

TR2-149-152

R. 309**MOINA TUNGSTEN-TIN MINING CO., N.L.****FLOTATION OF BISMUTH FROM 40-MESH CONCENTRATES****Sample**

A sample of 40-mesh mixed concentrates in wet state was submitted by the company early in February, 1957, for development of flotation procedure for recovery of the bismuth content as a saleable product. The sample was a cassiterite-wolfram table concentrate with associated pyrite and siliceous gangue.

Investigation

For obvious reasons the sample was preserved in its wet state and hence could be only partially mixed by rubbing through a 4-mesh screen. The several test charges cut out from the sample so mixed inevitably vary somewhat in composition from each other and from the charge chosen as a head sample.

All flotation tests were conducted at — 60-mesh, so to avoid unnecessary grinding of the friable bismuth mineral, the material — 60-mesh in each charge, amounting to about 50% of the weight thereof, was removed by wet screening prior to ball milling the remaining oversize to — 60-mesh.

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

Summary

1. The sample assayed:—

| | |
|-----------------------|-------|
| | % |
| Bi | 1.61 |
| Sn | 55.20 |
| WO ₃ | 12.45 |
| Acid insoluble | 11.54 |

2. Flotation of all sulphides as a mixed concentrate by means of copper sulphate and xanthate showed that substantially all the bismuth could be removed along with the pyrite from the tin and wolfram. But this mixed sulphide product was not of marketable quality. Thus in Test 7 the yield of such concentrate amounted to 11.23% by weight assaying Bi 11.0 and Sn 6.15%, and accounting for all the Bi and 12.7% of the tin in the original sample.

The bismuth and pyrite having been floated together with xanthates it would be difficult for any subsequent flotation procedure to separate a clean bismuth product. But a cleaner flotation operation in the presence of much sodium silicate (around 7 lb.) as developed in R 305 should give a fairly clean pyrite discard plus a sink product containing most of the bismuth and tin, contaminated with only a minor amount of pyrite.

3. Attempts at flotation of a selective bismuth concentrate ahead of pyrite removal had moderate success.

In Test 5, for instance, the pyrite was depressed with a little lime and cyanide in the presence of 7 lb. of sodium silicate prior to taking off the rougher bismuth float. This bismuth product amounted to 1.39% weight assaying 26.8% Bi and 8.4 per cent Sn and containing 29.1% of the Bi and 0.2% of the Sn in the original feed.

4. In the similar Test 10 the small amounts of lime and cyanide were retained for pyrite depression, but the sodium silicate—in large amounts a depressant for Moina bismuth—was eliminated. The bismuth product improved in quantity and tenor amounting to 2.1% weight assaying 39.4% Bi and 7.2% Sn and containing 62.5% of the Bi and 0.3% of the Sn in the original feed.

5. From 80 to 99% of the tin reported in the rougher tailings as a saleable concentrate.

Test Results

TEST No. 5

| Reagents | Flotation Conditions | |
|------------------------------|------------------------------------|------------------|
| | Lb. per Ton/Min. Rougher Floats | |
| | Bi | FeS ₂ |
| Sodium Silicate | 7/2 | .. |
| Lime | 0.2/5 | .. |
| NaCN | .25/5 | .. |
| CuSCn | .. | 1.5/5 |
| Mixed Xanthates, 2:1 | .09 | .05 |
| Cresylic Acid | .3 | .15 |
| Flotation Time | /4 | /4 |
| pH Value | 9.85/10.1 | /9.7 |

| Product | Percent | | | Percent Distribution | |
|---------------------------|---------|--------|------|----------------------|-------|
| | Weight | Sn | Bi | Sn | Bi |
| Bismuth Rougher Conc. .. | 1.39 | 8.40 | 26.8 | 0.21 | 29.1 |
| Pyrite Rougher Conc... .. | 7.13 | 2.20 | 4.5 | 0.28 | 25.0 |
| Rougher Tailing | 91.48 | 60.20 | 0.6 | 99.51 | 45.9 |
| Composite Head | 100.0 | 55.300 | 1.3 | 100.0 | 100.0 |

TEST No. 7

| Reagents | Flotation Conditions | |
|---------------------------|--------------------------------|--|
| | Lb. per Ton/Min. Rougher Float | |
| | <i>FeS₂</i> | |
| CuSO ₄ | 1/5 | |
| Mixed Xanthates 2:1 | .25/5 + .25 | |
| Cresylic Acid | 2 + 2 drops | |
| Flotation Time | /8 | |
| pH Value | 5.8/6.5 | |

| | Percent | | | Percent Distribution | |
|---------------------------|---------|------|-------|----------------------|-------|
| | Weight | Sn | Bi | Sn | Bi |
| Rougher Pyrite Conc... .. | 11.23 | 6.15 | 11.02 | 12.7 | 100.0 |
| Rougher Tailing | 88.77 | 60.3 | .. | 87.3 | .. |
| Composite Head | 100.0 | 54.2 | 11.24 | 100.0 | .. |

TEST No. 10

| Reagents | Flotation Conditions | |
|---------------------------|---------------------------------|------------------------|
| | Lb. per Ton/Min. Rougher Floats | |
| | <i>Bi</i> | <i>FeS₂</i> |
| Sodium Silicate | .. | 7/5 |
| Lime | 0.2 | .. |
| NaCN | .25/5 | .. |
| CuSO ₄ | .. | 1.5/5 |
| Mixed Xanthates 2:1 | .18 | .09 |
| Cresylic Acid | .21 | .10 |
| Flotation Time | /9 | /5 |
| pH Value | 8.8/8.8 | /10.5 |

| | | | <i>Percent</i> | | | <i>Percent Distribution</i> | |
|------------------------|----|-----|----------------|-----------|-----------|-----------------------------|-----------|
| | | | <i>Weight</i> | <i>Sn</i> | <i>Bi</i> | <i>Sn</i> | <i>Bi</i> |
| | | | | | | | |
| Bismuth Rougher Conc. | .. | 2.1 | 7.22 | 39.4 | 0.3 | 62.45 | |
| Pyrite Rougher Conc... | .. | 6.6 | 1.65 | 0.76 | 0.2 | 3.80 | |
| Rougher Tailing | .. | .. | 91.3 | 54.4 | 0.49 | 99.5 | |
| Composite Head | .. | .. | 100.0 | 49.9 | 1.32 | 100.0 | |