

Dr. K. W. Downes

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MINES BRANCH INVESTIGATION REPORT IR 63-61

**MINERALOGICAL REPORT ON A BULK
FLOTATION CONCENTRATE FROM GIANT
YELLOWKNIFE MINES LIMITED,
SUDBURY DIVISION**

by

M. R. HUGHSON & S. KAIMAN

EXTRACTION METALLURGY DIVISION

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FROM GIANT YELLOWKNIFE MINES LIMITED,
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M. R. Hughson* and S. Kaiman**

SUMMARY

Chalcopyrite, pyrite and sphalerite are the most abundant sulphide minerals in a bulk flotation concentrate. Smaller amounts of galena, pyrrhotite and marcasite are present. The minerals are intimately intergrown with each other; in the minus 270 plus 325 mesh fraction approximately half of the pyrite and sphalerite and one quarter of the chalcopyrite occur in intergrowths.

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Scientific Officer and Head, Mineralogy Section, Extraction Metallurgy Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

INTRODUCTION

A fifteen pound sample of a bulk flotation concentrate from the Sudbury Division of Giant Yellowknife Mines Limited was received by the Extraction Metallurgy Division on April 4, 1963 and was assigned our reference number 4/63-4. A 40 gram sample of the concentrate was submitted to the Mineralogy Section for determination of the metallic mineral composition. Also a possible explanation was to be sought for the difficulty in effecting a selective flotation of the metallic minerals.

The Company reported that chemical analyses of the bulk flotation concentrate gave the following results: Cu = 9.36%, Pb = 3.71%, Zn = 12.12%, Fe = 22.97% and S = 32.16%.

PROCEDURE AND RESULTS

The sample was washed with alcohol and ether to remove residual flotation reagents, wet screened at 325 mesh, and the plus 325 mesh material was dry screened. The results of the screen analysis are shown in Table 1.

TABLE 1

Screen Analysis

Size Fraction	Wt, grams	Wt, %
+ 65 mesh	0.96	2.4
- 65+100 "	1.94	4.9
-100+150 "	2.81	7.1
-150+200 "	5.01	12.7
-200+270 "	2.94	7.4
-270+325 "	2.81	7.1
-325 "	23.08	58.4
Total	39.55	100.0

To determine the metallic mineral composition a numerical count was made by traversing four polished sections of minus 270 plus 325

mesh material with a Swift automatic point counter. The results of the numerical count given in Table 2, show that the major metallic minerals are pyrite, chalcopyrite and sphalerite; the minor metallic minerals are galena, pyrrhotite, and marcasite; and the trace metallic minerals are magnetite and hematite. Non-metallic minerals constitute approximately 3 per cent of the sized fraction of concentrate.

The metallic minerals are commonly intergrown with each other. In order to determine the proportion of each metallic mineral which occurs as fine particles intergrown with other metallic minerals, a further point count was made of two polished sections of minus 270 plus 325 mesh material (55 to 43 microns). The results are presented in the second column of Table 3 which shows the frequency of occurrence of each metallic mineral as free grains and as intergrowths. By combining the results of both point count analyses the distribution of the metallic minerals in the sized fraction was calculated as is shown in the last column of Table 3.

By comparing the figures in the last columns of Tables 2 and 3 it is seen that approximately one half of the pyrite and sphalerite and one quarter of the chalcopyrite occur in intergrowths. In all, approximately 60 per cent of the metallic mineral content occurs as uncombined grains and the remainder as intergrowths. Approximately two-thirds of the intergrowths consist of two of the three most abundant metallic minerals, pyrite, chalcopyrite and sphalerite, and approximately one-sixth of the intergrowths (6 per cent of the metallic mineral content) consists of more than two metallic minerals.

TABLE 2

Metallic Mineral Composition
Minus 270 Plus 325 Mesh Size Fraction

Mineral	Specific Gravity	Counts	Wt, %
Pyrite	5.0	1195	37
Chalcopyrite	4.2	1410	36
Sphalerite	4.0	891	22
Galena	7.6	72	3
Pyrrhotite	4.6	35	1
Marcasite	4.9	29	1
Magnetite and Hematite	--	--	Trace
Totals		3632	100

TABLE 3

Distribution of Metallic Minerals in -270+325 Mesh Sample

Type of Occurrence	Count	Wt, %
Free chalcopyrite	596	27
" pyrite	353	19
" sphalerite	236	12
" galena	20	2
" marcasite	9	1/2
" pyrrhotite	7	1/2
Intergrown pyrite-sphalerite	260	14
" pyrite-chalcopyrite	172	8
" chalcopyrite-sphalerite	111	5
" sphalerite-galena	47	3
" pyrite-galena	20	}
" chalcopyrite-galena	24	
" chalcopyrite-pyrrhotite	12	
" chalcopyrite-marcasite	5	
" pyrite-pyrrhotite	4	
" sphalerite-pyrrhotite	4	
" sphalerite-marcasite	1	3
Intergrowths of more than two metallic minerals	120	6
Totals	2001	100

DISCUSSION AND CONCLUSIONS

Pyrite, chalcopyrite, sphalerite, galena, pyrrhotite, marcasite, magnetite and hematite were identified in a flotation concentrate from Giant Yellowknife Mines Limited (Sudbury Division). Pyrite, chalcopyrite, and sphalerite together comprise approximately 95 per cent of the metallic minerals present in the size fraction studied.

The extent of the intergrowth of the metallic minerals in the fine sized product investigated indicates that efficient concentration of the individual sulphide minerals by selective flotation would probably not be practicable.

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