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[Strategic minerals investigations; preliminary reports unnumbered]

THE ARLINGTON COPPER MINE
NORTH ARLINGTON, NEW JERSEY

by

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ILLUSTRATIONS

THE ARLINGTON COPPER MINE

North Arlington, New Jersey

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ABSTRACT

The Arlington copper mine is located in North Arlington, Bergen Co., N. J. The ore deposit occurs in a 10- to 30-foot thick arkosic sandstone layer, interbedded in red shale. Copper mineralization is associated with thin diabase sills and dikes. It would probably not be feasible to develop the underground workings since they are overlain by the residential section of North Arlington. One area, containing approximately 11,000 tons of indicated ore could possibly be quarried.

INTRODUCTION

The Arlington copper mine is located near the corner of Schuyler Avenue and Belleville Pike in North Arlington, Bergen County, N. J. It is 3 miles northeast of Newark, N. J., and 8 miles west of New York, N. Y. A tall brick chimney, built for the power plant in 1901, still marks the site of the mine. The mouth of the main tunnel and the quarries are located near the top of an 80-foot escarpment that runs in a northeasterly direction and overlooks the Jersey Flats to the southeast (see pl. 1). The deposit was studied in June and October, 1943, by H. R. Cornwall as part of the Geological Survey's program of investigation of siliceous fluxing ores.

The mining property is at present owned by the Borough of North Arlington, N. J., and the Scandia Manufacturing Co., Belleville Pike, North Arlington, N. J. Of the block of indicated ore under consideration in this report, a little more than one-half (the southwest portion) is owned by the Scandia Manufacturing Co. The remainder (northeast portion) is owned by the Borough of North Arlington, N. J.

The Arlington mine was discovered about 1714. The mine was worked continuously until the American Revolution in 1776. During the 19th century the mine was sporadically operated by several different companies. In 1899 the property was taken over by the Arlington Copper Company, capitalized at $2,500,000. Extensive development was carried out. As a result it was believed that 5,000,000 tons of 2.5 percent copper ore was available. A 125-ton mill with provision for increase up to 500 tons was installed. A power plant, roasting furnace, and leaching tanks were likewise built at this time. The process of separation of the copper, leaching of the roasted ore by dilute sulfuric acid, proved to be unsuccessful. The whole operation was abandoned soon thereafter. No mining has since been done.

The Arlington mine has been described by N. H. Darton,[1] J. V. Lewis,[2] G. F. Black,[3] and W. L. Phyfe.[4]

GEOLOGY

The Arlington copper deposit occurs in the Brunswick shale, a formation of terrestrial sandstones and shales which belongs to the Newark group of Triassic age. The Brunswick shale, which is normally a fine-grained red shale, contains interbedded lenses of gray, arkosic sandstone. It is in one of these sandstone lenses that the Arlington copper deposit formed. The beds in the vicinity of the mine have a fairly uniform strike of about N. 28° E., and uniform dip of about 10° NW.

The ore-bearing gray sandstone is, according to J. V. Lewis,[5] underlain by a fine-grained intrusive sheet of diabase, 5 to 20 feet thick. The intrusive chilled so quickly that the overlying beds were little altered. Lewis states that the diabase surface was followed westward for ½ mile in mining operations, and that, in one place, it was traversed by a fault of considerable throw.

In an examination of all available surface outcrops in the area, the writer observed the following relationships. The gray sandstone occurs as lenses in several horizons in the red shale, but most of the sandstone occurs at the horizon from which the greater part of the ore has been mined. While there may be one persistent trap sill at the base of the main copper-bearing sandstone bed, there are also several other less extensive trap sills and dikes in the area. These intrusives are, on the average, 2 to 4 feet thick. The copper deposits are associated with them. Where they are in contact with the shale, the shale is bleached for 2 or 3 feet away. In the quarry faces at the ends of the block of indicated ore under consideration (see pl. 1), the sandstone contains numerous angular fragments of trap and shale from less than 1 inch to more than 1 foot in diameter. The fragments are larger and more numerous near the underlying trap (see fig. 1). Bedding planes in the sandstone have been obliterated.

Examination of two thin sections of the sandstone breccia indicates that there are fragments of both altered shale and fine-grained,

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1/ Darton, N. H., U. S. Geol. Survey Geol. Atlas, New York City folio (No. 83), 1902.

2/ Lewis, J. V., Copper deposits of the New Jersey Triassic: Econ. Geol. vol. 2, pp. 242-257, 1907.

3/ Black, G. F., The Belleville copper mine: Am. Mineralogist, vol. 7, p. 154-158, 1922.

4/ Phyfe, W. L., Copper deposits of New Jersey: Princeton Univ. senior thesis, pp. 53-83, 1933.

5/ Lewis, J. V., op. cit., p. 248.

altered diabase in an arkosic sandstone matrix. The trap fragments may represent an early, solidified portion of the intrusive which was broken up and displaced by disturbances during the later stages of emplacement of the magma. The shale fragments may be the remnants of a shale lens in the sandstone which formed a plane of weakness along which the basaltic magma was intruded. It is not clear at what stage the shale was broken up. Shale fragments were not observed in the trap, but this might be due to the lack of adequate exposures.

ORE DEPOSITS

Chalcocite (Cu_2S), chrysocolla ($CuSiO_3.2H_2O$), and malachite ($Cu_2(OH)_2CO_3$) are the most important ore minerals, with minor amounts of azurite ($Cu_3(OH)_2(CO_3)_2$), cuprite (Cu_2O), and native copper. These minerals occur mainly as disseminations and rich veinlets in the sandstone.

The underground workings were not accessible at the time the writer visited the deposit. The quarries examined are near the top of the escarpment, facing the Jersey flats, and extend along it in a northeasterly direction. Most of the rock on the quarry faces at the northeast and southwest ends of the block of indicated ore (see pl. 1) is a copper-bearing sandstone breccia. The bottoms of these two faces are both apparently near a contact with a trap sill (see fig. 1). The upper surface of this sill is irregular.

The copper minerals are apparently most abundant in a zone 4 to 8 feet thick in the sandstone breccia immediately overlying the trap, becoming gradually less abundant both above and below. The copper occurs mostly in the sandstone matrix where it is disseminated as malachite, chrysocolla, chalcocite, and native copper grains with occasional rich veinlets of chalcocite. The trap fragments are somewhat vesicular, and these vesicles are often lined with limonite and malachite, as are also the joints and fractures. The trap intrusive itself carries some copper, as well as the underlying sandstone (see fig. 1), but these rock units are too poorly exposed to permit reliable estimation of their grade.

ORE RESERVES

Only reserves of shallow ore are estimated in this statement because the underground workings were inaccessible at the time of the writer's visit. The block of indicated ore between two quarry faces (see pl. 1, and fig. 1) measured 300 feet long, 75 feet wide at the southwest end, and 25 feet wide at the northeast end. The average depth was considered to be 10 feet. Using a factor of 13 cubic feet per ton, the indicated tonnage of this block is 11,000 tons. It is quite possible, however, that the northeast end may be mineralized

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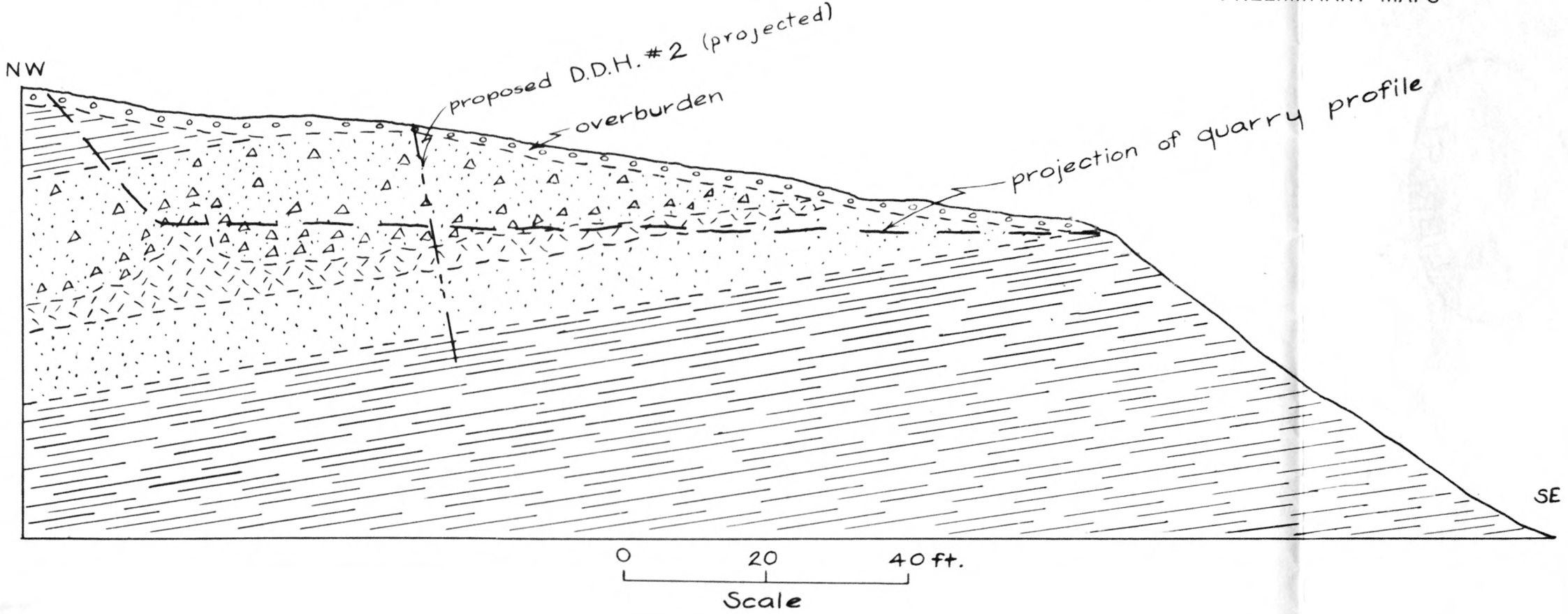

Fig. 1 Cross-section A-A', Arlington Copper Mine. Explanation same as Plate 1. Mineralization apparently most intense immediately above trap.

for a horizontal width of 50 feet or more, as the original quarry cut was 50 feet wide. Bedrock is now exposed for only 25 feet on this face and this is the width that was used for computing the tonnage. It is also quite possible that the southwest end of the block may have a greater width and depth. A shallow ditch, recently dug in bedrock along the southeast edge of a new shed constructed in the quarry (see pl. 1), is in well mineralized sandstone. If the mineralized sandstone is continuous from the northeast end of this ditch to the northwest side of the quarry, the bed must be at least 25 to 30 feet thick, even after allowing for a 4- to 5-foot included trap sill. It is impossible to estimate, without diamond drilling, what maximum tonnage of sandstone ore could be expected to occur in this block, and how uniform the copper mineralization may be. Present exposures of bedrock are unsatisfactory.

A composite sample of the two quarry faces at the ends of the mineralized block assayed as follows:

SiO_2	71.13%
Al_2O_3	12.84
Fe	2.45
Cu	1.52
S	.08
Ign	2.77

Four more detailed samples of these two faces have been assayed by the Geological Survey Chemical Laboratory. The results are given in table 1, p. 5. The sandstone breccia overlying the trap apparently contains the greatest amount of copper: 1.37 percent at the southwest end of the block, and 1.25 percent at the northeast end. The sandstone near the bottom of the southwest end of the block contains an appreciable amount, however, and there are indications that, in places, it has been mineralized as richly as the breccia. The best estimate of the average grade of the block of indicated ore that can be made by weighting these few assays in accordance with the geologic evidence is as follows:

% Cu	% SiO_2	% Al_2O_3	% Fe_2O_3	% TiO_2
1.25	71.2	12.00	4.5	0.5

It has been estimated 6/ that 100,000 tons of copper ore have been taken from the Arlington mine, and the average grade is said to have been "nearly" 2.5 percent copper. The total quantity of available ore has been variously estimated at from 2,000,000 to 5,000,000 tons.6/ Lewis,7/ however, in 1907 had this to say: "It may be

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6/ Phyfe, W. L., op. cit., p. 72.
7/ Lewis, J. V., op. cit., pp. 242-257.

reasonably questioned whether the average grade of available ore has been satisfactorily established, and it is quite certain that nowhere has the existence of any great body of ore yet been demonstrated."

Table 1

Sample No.	1	2	3	D
SiO_2	72.98%	78.60%	62.54%	69.76%
Al_2O_3	11.08	10.78	15.44	12.02
Fe_2O_3	4.64	1.84	6.90	5.38
TiO_2	0.43	0.30	0.88	0.50
Cu	1.25	0.70	0.85	1.37

Location and description of samples.8/

#1 22 ft. by 3 ft. face of sandstone breccia at northeast end of ore block.

#2 20 ft. by 4 ft. face of sandstone, southeast portion of southwest end of ore block.

#3 15 ft. by 2 ft. face (in 2 exposures) of trap and altered shale.

#D 30 ft. by 8 ft. face (in 2 exposures) of sandstone breccia, central and northwest portion of southwest end of ore block.

8/ All samples assayed by the Geological Survey Chemical Laboratory, Washington, D. C.

RECOMMENDATION

The assays of the samples of the two ends of the mineralized block, described in the section on ore reserves, indicate that this ore might be valuable as a silica flux.

One problem in quarrying the ore would be the nearness of the Scandia Manufacturing Co. plant, and the Public Service power plant to the southwest end of the block. It would be difficult to blast from this end without damaging these plants, but quarrying could, perhaps, be started from the northeast end.

Another adverse factor is that the block is covered by two to four feet of overburden, and may include some shale as well as intrusive trap. This means that in addition to stripping, the rock might have to be selectively quarried to a certain extent to maintain a sufficiently uniform grade for smelter flux. The tonnage is so small that a contract basis would be the logical method of operation, but supervision of such an operation would be difficult.

The next step in the development of this block of ore, if warranted by local needs for copper-bearing silica flux, should be to ascertain whether the owners want to sell the ore. It would also be necessary, before production is attempted, to get more information about the uniformity of mineralization and the nature of the rock. Three diamond drill holes at the locations proposed on plate 1 would accomplish this objective. Each hole should be sunk perpendicular to the beds, i.e., dip 81° in a direction S. 62° E., and should be continued deep enough to reach the underlying shale at an estimated depth of 30 to 40 feet.

November, 1943.