EVALUATION OF FELDSPAR TAILINGS BY FLOTATION

Feldspar Tailings Report No. 5 - April 1969 Progress Report

Lab Nos. X & T - Book 246

by
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Introduction

In evaluating the tailings samples in the Bureau of Mines project, it was necessary to determine the mineral composition. The most direct and most feasible method on hand was to make use of the different reactions of the various minerals to a flotation process.

A standard procedure was devised for each tailings stream, and applied to the daily, weekly and composite samples (See Feldspar Tailings Report No. 2 in December 1968 Progress Report). It later became apparent that some samples did not respond favorably to this procedure.

Part of this report deals with the investigation of one outstanding stream, Feldspar Corporation's coarse tailings. Since about May of 1968, it had proved virtually impossible to produce a feldspar of grade (total alkali of 10.5 percent and Al_2O_3 of 19 percent) from this plant stream. An effort was made to determine why this sample proved so difficult to beneficiate.

The other part of this report deals with adaptation of a different procedure to the composite material. This work was performed on the overall composite, composite of the weekly composite, of the three feldspar plants. This procedure involved only a two step flotation versus a three step flotation as used previously.

Sample Identification

Sample No. X - This sample represents a composite of the weekly samples collected at Feldspar Corporation. The specific stream was the coarse tails (See Feldspar Tailings Report No. 3, I. H. Redeker, Figure 6).

Sample No. T - This sample represents a composite of all the weekly composites collected at the three feldspar companies. The allotment of percentage was based on the average production of each plant; these figures being supplied by the companies at that time.

Company	Stream	T.P.W. Dry	% Moisture	T.P.W. Wet	% Weight
Lawson	Coarse	1,595	17	1,920	32
Feldspar Corp.	Filter Cake	1,284	18	1,570	26
Feldspar Corp.	Coarse	168	7	180	3
I.M.C.	Filter Cake	829	23	1,070	18
I.M.C.	Coarse	1,169	11	1,310	22
Total		5,045		6,050	100

Procedure

Sample No. X - Since the standard method being used seemed adequate for the removal of mica and iron from this coarse tailing, it was decided not to change this part. Work was therefore concentrated on the feldspar flotation step, and factors affecting it.

Three variables were inspected and altered in an effort to produce acceptable grade. These variables were 1) mesh of grind, 2) amount of HF and 3) amount of Armac-T collector used.

Sample No. T - Since the standard method being used seemed adequate for production of suitable feldspar from the overall composite, this test series was not intended to improve on this step. Instead the object was to investigate a different approach to separation of the mica-iron minerals from the quartz-feldspar, and to see if this different method would adversely affect the feldspar-quartz separation.

Time did not allow the detailed investigation of all variables, and their combinations, therefore certain ones were held constant throughout the test series. Variables investigated during the mica-iron test series were the amount of M-70 collector, and the amount of sulfuric acid.

After the effects were observed and analyzed, various reagent levels were tried on the feldspar-quartz separation. This was done in order to inspect the effects of the mica-iron float on the final feldspar product.

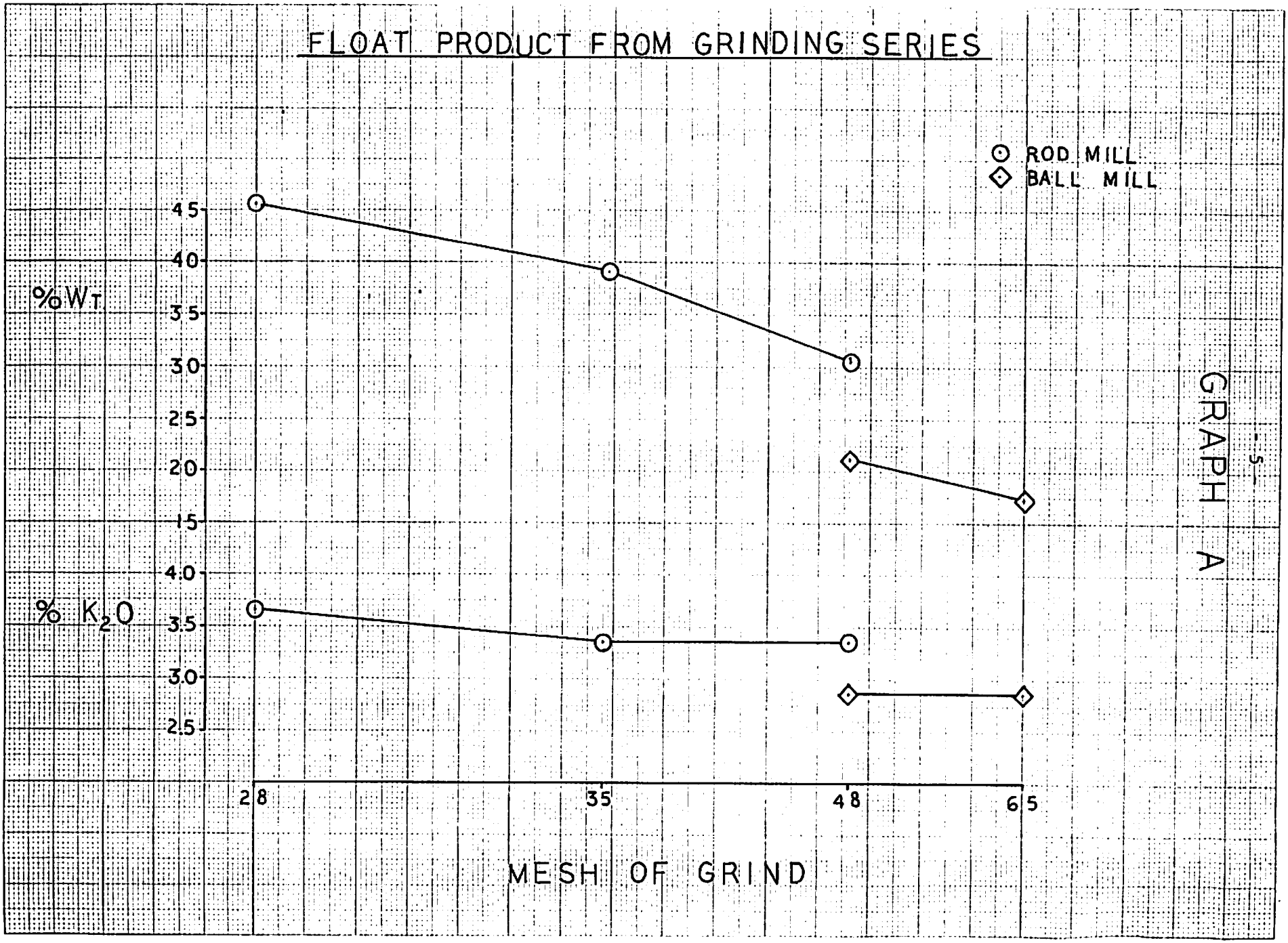
Results

Sample No. X - First observation seemed to indicate that the minerals were not liberated. This was substantiated by the personnel at the producing company. The oversize material was therefore stage-ground, in half-minute intervals, through a specified screen. When all, except clean mica, was thus reduced, the standard procedure was continued.

The unexpected results are shown in Graph A. The results are somewhat facinating in that the K_2O content of the feldspar concentrate went down on finer grinding. It is known that the soda spar weathers preferentially from the pegmatites, and it was therefore postulated that the soda spar would also grind preferentially, leaving a higher potash spar behind. It is not, however, surprising to see the amount of feldspar decrease with finer grinding. Not shown is the fact that the quartz product remained almost constant in weight.

Next the flotation of a sized feed was attempted. A large sample was wet screened on 28, 35, 48, and 200 mesh screens. A sample of each fraction was then subjected to the standard float procedure. Minor reagent adjustments were made on the coarser fraction due to the size. Grade was produced only from the minus 48 plus 200 mesh fraction.

Microscopic studies, in conjunction with the above tests seemed to refute the assumption that the material was not liberated. Therefore, changes in the two main variables, H F and Armac-T collector, were then tried.


FLOAT PRODUCT FROM GRINDING SERIES
ROD MILL
BALL MILL
% WT
45
40
35
30
25
20
15
% K2O
4.0
3.5
3.0
2.5
28
35
48
65
MESH OF GRIND
GRAPH A
-5-

A test series was made using larger quantities of hydrofluoric acid. Hydrofluoric acid is used as an activator for feldspar and a depressor for quartz. With the information from this work a higher H F level was chosen. However grade was still not obtainable.

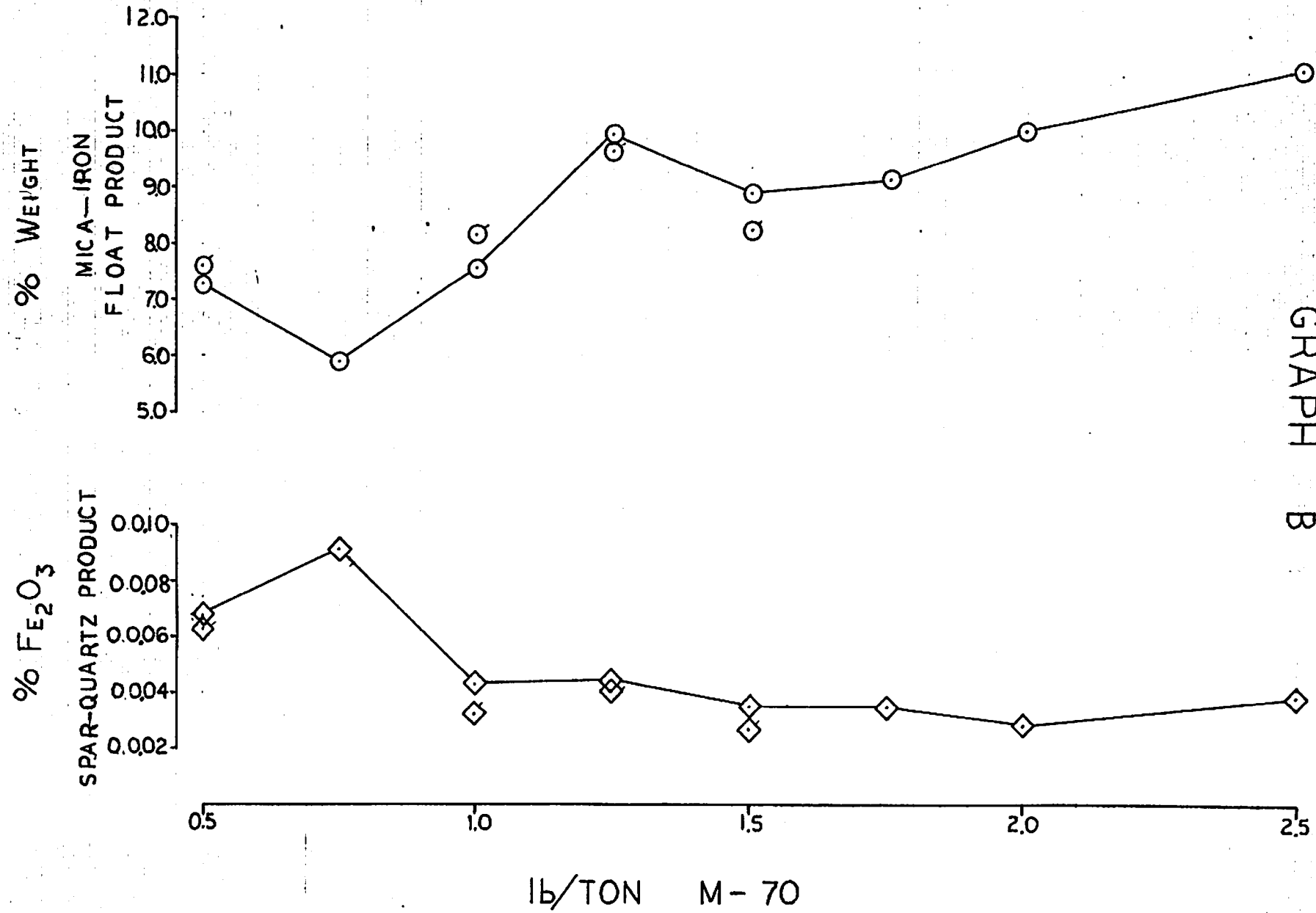
Using the new H F level, the amount of collector for the feldspar was lowered. In the extreme case (Armac-T = 0.05 lb/ton) grade, (percent K_2O plus percent Na_2O = more than 10.5 percent) was produced. But this case appears to be the result of selective flotation of the potash feldspar.

At this point further investigation of these phenomena was halted due to the discontinuation of this method of investigation in the Bureau of Mines Project.

Sample No. T - The major objective of this test work was to lower the Fe_2O_3 analysis of the final product. In order to accomplish this, the two major contributing variables to the mica-iron float were studied. These variables were the amount of H_2SO_4 and the amount of M-70 collector.

The first set of tests involved holding the sulfuric acid level constant, at 1.5 lb/ton, and varying the amount of Morco 70 (M-70) collector. The results (see Graph B) follow the expected pattern. The more M-70 collector used, the more material floated and the lower the Fe_2O_3 analysis of the machine discharge. The major variation seems to be at 0.75 lb/ton M-70, but time did not allow closer investigation of these results. From this information it was decided that 1.25 lb/ton of M-70 collector was enough to ensure

PRODUCTS FROM M-70 SERIES



GRAPH B

sufficient removal of the high-iron and iron stained material. Therefore, study of the effects of the sulfuric acid was undertaken.

It was known from previous test work at the Laboratory that unless the pH was depressed sufficiently, feldspar and quartz would float with the iron minerals.[1] The amount of sulfuric acid in the conditioning step was varied from a high of 2.5 lb/ton to a low of 0.5 lb/ton, with the pH varying from 2.2 to 3.15 respectively. Results, as seen in Graph C, show general aggrement with the expected reactions.

In both the preceding test series it seems apparent that small fluctuations in the reagent level will not cause large variations in the final products.

Subsequent testing in the feldspar float procedure resulted in proposal of the standard procedure shown in Table 1. The results from one test are shown for reference.

Remarks

In the case of Feldspar Corporation's coarse tails (Sample No. X) desired grade has been obtained, but results were not satisfactory for evaluation purposes. The formation of a standard procedure is impossible at this time. At present, this tailings stream represents only a minute part of the overall tailings problem. Available information also indicated that the characteristics of the stream will change when the company installs

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[1] "Flotation of Weathered Silicates" by Dean Van Dyk , paper presented to Carolinas Section of AIME, Gastonia, N.C , May 5, 1967

GRAPH C

PRODUCTS FROM H_2SO_4 SERIES

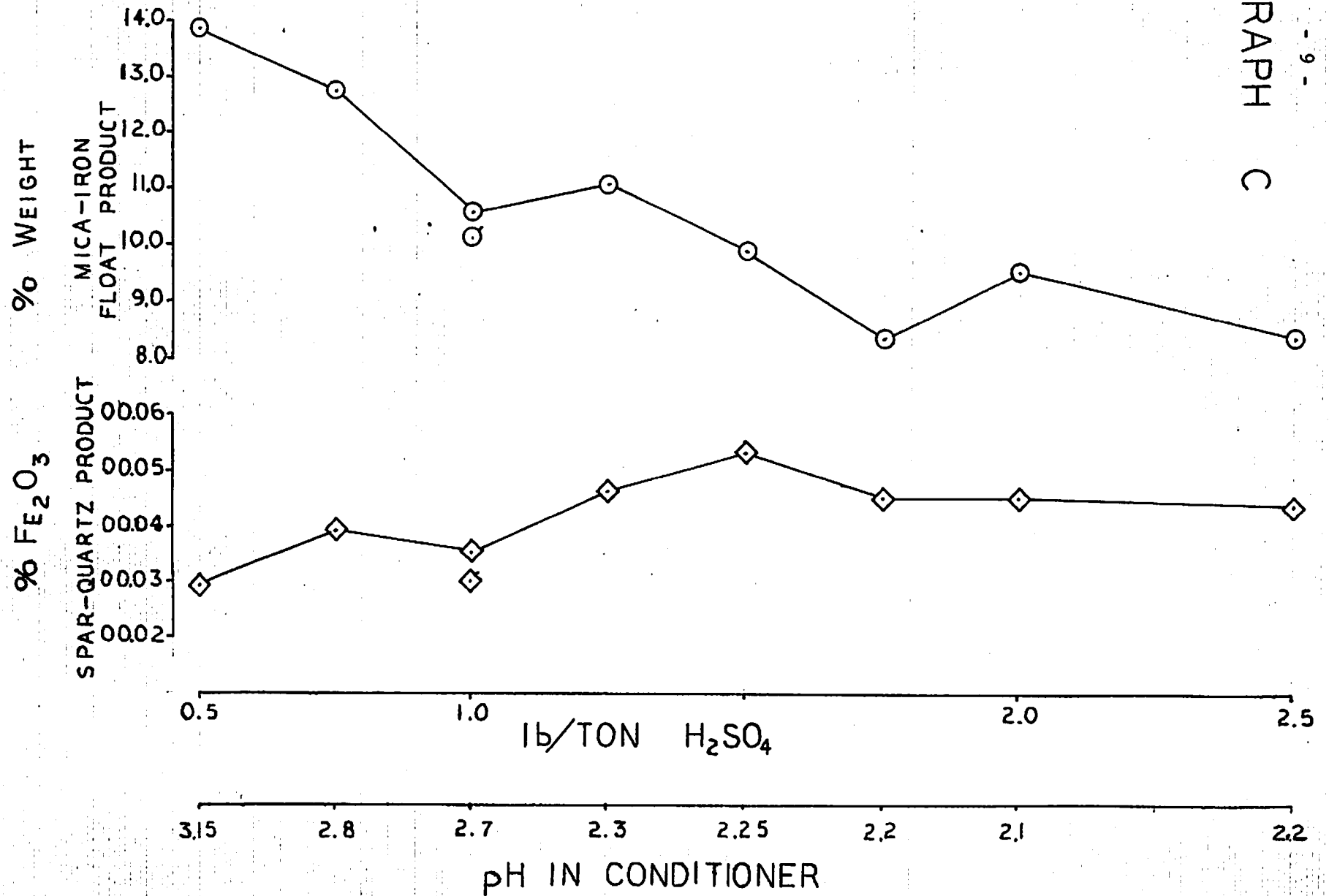

Table 1

ORE DRESSING TEST DATA

Sample No. Composite of weekly composites Test No. T-33

Engineer Edwin H. Bentzen Date

Object of Test Removal of mica-iron material in single float

Product	Assays										Calculated
	Wt. %	Na_2O	K_2O	Fe_2O_3	Al_2O_3	CaO	SiO_2	I.L.			Free Qtz.
-200 mesh slime											
primary	27.3										
secondary	3.8										
+28 mesh mica	0.7										
mica-iron float	10.3										
feldspar float	28.7	6.41	4.50	0.044	19.5	1.40	68.0	0.10			12.1
quartz product	29.2	0.24	0.01	0.11							
Total	100.0										

Process — Reagents (lbs/ton of float feed)

Equipment	Time	% Solid	pH		H_2SO_4	M-70	H-25	HF	Ar-T	NaOH	
grind +28 mesh	1.5										
deslime											
scrub	5	68								2.0	
deslime											
mica-iron cond.	5	59	2.8		0.75	1.25					
" " float	1.75		3.5				0.10				
feldspar cond.	3	51	2.2					1.5	0.12		
" float	1.5		2.9				0.05				

Remarks:

a new addition to their plant. Future investigation of this material should therefore be postponed until the addition has been in operation for a time. If this phenomenon still persists, and the information is warranted by sufficient tonnage, a more detailed and longer investigation could be undertaken. This would include a closer look at the particles involved, as well as procedures affecting flotation.

In regards to the tests on Sample No. T (composite of the weekly composites), the results indicate this procedure can be of use in future tailings evaluation. If the primary information sought is the feldspar content and grade, while other mineral content is incidental information, this method would be quicker, easier, and more flexible.

Speculation has also been advanced that the "mica-iron" float product can be simply separated into a mica product and an iron mineral product. If this can be shown, it too would warrant consideration as a future plant process.