celebrated iron ore of Taberg, Sweden. This Swedish ore has been worked for over three hundred years and was described in 1876 by A. Sjören under the name of "magnetite olivinite."

Except on the side where the feldspar was found, microscopic examination showed that the olivine is generally altered to a serpentine, which displayed a beautiful fibrous structure in polarized light. The outline of the serpentine masses, the inclosed grains, and network of fissures remain the same as those observed in the unchanged olivine. The magnetite retains the same relation to the serpentine that it held to the olivine, and the general structure of the rock is unchanged. Also olivine grains

are seen only partly altered, the edges and the borders of the fissures being metamorphosed into serpentine, while the interior remains nearly intact. Some other products of alteration were observed, such as actinolite and dolomite.

The contact of the peridotite with the adjacent rocks could not be found, hence no definite statement of its origin can be made. Such mineralogical composition and structure have not been found, so far I as know, in any terrestrial rocks which have not proved to be eruptive when their history was studied with sufficient care. Hence it is probable that this is an eruptive rock, and it is necessary so to regard it until it be proved otherwise. This rock and other varieties of peridotite are the nearest known allies of the meteorites, as has long been pointed out. It is rocks of this character, as has been suggested by others, that give us the most probable clew to the interior composition and structure of the earth.

This examination may serve as an illustration of the aid microscopical lithology may be to the practical side of life; since now, for the first time since this rock has been worked, can the iron master who wishes to use it, approach understandingly the metallurgical problems it presents, whether he desires to use the entire rock or only the separated magnetite.

For the original paper the reader is referred to the Bulletin of the Museum of Comparative Zoölogy, Geological Series, Vol. I, pp. 183–187.