TR4-153-156.
R.351

MOLYBDENITE — MT. STRONACH

CONCENTRATION BY FLOTATION

Sample

Approximately half a ton sample of ore was submitted by Mr. B. A. Farquhar for concentration tests. The molybdenite occurs as small patches in biotite granite. There is a small quantity of chalcopyrite and pyrite associated with the molybdenite.

The sample as received assayed—

	%
Molybdenite	0·39
Copper	0·07
Iron	1·77
Sulphur	0·24
Lead	—
Bismuth	Trace

No responsibility is accepted for the results shown in this report except in so far as they apply to the sample tested. British Standard Screens are referred to in the report.

Summary

1. The ore presents few problems, and production of high grade concentrate of the order of 93-95% MoS_2 is not difficult.

2. Recoveries of over 80% of the MoS_2 in a high grade concentrate were obtained. Three or possibly four stages of cleaning appear necessary.

3. Fine grinding is not necessary, but it appears that the ore should be ground substantially minus 60 mesh.

4. All flotation tests were conducted at natural pH values ranging from 7 to 8.

Sample Preparation

The sample was reduced by jaw crusher and rolls to pass a 10 mesh screen. During crushing the molybdenite flakes tended to flatten out and were difficult to reduce in size.

Investigation

First grade molybdenite concentrate must contain over 80% MoS_2, and preferably over 90% MoS_2. Penalties are incurred for contained bismuth or copper in excess of 0·2% each.

In the sample tested bismuth is present in very small amount and presents no problem.

The copper as chalcopyrite tends to float readily with the molybdenite, and it is necessary to use copper depressants to reduce the copper content to 0·2% or less. Slimes also float readily in rougher flotation, but are apparently controiled by the use of sodium silicate. Biotite mica flakes have a tendency to appear in the molybdenite concentrate, but fortunately in very small amount, as a biotite-molybdenite separation would be difficult.

Test Results *Preliminary Test*

A series of preliminary tests gave the following indications:—

1. High recovery of molybdenite in a low grade rougher concentrate was comparatively easy. Rougher tailings of the order of 0·02-0·05% MoS_2, were obtained.

2. The ore should be ground substantially through 60 mesh, as some molybdenite flakes coarser than 60 mesh were difficult to float and appeared in the tailings.

3. Considerable slimes easily entered the rougher concentrates, and might be due to smearing of slimes with molybdenite during grinding. Use of sodium silicate appears to have reduced this considerably.

4. Chalcopyrite readily floated with the molybdenite, even without xanthate additions. In later tests, sodium cyanide and potassium ferrocyanide appeared to be effective copper depressants, but no attempt has been made to evaluate their effects or to determine optimum usage.

5. Rougher flotation should be as intense as possible to recover the coarser MoS_2 flakes.

Production of high grade concentrates

Test 15 Depression of chalcopyrite.

Grinding.—Batch ground to 9·3% plus 60 mesh and 57·7% minus 200 mesh. Rougher concentrates cleaned three times.

Reagent	lb/ton Ore
Sodium metasilicate	1.13
Sodium cyanide	0.51
Potassium ferrocyanide	0.51
Syntex M	0.023
Frother 52	0.50

	Percent			
Product	Weight	MoS_2	Cu	Dist. MoS_2
MoS_2 concentrate	0.33	93.3	0.19	81.3
Cleaner tailings	0.88	2.4		5.7
Rougher tailings	98.79	0.05		13.0
Composite Head	100.00	0.38		100.0

Test 19

Grinding.—Batch ground to 7·7% plus 60 mesh and 45·5% minus 200 mesh on tailings.

Rougher concentrate cleaned three times.

Reagents	lb/ton Ore
Sodium metasilicate	1.12
Sodium cyanide	0.50
Potassium ferrocyanide	0.50
Syntex M	0.02
Frother 52	0.32

Product	Percent			
	Weight	MoS_2	Cu	Dist. MoS_2
MoS_2 concentrate	0.30	95.6	0.1	77.1
Cleaner tailings	1.59	1.6		7.1
Tailings	98.11	0.06		15.8
Composite Head	100.00	0.37		100.0

Test 20

Grinding.—Batch ground to 8·2% plus 60 mesh and 44·7% minus 200 mesh on tailings.

Rougher concentrate cleaned three times.

Reagents	lb/ton Ore
Sodium metasilicate	1.12
Sodium cyanide	0.50
Potassium ferrocyanide	0.50
Syntex M	0.02
Shell M.I.B.C.	0.16
Fuel Oil	0.16

Product	Percent			
	Weight	MoS_2	Cu	Dist. MoS_2
MoS_2 concentrate	0.29	96.3	0.08	72.8
Cleaner tailings	2.82	1.3		9.3
Tailings	97.89	0.07		17.9
Composite Head	100.00	0.38		100.0

Tests 15, 19, and 20 were all carried out on material that had been given a single batch grind.

In Test 17, outlined below, the ore was stage ground and screened on a 60 mesh screen after each stage. The plus 60 mesh material was returned to the next grind, &c. The final plus 60 mesh material was all ground to pass the 60 mesh screen.

Test 17

Grinding.—Stage ground to pass 60 mesh screen.

Tailings showed 0·2% plus 60 mesh, 44·7% minus 200 mesh.

Rougher concentrate cleaned four times.

Reagents	lb/ton Ore
Sodium metasilicate	1.12
Sodium cyanide	0.52
Potassium ferrocyanide	0.52
Syntex M	0.02
Frother 52	0.22

Product	Percent				
	Weight	MoS_2	Cu	Bi	Dist. MoS_2
MoS_2 concentrate	0.35	93.7	0.20	0.06	87.1
Cleaner tailings	2.57	0.8			5.1
Tailings	97.08	0.03			7.8
Head (comp.)	100.00	0.38			100.0

Bulk Flotation

Bulk flotation of the molybdenite and chalcopyrite using butyl xanthate, sodium silicate and frother 52 resulted in a cleaned concentrate containing about 96% of sulphides with molybdenite 58·4% and copper 10·8% (Test 22).

Sizing Analysis

Tailings Test 19

Fraction B.S. Screen	Weight	MoS_2
+ 60	7.7	0.2
+ 85	15.8	0.03
+100	5.9	0.05
+120	10.1	0.05
+150	7.5	0.03
+200	7.2	0.05
—200	45.5	0.05
Composite	100.0	0.07

The plus 60 mesh fraction contained appreciable free flakes of molybdenite.