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CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 60-1

THE DISTRIBUTION OF THE NIOBIUM CONTENT BETWEEN LIGHT AND HEAVY FRACTIONS IN ORE SAMPLES FROM QUEBEC COLUMBIUM LIMITED, OKA, QUEBEC

by

E. H. NICKEL

MINERAL SCIENCES DIVISION

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INTRODUCTION

As a result of beneficiation tests on niobium ore from Oka, Quebec, it has been found that pyrochlore and niocalite--the principal niobium-bearing minerals in some of the deposits--respond differently to selective flotation (Mineral Sciences Division Internal Report MS-59-11, by E.H. Nickel). It is therefore important to know the proportion of niocalite in samples undergoing ore dressing tests. This report outlines the method used for determining the amount of niocalite in this type of niobium ore, and gives the results of this method as applied to two samples submitted for this purpose by Mr. Stephen B. Bond, Manager, Quebec Columbium Limited, Oka, Quebec. A request for this determination is contained in a letter from Mr. Bond dated November 26, 1959 (see Appendix). The samples, labelled "1" and "2", consisted of crushed diamond drill core, and weighed about 4 lb each.

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PROCEDURE

Both samples were crushed separately to -28 mesh. Smaller samples were then cut from both lots for a head niobium analysis and for the separation procedure outlined below. The samples for separation were then crushed to 100% minus 65 mesh, care being taken during the crushing to minimize the production of slimes. Microscopic examination showed that, at this size, liberation of the mineral components was essentially complete.

If a complete separation of niocalite and pyrochlore could be effected, analysis of the separated fractions would give the distribution of the niobium with respect to these minerals. Since there is a considerable density difference between niocalite and pyrochlore, a gravity separation should be able to effect the desired separation. Heavy liquid separations were therefore made on the samples by means of Clerici solution with a density of 3.7, which is between that of niocalite (3.3) and pyrochlore (4.2). The separation of the + 325 mesh material was done in standard separatory funnels, while the -325 mesh material was separated in a centrifuge. After completion of the separation, the + 325 mesh and -325 mesh portions were recombined for analysis. Examination of the products under a petrographic microscope showed that the separation had been successful, ie that essentially all the niocalite was in the float fractions, and the pyrochlore was in the sink fractions.

The sink and float products of both samples were then analyzed spectro-photometrically for niobium, using the thiocyanate method. The analyses were performed by R.C. McAdam of the Analytical Chemistry Section of the Mineral Sciences Division.

RESULTS OF INVESTIGATION

The results of the heavy liquid separations and the chemical analyses are given in Table 1.

TABLE 1

Niobium Distribution in Sink and Float Fractions Obtained from the Heavy Liquid Separations at a Density of 3.7

	Wt %	% Nb_2O_5	Nb_2O_5 Distribution
Sample 1			
Float	95.6	0.38	47.6 %
Sink	4.4	9.10	52.4
Head (calculated)	100.0	0.76	100.0
" (analyzed)		0.77	
Sample 2			
Float	93.5	0.29	42.3 %
Sink	6.5	5.70	57.7
Head (calculated)	100.0	0.64	100.0
" (analyzed)		0.67	

These results show that both samples have a similar distribution of niobium in their sink and float fractions, which indicates a similar proportion of niocalite in both samples.

The total amount of niobium in the sink fraction cannot be attributed only to pyrochlore, because, on the basis of microscopic examination and X-ray diffraction analysis, appreciable amounts of perovskite are present in the sink fractions of both samples, and previous work on niobium ore from this area has shown that the perovskite can contain a significant amount of niobium (Investigation Report MD 3116 of the Mineral Dressing and Process Metallurgy Division, by E.H. Nickel). X-ray diffraction analysis indicates that sample 2 contains more perovskite than sample 1.

CONCLUSIONS

An investigation of the two samples of niobium ore has shown that nearly one-half of the niobium occurs in the form of niocalite. In sample No. 1, 47.6% of the niobium is present as niocalite, and in sample No. 2, niocalite accounts for 42.3% of the niobium.

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APPENDIX

QUEBEC COLUMBIUM LIMITED
Oka, Quebec
Canada

November 26, 1959

Dr. A.T. Prince,
Dept. of Mines and Technical Surveys,
Mineral Sciences Division,
555 Booth Street,
Ottawa, Ontario.

Dear Dr. Prince:

Enclosed are the two samples of Oka, Bond Zone ore, which I discussed with you by telephone yesterday, and which you agreed to have tests run for the percentage of Cb_2O_5 due to the niocalite content of the ore.

Thank you very much for helping us out in this manner and we are looking forward to receiving the results.

Kind regards,

Sincerely yours,

Stephen B. Bond, mgr.