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MINES BRANCH INVESTIGATION REPORT IR 65-88

MINERALOGICAL INVESTIGATION OF COPPER CONCENTRATES FROM GASPE COPPER MINES LIMITED, MURDOCHVILLE, QUEBEC

by

W. PETRUK

MINERAL SCIENCES DIVISION

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SUMMARY OF RESULTS

Four samples of copper concentrates prepared from the Gaspe copper ore were studied in order to identify the minerals and determine their quantities. The minerals were identified by means of the X-ray diffractometer and their quantities were calculated from chemical analyses. The results show that the samples are composed of 66.5 - 85.7% chalcopyrite, 0.5 - 3.1% quartz, 4.4 - 7.9% oligoclase, 0.0 - 5.9% diopside, 0.3 - 4.8% wollastonite and 1.0 - 2.3% calcite.

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INTRODUCTION

Four samples of copper concentrates prepared from the Gaspe copper ore were received by the Mines Branch from A.G. Balogh, Metallurgist, Gaspe Copper Mines Limited, Murdochville, Quebec on May 28, 1965. In a covering letter, Mr. Balogh stated that he had been investigating some properties and characteristics of the concentrates and this had led him to suspect that their refractory nature is related to their mineralogy. He therefore requested that the predominant minerals be identified and their quantities determined. For this purpose he provided a partial chemical analysis of the samples and a list of the more common minerals in the Gaspe ore body. These minerals were reported to be wollastonite, diopside, oligoclase, grossularite, scapolite, quartz, chalcopyrite, bornite and pyrite. The samples received consisted largely of -325 mesh material, and were labelled Sample No. 1, Feb. 12, 1964; No. 2, Mar. 22, 1965; No. 3R, Apr. 12, 1965; and No. 4R, Apr. 25, 1965.

METHOD OF INVESTIGATION

The samples were split and one half were separated into gravity sink and float fractions by means of a heavy liquid having a specific gravity of 3.33. The resulting fractions were scanned with the X-ray diffractometer and the minerals identified. The results showed that the separations were incomplete and the gravity sink and float fractions could not be used for determining the quantities of minerals in the samples. Quantitative mineralogical analyses by means of the X-ray diffractometer were then made on the other halves of the samples.

The CO_2 content of each sample was determined chemically and the mineralogical compositions of the samples calculated from the chemical analyses.

RESULTS OF INVESTIGATION

All the samples were found to consist largely of chalcopyrite with lesser amounts of quartz, feldspar, pyroxene, and calcite. In addition a small amount of mica was observed in sample No. 2

The X-ray diffractometer patterns suggest that trace amounts of amphibole, dolomite, chlorite, magnetite and pyrite are also present, but this could not be confirmed by optical methods.

The approximate quantities of quartz were determined by means of X-ray diffractometer (see Table 2). The quantities of the other minerals could not be obtained by this method because their X-ray

diffractometer peaks were too weak for accurate measurements. In general, diffractometer analyses cannot be made on feldspar and pyroxene unless they are present in quantities greater than 10 per cent and analyses for calcite cannot be obtained unless it is present in quantities greater than 3 per cent.

TABLE I

Chemical Compositions of Samples

(wt. %)

Sample No.	Cu	Fe	S	SiO_2	Al_2O_3	MgO	CaO	CO_2	Total
1	29.5	28.3	31.0	5.3	1.0	---	1.8	0.5	97.4
2	27.6	27.6	29.5	7.8	1.2	0.5	4.2	0.8	99.2
3R	22.9	26.5	26.6	13.8	1.8	1.1	5.3	1.0	99.0
4R	26.2	26.4	28.0	10.2	1.4	1.0	3.2	1.0	97.4

Note: All the chemical analyses except those for CO_2 were supplied by A. G. Balogh, Gaspe Copper Mines Limited. The CO_2 analyses were determined in the Analytical Chemistry Sub-division, Mineral Sciences Division, Internal Report MS-AC-65-809.

TABLE 2

Quartz Contents of Samples

(determined by X-ray diffractometer)

Sample No.	Quartz Contents (wt. %)
1	1
2	3
3R	5
4R	5

In order to determine the approximate mineralogical compositions of the samples the quantities of each mineral were calculated from the chemical analyses given in Table 1. The calculations were made as follows:

1. All the Cu and appropriate amounts of Fe and S were calculated as chalcopyrite ($CuFeS_2$).

2. The excess Fe and S are assumed to be present as a sulphide and FeO, but are given only as excess Fe and excess S.

3. All the CO_2 and appropriate amounts of CaO were calculated as calcite ($CaCO_3$).

4. All the Mg and appropriate amounts of CaO and SiO_2 were calculated as diopside ($CaMgSi_2O_6$).

5. All the Al_2O_3 and appropriate amounts of SiO_2, CaO and Na_2O (assumed to be present) were calculated as oligoclase (80% $NaAlSi_3O_8$ and 20% $CaAl_2Si_2O_8$).

6. The remaining CaO and appropriate amounts of SiO_2 were calculated as wollastonite ($CaSiO_3$).

7. The remaining SiO_2 was assumed to be present as quartz (SiO_2).

The results of the calculations are given in Table 3.

TABLE 3

Calculated Mineralogical Compositions of Samples

Sample No.	Chalco-pyrite	Excess Fe	Excess S	Calcite	Diopside	Wollas-tonite	Oligoclase	Quartz
1	85.7	2.2	0.9	1.0	---	2.1	4.4	1.4
2	80.2	3.2	1.3	1.7	2.7	4.8	5.2	0.5
3R	66.5	6.3	3.2	2.3	5.9	4.6	7.9	3.1
4R	76.1	3.2	1.3	2.3	5.4	0.3	6.1	3.0

No confidence limits can be placed on the calculated values except that quartz contents fall within the limits of analytical error of the values obtained by X-ray diffractometer.

CONCLUSIONS

Two samples labelled 3R and 4R contain more quartz, oligoclase, diopside and calcite than the other samples. Assuming these samples to be the refractory ones, it is not clear from a mineralogical evaluation alone which of these minerals, or combinations of minerals, is chiefly responsible for the refractory nature of the concentrate.

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