

SUMMARY REPORT
CONNORS AREA, JAMAICA

INTRODUCTION

The disseminated copper occurrence in the Connors area was discovered in the regional geological-geophysical-geochemical program carried out by Jamaica Copper and Iron Ltd. during 1956. The deposit was indicated by both self-potential and geochemical soil sampling. Preliminary geological follow-up outlined an area of fractured and hydrothermally altered intrusive rocks adjacent to a small granodiorite pluton. A limited amount of diamond drilling was carried out. The grade of copper indicated by the drilling appeared to be too low to be of interest at that time.

Renewed interest in the economic possibilities resulted from the increase in the price of copper and from a new interpretation of the drilling data. These considerations suggested that additional drilling was warranted.

The writer carried out approximately two weeks of detailed geological mapping during July 1967 in order to obtain additional data on which to base the drilling program.

The present report discusses the surface geology of Connors area and contains a re-evaluation of the earlier data.

LOCATION AND ACCESS

Connors area lies in the Parish of St. Catherine, near the center of the island of Jamaica. It is accessible by all-weather "Main Road" from Kingston, which lies 35 miles to the east.

PREVIOUS WORK

The original reconnaissance work carried out by Jamaica Copper and Iron Ltd. in the Bellas Gate region of the Central Inlier included geological, aeromagnetic, ground magnetic, self-potential, resistivity, and geochemical surveys. Geological mapping and detailed self-potential, resistivity, electromagnetic and geochemical surveys were carried out over the Connors anomaly area.

During 1959 six short diamond drill holes were put down by Jamaica Copper and Iron Ltd. Total drilling in this program amounted to 1,247 feet. An angle hole 900 feet in length was drilled from the west beneath the anomaly area in 1961. At about the same time stream sediment sampling was carried out.

American Smelting and Refining Co. took an option on the property including the Connors area during 1963 and 1964. Their work included reconnaissance geological mapping and induced polarization testing along widely-spaced lines. They also carried out a limited amount of diamond drilling about a mile from Connors area.

DISCUSSION OF THE RESULTS OF PREVIOUS WORK

The mineralized area at Connors was strongly indicated by both the geochemical soil sampling and the self-potential survey. The geochemical work outlined a roughly circular area approximately 600 feet in diameter in which soil-copper values were in excess of 3,000 parts per million. The self-potential anomaly area corresponded quite closely to the area of anomalous copper values. The self-potentials were not particularly strong but the anomaly is very well defined. The outer limits are taken at the minus 40 millivolt contour. Values below 100 millivolts occur in two separate localities east and west of the road.

A weak magnetic anomaly over the mineralized area is indicated by the reconnaissance survey. Magnetite was observed in the outcrop in narrow veins and fine disseminations. Moderate to strong magnetic anomalies occur over the copper orebodies in Puerto Rico, caused by disseminated magnetite apparently formed during a late stage of alteration.

The detailed resistivity and electromagnetic surveys fail to give any indication of a mineralized zone. The resistivity survey indicates the presence of a poor conductor in the vicinity of the altered intrusive. The electromagnetic ("Long Wire") survey shows a complicated pattern which does not appear to correlate with the known geology.

The initial diamond drilling was carried out within the strongest part of the self-potential anomaly area. Six holes were drilled. They indicated an oxidized capping to a depth of from 60 feet to 106 feet, overlying a thin zone of secondary enrichment. Only four of the holes continued much beyond the enriched zone. The oxidized zone appears to contain a substantial amount of copper (0.2% to 0.5%) but reliable data are lacking. The results of the drilling are summarized below.

<u>Hole No.</u>	<u>Final Depth</u>	<u>Top of Sulphides Depth in Hole</u>	<u>Elevation</u>	<u>Enriched Zone (% Cu/core length)</u>	<u>Primary Zone (% Cu/core length)</u>
1	243'	106'	1,325'	1.33/31.5'	0.65/105.5'
2	271'	100'	1,310'	1.34/26'	0.70/143'
3	224'	104'	1,347'	1.02/14'	0.36/106'
4	254'	70'	1,302'	1.50/18'	0.85/166'
5	98'	60'	1,312'	1.51/26'	-
6	157'	98'	1,295'	1.92/22'	-

Copper values in the zone of supergene enrichment are about double those in the underlying primary material. Average copper grade is 0.67% for the primary zone and 1.45% for the secondary zone. The latter has an average thickness of 23 feet. No molybdenum analyses were carried out.

Diamond drill hole 3 is located near the northern edge of the strongest part of the geochemical anomaly. The alteration appears to be weaker north of this locality. The average primary grade in the other holes cutting the primary zone is 0.75% copper.

Diamond drill hole 7 was intended as a cross section of the mineralized area. The best copper section in this hole, from 400 feet to 585 feet, assayed 0.45% copper. In the last 285 feet the grade dropped abruptly to 0.04%.

Surface mapping indicates that the copper mineralization occurs in hydrothermally altered intrusive rock. Drill hole 7 is logged as mainly volcanic rock; the very low grade section at the bottom is described as mostly welded tuff. Since the core from all of the drilling has been lost, this could not be verified.

The work by the American Smelting and Refining Co. geologists and geophysicists was not sufficiently detailed to add much to the picture. Two induced polarization profiles cross the Connors area. The strongest anomaly obtained in this work correlates well with the self-potential "low" west of the road. Above average induced polarization values occur across the entire mineralized zone, including the section underlain by hydrothermally altered and pyritized volcanic rocks.

TOPOGRAPHIC SURVEY

We were unable to locate any of the markers used in previous transit surveying. Accordingly control lines were laid out with a transit using the collar of drill hole 1 as a starting point. The lines were run north, south, east and west of the drill hole; a transit survey also was carried out along the portions of Rock River and Sian River within the Connors area. The surveying was done by Henry Bell who previously had been employed by Jamaica Copper and Iron. For some reason his work turned out to be quite inaccurate and most of the stations were re-checked using an Abney level and tape.

Surveying in the remainder of the area was carried out by the writer in conjunction with the geological mapping. Control for the stations was established with Brunton compass, Abney level and tape. The local accuracy of the surveying is of the order of one or two feet horizontally and vertically and should be sufficiently good for the requirements of the detailed geological map and in planning further work.

The survey stations are numbered on the map and on the ground. Only three of the drill hole collars were located accurately - viz. DDH 1, DDH 3 and DDH 7. The other drill hole locations are approximate and are located near the following stations: DDH 2 at G-31; DDH 4 & 5 at G-32; DDH 6 at G-44.

GEOLOGY

The region surrounding Connors area is underlain by a thick volcanic pile of probable Late Cretaceous age. The rocks are andesitic in composition and consist mainly of tuff and tuff Breccia with subordinate amounts of lava. The pile has been

intruded by an elongated stock of granodiorite (Connors pluton) and by fairly numerous dikes, some of which appear to be contemporaneous with the volcanic rocks.

Tangential to the south margin of the Connors pluton but of much greater extent is a northwest-trending zone of hydrothermal alteration. The volcanic rocks have been partially silicified and a considerable amount of pyrite has been formed, probably from the ferromagnesian minerals and magnetite. The original textures of the volcanic rocks generally are retained. The appearance of the surface rocks may be modified considerably by the oxidation products of pyrite. The hydrothermally altered volcanic rocks do not contain anomalous amounts of copper at most of the localities examined.

In the vicinity of Connors, hydrothermally altered and mineralized intrusive rocks occur along the south margin of the Connors pluton. Part of the altered rock is identical in texture to the equigranular granodiorite of the pluton. Altered porphyritic rock also occurs which resembles the porphyritic intrusive rock which crops out south of the Connors area.

The altered intrusive rock has been highly fractured, the fracture planes forming a three dimensional network. No particularly strong direction of fracturing was noted in the preliminary mapping. Sulphide minerals occur along the fractures and are disseminated throughout the rock.

I have not examined the drill core and have had to rely mainly on deeply-weathered surface exposures in evaluating the alteration and mineralization. The tropical weathering has modified drastically the hydrothermal alteration products. At surface the rock is composed mainly of silica, clay minerals, "sericite" and the weathering products of the sulphide minerals. The colour of the surface material is

light gray mottled with browns and reds. The original texture of the rock has been retained sufficiently well to permit the separation of volcanics and intrusives, but I was unable to separate the types of intrusive rock in the most intensely altered portion of the area.

The porphyritic intrusive rock is exposed in isolated outcrop in the southern portion of the map area. This rock contains sparse feldspar phenocrysts in a holocrystalline, medium-gray groundmass. The exposures examined have been hydrothermally altered, generally weakly to moderately. Intensity of alteration increases to the northwest toward the main geochemical-geophysical anomaly area. A sample of strongly altered but less weathered rock which is probably porphyritic intrusive crops out in a small stream at G-6 (1375N, 2404E). A sample of this material, which contains chalcocite and minor chalcopyrite, assayed 0.60% copper.

The preliminary mapping suggests that the main mineralized area occurs at the junction between the Connors pluton and a (later?) porphyritic dike or dikes. It also is closely related spatially to the throughgoing zone of fracturing represented by the hydrothermal alteration in the adjacent volcanic rocks.

A line indicating weaker alteration in the main portion of the mineralized area is shown on the accompanying map. This isograd only approximate due to the modifying effects of weathering,

The weathered bedrock is covered in most of the Connors area by landslide and stream terrace deposits. Residual soils have been included with bedrock on the accompanying map wherever the underlying material could be located with a three-foot augur. In parts of the area residual soils have not been differentiated from landslide material.

DISCUSSION OF THE ECONOMIC POSSIBILITIES

Only a small part of the mineralized area at Connors has been tested by drilling to a comparatively shallow depth. The grade indicated by this drilling is quite low. Furthermore the area of interest appears to be too small to contain a really large deposit. The purpose of any further work should be to determine as economically as possible whether a minimum-sized deposit is likely to occur. On the basis of available information this minimum size is of the order of 25 million tons, but a somewhat smaller tonnage, say 15 million, may be acceptable with a combination of favourable circumstances. These favourable factors, which cannot be assessed at this time, are discussed below.

1. The deposit may contain metal values other than copper which have not been determined by previous assaying. Molybdenum has been identified in geochemical analysis. Gold and silver may also occur in small quantities.
2. The pyrite content of the deposit may be saleable in Jamaica. Phelan Sulphur Company of Houston, Texas has expressed an interest in the pyrite for local production of sulphuric acid for an unstated use.
3. The overlying oxide portion of the deposit contains a substantial amount of copper which should be readily available for leaching. It may also be profitable to leach the lower grade primary material surrounding the deposit.
4. The zone of supergene enrichment appears to contain about twice as much copper as the deposit as a whole. This will be mined in the early stages and will help to repay the capital expenditure at a fairly early stage.

5. The Government of Jamaica is favourably inclined toward foreign investment. As the first producer of copper on the island, the company would be entitled to substantial tax relief. It is not unlikely that total freedom from income and other taxes could be negotiated for a period of five years.

The minus 40 millivolt self-potential contour closely follows the contact of the hydrothermally altered rock in the northern part of the area. Obviously this cannot be used as an outline of the deposit but it is useful as an indicator. This contour encloses an area which contains approximately 20 million tons of material to a depth of 500 feet. The detailed geological mapping indicated that favourable conditions continue to the southeast over an area which may be nearly equal in size. The lack of a self-potential anomaly there is unfavourable, but may be the result of the water-table conditions.

Diamond drill hole 7 encountered barren material at depth below the center of the main deposit. The barren material was logged as volcanic rock, including ignimbrite. This suggests that the contact with the mineralized and altered intrusive rocks may dip to the east. This possibility should be tested by diamond drilling.

PROPOSAL FOR DIAMOND DRILLING

The preliminary diamond drilling program is intended to determine whether the minimum tonnage objective could be present in the area. Obviously a great deal of additional drilling will be necessary to prove up the deposit.

Four drill holes are proposed. The first three form a cross section of the main portion of the Connors deposit. The fourth hole is a preliminary test of the indicated extension of the deposit to the southeast. The final hole should be drilled

only if sufficient encouragement is obtained in the first three holes to suggest that the minimum tonnage might be obtained by an extension in this direction.

The proposed depth of each hole is 700 feet. This may be varied according to the results obtained. All of the holes are vertical.

The first hole in the proposed program is located at 1900N, 1600E. It is intended as a test of the self-potential and induced polarization indications east of the road. This portion of the area is covered by alluvium and has not been tested previously.

The second hole is located at 1900N, 2000E. It is the first test at depth of the area in which the earlier drilling was carried out.

The third hole is located at 1900N, 2200 E in a portion of the area covered by alluvium. In the event that unaltered granodiorite is encountered at the sub-outcrop this hole will test the possible easterly dip of the mineralized zone.

The fourth hole is located at 1400N, 2400E. It is intended to test the indicated extension of the mineralized intrusive to the southeast. Since this portion of the area has a substantially thinner cover of weathered and oxidized material it is possible that greater economy and efficiency could be achieved by drilling several shallow holes with a small drill. This work could be carried out at the same time as the drilling to the north, with the same supervisor. A "Winkie" drill can be rented from one of the drilling contractors in Jamaica.

The cost of the proposed drilling program cannot be estimated closely since the local contractors operate on a cost plus basis. However, if a first-rate foreman can be obtained the cost should not exceed ten dollars per foot. The minimum program of three holes should be completed in about two months from arrival of the drill on the property.

Respectfully submitted

W. R. Bergey

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