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WAR MINERALS REPORT*

Report of the Bureau of Mines to Secretary of the Interior, Harold L. Ickes

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OHIO COPPER COMPANY
Salt Lake County, Utah

- Copper-Lead-Zinc -

Summary

The Ohio Copper Company property is located in the Bingham Mining District, Utah. The company is producing copper from an underground leaching and precipitating operation, and from milling tailings from a previous copper concentrating plant.

Water is pumped to the outcrop of the fractured quartzite ore body, and it seeps down through the ore body, dissolving copper minerals. The copper is precipitated from solution by scrap iron on the Mascotte Tunnel level. The present production from the leaching operation is 17 tons of copper per month.

The combination leaching and flotation plant at Lark, has a capacity of 1,200 to 1,500 tons of tailings per day. The copper recovery averages 74 percent, or 6.2 pounds of copper per ton of mill feed from an ore assaying 0.42 percent copper.

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* The War Minerals Reports of the Bureau of Mines are issued by the United States Department of the Interior to give official expression to the conclusions reached on various investigations relating to domestic minerals. These reports are based upon the field work of the Bureau of Mines and upon data made available to the Department from other sources. The primary purpose of these reports is to provide essential information to the war agencies of the United States Government and to assist owners and operators of mining properties in the production of minerals vital to the prosecution of the war.

Large lead-zinc-copper ore bodies have been mined in the Jordan and Commercial limestones in ground adjoining the Ohio Copper. Many of these ore bodies, and the lead-zinc bodies in particular, were found a considerable distance from the main intrusive, in limestone little affected by contact metamorphic agencies.

Much of the work on the 700-foot level on the Ohio Copper ground has been done near the large quartz monzonite dike. A small tonnage of lead-zinc, and copper-gold ore has been mined from the Commercial and Jordan limestones on the 700-foot level. See figs. 1 and 2.

To the north of the workings on the 700-foot level, a fissure zone exposed in the workings on the Mascotte Tunnel level, and projected to intersect the Commercial limestone below the 700-foot level, appears to be a favorable horizon for copper-lead-zinc replacement ore bodies.

Exploration of the intersection of the fissure zone and the Commercial limestone will entail considerable dead work in the form of rehabilitating about 600 feet of drifts and driving about 600 feet of crosscuts. For this reason, the Bureau of Mines believes the exploration program herein outlined is warranted only when it becomes necessary to secure production from ore bodies of very speculative worth.

Introduction

The possibility of developing additional copper, zinc, and lead ore reserves in limestone horizons, productive in properties to the south and west of Ohio Copper ground, has led to increased interest in the Ohio Copper Company.

The Copper Branch of the War Production Board has studied reports on the geology and ore deposits at the Ohio Copper property, and has requested

the Bureau of Mines to investigate the possibility of developing more ore in the limestone.

An engineer from the Bureau of Mines examined the Ohio Copper Company's ground in April 1943. All existing maps and information pertaining to the mine were made available by the company. The geologic plan and section maps were taken from a report by Mr. J. J. Beeson to the Ohio Copper Company.

History and Present Property Ownership

The Bingham Mining Disttict was organized in December 1863, after discovery of minerals earlier in the same year. Transportation difficulties and the lack of suitable reduction plants retarded active production from the lode properties until a few years later.

The Ohio Copper Company was formed in 1907, but reincorporated as the Ohio Copper Company of Utah in 1916.

Mining and milling of ore from the quartzite ore body were begun in 1907. The first mill employed gravity concentration alone until 1919, during which year flotation was added. The property was idle between 1919 and 1923. In June 1923, the company developed their present leaching-in-place method, with precipitation on the Mascotte level. Tailings from the original table concentrator are being treated in the present mill at Lark.

The company owns 14 lode claims, comprising 120 acres. By agreement the Utah Copper Company controls the surface and underground rights to a depth 50 feet above the Mascotte Tunnel level.

Physical Features and Communications

The Ohio Copper property is located in the Bingham Mining District, Salt Lake County, 30 miles southwest of Salt Lake City. Excellent highways connect the district with Salt Lake City, and the smelter areas of Midvale, Murray, and Garfield. The district is served by a branch line of the Denver and Rio Grande Western Railroad. Electric power is supplied at the Mascotte

Tunnel portal by the Utah Power and Light Company.

Many of the producing mines are near the head of Bingham Canyon in an area of considerable relief where elevations are as much as 8,000 feet. The haulage level for the Ohio Copper production is the Mascotte Tunnel. The portal of this level is on the east side of the Oquirrh Range at an altitude of 5,550 feet. The surface installations are located here.

Labor and Living Conditions

Labor in the Bingham District is scarce under present war conditions. A sufficient number of miners for the proposed project can probably be found in the district.

Men can obtain living accommodations at Lark, at the portal of the Mascotte Tunnel. There are a number of recently constructed houses at Lark, some of which may be available for men with families.

The prevailing wage scale for miners in the Bingham District is $7.70 per day for a 6-day week. Board and room at Lark can be obtained for $45 to $50 per month.

The climate of Bingham is semi-arid, though heavy snowfalls are frequent in the higher parts of the district during the winter months. At Lark, the snowfall is much lighter. Summer temperatures are moderate, but winter temperatures frequently drop to zero.

Geology and Ore Deposits

The most important rocks in the district are the Bingham quartzite of Pennsylvanian age, and the intrusive quartz monzonite and associated igneous rocks of somewhat different texture and composition. There are areas of extrusive rocks along the valleys bordering the Oquirrh Range, but these rocks have no economic importance.

The Bingham quartzite is the most widespread rock in the district. It consists chiefly of a fine grained, massive quartzite, with interbedded limestones and samdstones. The limestones are of great economic importance because of their relation to the ore deposits.

The mineralization in the Bingham district owes its origin to the intrusion of large masses of quartz monzonite into the Bingham quartzite sediments, and the intense mineralization by solutions from deep seated sources during the processes of emplacement and cooling. The Ohio Copper property is located near the center of a highly mineralized area, 4 miles long and 2 miles wide.

Large ore bodies have been found in the altered quartz monzonite and in the quartzite limestones. The ore body of the Utah Copper Company was formed by mineralizing solutions replacing the original monzonite and resulting in an enormous disseminated deposit containing chalcopyrite and bornite. Near the monzonite contacts the quartzite has been shattered by the intrusion and by subsequent fracturing. Large ore bodies have been found in some of the shattered quartzite areas and particularly in Ohio Copper ground.

Copper, lead, and zinc ore bodies formed as limestone replacement bodies near fissures, have been the source of a large tonnage of ore, and second only in importance to the Utah Copper disseminated ore body.

The ore deposits associated with the larger intrusive masses have a zonal arrangement. Typical contact metamorphic deposits are found in the limestone adjacent to the larger intrusions. Chalcopyrite, with garnet, ipidote, and other high temperature minerals are common. Such deposits have produced a large tonnage of low-grade copper ore in some properties. Replacement copper ore bodies have been found in highly altered crystalline limestone several hundred feet from the intrusions. The intense alteration of the limestone may extend as much as a thousand feet from the instrusive mass. Deposits beyond this intense alteration usually contain lead, and finally in the less altered limestones

the typical lead-zinc bodies are found. Siliceous silver ores with little lead and zinc are found near the outer margins of the lead-zinc bodies.

The Commerical and Jordan limestones have been the most productive limestones in the district for many years. Recently the limestone beds below the Jordan have been productive to the southwest of the Ohio Copper ground. These beds have been named the A, B, C, D, and E beds.

Replacement deposits on the footwall of the Jordan limestone have been found near the southern boundary of the Ohio Copper property. Large bodies of lead-zinc ores have been found in the Brooklyn ore shoot which is higher in the bedding and farther from the alteration induced by the intrusion. These deposits occur in ground owned by the United States Smelting, Refining, and Mining Company.

Mineralization so far demonstrated in the Commercial limestone on Ohio Copper ground was confined to the footwall and hanging wall contacts. On the footwall of the Commercial limestone considerable pyrite and small amounts of lead and zinc were found on the 700-foot level. Pyrite with chalcopyrite, galena, and sphalerite, have replaced Commercial limestone on a sub-level above the 700-foot level and east of the No. 2 shaft. This indicates lead-zinc mineralization at a greater distance from the large quartz monzonite dike.

North of the 700 level workings a fissured zone striking northeast and approximately 100 feet wide, in the Utah Copper drift of the Mascotte Tunnel level, is indicated in the quartzite. Fig. 1 and Fig. 2. The fissures contain pyrite, chalcopyrite, and other copper minerals. Projections of these fissures eastward and downward would intersect the Commercial

limestone a few hundred feet north of the present workings on the same 700-foot level. This zone of fissuring projected to the southwest passes through the Ohio Copper ore body in the quartzite. Projecting the zone to the northeast and upward, it passes through the Montana-Bingham property, in the Mayflower limestone.

There is evidence of north-south fissuring intersecting the northeast zone in the Ohio Copper quartzite ore body and in the Montana-Bingham ore bodies. These intersections may have been important factors in the deposition of the ore that has been found.

The intersections of the steeply dipping northeast copper bearing fissures with the Commercial limestone below the 700-foot level and at a distance beyond the effects of intense metamorphism induced by the quartz monzonite, may have resulted in replacement ore bodies.

Development

The property is developed by the Mascotte Tunnel level, 13,000 feet long, and 700-foot level, 465 feet below the Mascotte level. An inclined winze connects these two workings. It is 740 feet long and was driven on a 41 degree slope.

Approximately 5,000 feet of exploration work in drifting and crosscutting has been done on the 700 level. In addition, there are several hundred feet of raises and sub-level drifts above the 700-foot level. Near the southwest part of the property the 700-foot level connects with the workings of the United States Smelting, Refining, and Mining Company.

The Ores

The largest part of the Ohio Copper production has been drived from

the ore body in the quartzite. This ore consists of disseminated pyrite, chalcopyrite and chalcocite, with the quartzite gangue. Formerly this ore was mined by a block caving system and milled in a plant at Lark. During the last twenty years it has been more economical to precipitate the copper from solution, after pumping water into the fractured ore body from the surface. Tailings from the milling of the quartzite ore are now being treated in a new plant at Lark. The capacity of the plant is 1,200 to 1,500 tons per day.

A small tonnage of copper-gold ore has been mined from the 600-foot level and sub-levles above the 700. This ore was deposited as a replacement ore body on the footwall of the Jordan limestone. It consists chiefly of chalcopyrite and pyrite mineralization of the metamorphosed limestone. The average assay of this ore was 0.187 ounce gold, 1.66 ounces silver, and 1.47 percent copper.

A small tonnage of lead-zinc-copper ore was mined from a sub-level above the 700-foot level. This ore was found on the footwall contact of the Commercial limestone and near the eastern property line. The ore minerals in this ore were chalcopyrite, galena, and sphalerite. Lesser amounts of this ore were found in the Commercial limestone in drifting on the 700-foot level near both the footwall and hanging wall of the limestone.

Plans for Company Operations

The Ohio Copper Company is producing copper by leaching the ore in situ. Water is pumped over the fractured quartzite ore body adjoining the Utah Copper mine, and the copper resulting from leaching is precipitated from solution by scrap iron on the Mascotte Tunnel level. The leaching process is operated for approximately 2-12 years and then shut down

for an equal period to allow the copper minerals in the ore body to oxidize.

The company is also milling copper tailings in their mill at Lark. The capacity of this mill is 1,200 to 1,500 tons per day. The tonnage of tailings is estimated at 3,000,000 tons assaying 0.42 percent copper. The tailings were derived from a previous operations which milled ores mined from the Ohio Company's ore body. The company plans to continue the two operations, and will immediately commence to develop and mine any ore reserves indicated by the Bureau of Mines explorations.

Power

Electric power for operation of compressor and hoisting equipment can be obtained from the Utah Power and Light Company.

Work Proposed by Bureau of Mines

The zone of fissuring on the Utah Copper drift appears to be the zone which passes through the Mayflower limestone on the Montana-Bingham property. Here lead-zinc ore bodies have been mined in the Mayflower limestone. The Commercial limestone is a larger and less siliceous bed than the Mayflower, and in other sections of the district has been more susceptible to replacement by mineralizing solutions than the Mayflower.

It appears that the intersection of the zone of siffuring with the Commercial limestone is a favorable horizon for replacement ore bodies. Exploration of the intersection of the fissured zone with the Commercial limestone can be accomplished by a combination of crosscutting and diamond drilling. Rehabilitation of a section of the 700 level, retimbering part of No. 2 shaft, and installation of equipment at No. 2 shaft, will first be necessary.

The Copper fissures comprising the zone on the Utah Copper drift of the Mascotte Tunnel level have been projected a long distance to the east then down to and below the 700 level. The projections were made from the observed strikes and dips. A few of the fissures as projected to the 700 level, pass out of a zone comparable to the width of the zone on the Mascotte Tunnel level. However, they may hange in strike and dip so the zone at the 700 level and below may be similar to that shown on the Utah Copper drift. The total footage of proposed cross-cutting will depend upon the number of fissures encountered. The minimum distance will probably be about 250 feet, and the maximum distance will probably be about 600 feet. A sufficient number of fissures should be cut so that a drilling program below the 700-foot level can be planned. The position and number of diamond drill holes will depend upon the attitudes of the fissures encountered in the cross-cut.

Preliminary estimates of the cost of the proposed exploration are as follows:

Repair of present equipment and installation of additional equipment at No. 2 shaft	$ 1,600
Rehabilitation of 500 feet of drifts on 700-foot level.	3,500
Crosscutting 600 feet @ $20 per ft.	12,000
2,000 feet of diamond drilling below 700-foot level @ $3.50 per ft.	7,000
Supervision and sampling	2,000
Travel	700
Supplies and contingencies	1,000
Total	$27,800

In addition to the above cost, an estimated $8,500 will be required for purchase of equipment for No. 2 shaft. It is probable that the Ohio Copper Company will arrange to purchase this equipment with company money.

The total footage of necessary rehabilitation on the 700-foot level may be as much as 700 feet but probably will be much less. Two to three hundred feet of the drifts may require little, if any, rehabilitation. However, it is also possible that the cost may far exceed the estimate because more difficult conditions than anticipated may be encountered.

The maximum footage of crosscutting was used in estimating the total costs. This footage and cost may be much less, depending upon the conditions exposed in the work. The footage of diamond drilling will depend upon geologic conditions exposed in the crosscut. It may be as much as 2,000 feet.

Conclusions and Recommendations

1. A possibility exists based on geologic inference and the recorded productivity of various ore-bearing horizons that important ore bodies may occur at the intersection of a strong zone of fissuring with the Commercial limestone horizon.

2. The projected zone of fissuring has been productive in the Montana-Bingham ground in the Mayflower limestone about 1,200 feet stratigraphically higher in the geologic column.

3. Between 500 and 700 feet of drift must be rehabilitated and about 600 feet of new crosscuts completed before core drilling can be started. This large amount of dead work is the principal cost item in the proposed exploration program.

4. It is recommended that exploration be undertaken if metal shortages become so critical as to warrant exploration based on such limited data.

