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ROBERTSTOWN ASBESTOS.

PREPARATION OF A MARKETABLE PRODUCT.

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ROBERTSTOWN ASBESTOS

PREPARATION OF A MARKETABLE PRODUCT

Abstract

A low grade sample of asbestos bearing material from the Robertstown district was treated by wet classification and flotation to yield asbestos for industrial tests. The product appears to be suitable for heat insulation and as a paint filler. An ore-body, suitable for open cut working, of at least 250,000 tons averaging five per cent recoverable asbestos appears to be necessary to support a commercial operation.

1. SUMMARY.

(a) A sample of Robertstown low grade asbestos ore was tested in the laboratory by wet and dry classification and flotation.

(b) A combination of wet classification and flotation was used to prepare samples for industry.

(c) Laboratory and industrial tests showed that the asbestos is suitable as a paint filler and for heat insulation when mixed with magnesia.

(d) Assuming five per cent asbestos recoverable from the ore and a market of 1,000 tons per year, the selling price would be approximately £60 per ton.

(e) The ore body to support the venture should be 250,000 tons, suitable for open cut operations with overburden to ore ratio no greater than two to one.

2. INTRODUCTION.

Field exploration by staff of the South Australian Geological Survey in the Robertstown district indicated a widespread asbestos mineralisation. Several small bodies have been worked in the past using hand sorting, air winnowing or simple elutriation with water (1).

The asbestos is the variety crocidolite, and is limited in industrial uses. It is not suitable for asbestos cement, electrical insulation boards, and similar purposes requiring high strength fibre. It was shown by Gartrell (2) to have admirable heat insulation properties and has been used as a medical absorbent. It can probably be used as a filler in some special paints.

In view of the growing markets in Australia for industrial minerals it was thought that the Robertstown asbestos, though limited in uses, might find a reasonable market if it were readily available. No high grade zones are exposed but it was considered that wet processing by modern mineral dressing methods could be applied to low grade ore. In order to assess these possibilities a parcel of ore from an old open cut was obtained by the Geological Survey staff. This was not expected to be representative of any block of ore, but was to provide material for mineral dressing experiments and, after selection of a method, to provide sufficient asbestos product for submission to consumer industries.

When the treatment method had been outlined and the consumer reaction noted, it became possible to estimate the market requirements and production costs. These in turn showed the type of ore body for which a search should be made.

3. MATERIAL EXAMINED.

The sample was selected by Mr. D. King of the Geological Survey from the "Blue Hole" deposit in Section 295, Hundred of Apoinga. In his report of the deposit (3) Mr.King states:

"In the quarry exposure, the crocidolite occurs as ramifying narrow veinlets filling joints and other fissures in a highly decomposed albite-biotite-tourmaline replacement rock. Crocidolite also occurs to a lesser degree along bedding planes in adjacent dolomite. The asbestos veins vary from a fraction of an inch to three inches in width and consist predominantly of cross fibre of corresponding lengths; some of the narrower veins are composed of a powdery incipient asbestos. A thin coating of emulsified and redistributed crocidolite has developed over practically the whole of the quarry face and the rejected rock in adjacent dumps."

A specimen of crocidolite fibre from the workings has been analysed and its chemical composition as quoted by Mr. King in his report is shown in Table 1.

TABLE 1.

Complete Chemical Analysis of Asbestos.

Assay	Per Cent
SiO_2	54.87
Al_2O_3	1.78
TiO_2	0.68
Fe_2O_3	16.41
FeO	5.38
MgO	11.34
CaO	0.45
Na_2O	0.25
H_2O+	1.62
H_2O-	0.51
MnO	trace
CO_2	nil
	100.06

4. EQUIPMENT USED.

The laboratory equipment used in this investigation was as follows:

(a) Denver Centrifugal Classifier.

(b) One inch diam. glass hydroclone.

(c) Fagergren flotation cell.

(d) Three inch diam. hydraulic cyclone.

(e) One inch microcyclone.

(f) 100 lb/hr. Agitair flotation unit.

(g) Jaw Crusher 8" x 5".

(h) Roll Crusher 10" x 6".

5. EXPERIMENTAL PROCEDURE.

Preliminary laboratory scale tests were carried out with the object of determining the most suitable methods of treatment. A combination of hydrocyclone and flotation steps was then used in a continuous pilot plant operation to treat 800 pounds of ore.

6. RESULTS OF EXPERIMENTS.

6.1 Selection of Treatment Method.

For this work one bag of ore was taken from the bulk sample and crushed to minus $\frac{3}{8}$ inch in jaw and roll crushers. Examination of the crushed ore revealed that the majority of the fibres were less than $\frac{1}{8}$ inch in length, and that the apparently large pieces of asbestos consisted of these small fibres packed closely together.

6.1.1. Wet Classification.

The crushed ore was washed in a centrifugal classifier. Good liberation of the asbestos was obtained, but it was contaminated with slimed rock. Screening on a 65 mesh screen gave a clean product, but much asbestos was lost in the undersize. The crushed ore was next screened on 16 mesh and the coarse fraction was classified and treated in a glass cyclone to give a good product. The minus 16 mesh material was treated in the hydraulic cyclone and a glass cyclone, but poor recovery of the asbestos resulted.

6.1.2. Dry Classification.

A sample of minus $\frac{3}{8}$ inch material was crushed to 100 per cent minus $\frac{1}{4}$ inch and dry classified in a cone using a current of air as the classifying medium. Very poor liberation of the asbestos from the parent rock was obtained and, because of the large amount of dust present, 30 per cent of the feed reported as a very dirty concentrate.

6.1.3. Flotation.

Using a 500 gram charge in the laboratory flotation cell it was found that the asbestos would float readily using oleic acid at pH. 9.0 and above. Sodium carbonate and caustic soda appeared to be superior to lime as pH. controllers. Tourmaline and rutile floated with the asbestos below pH. 9.0, but were partly depressed in the alkaline circuit. The impurities in the product were reduced by treatment in the cyclone but it is probable that better results would be obtained if the cyclone was used prior to flotation.

6.2. Pilot Scale Recovery of Asbestos.

An 800 pound sample was crushed to minus $\frac{3}{8}$ inch and screened on 16 mesh. The plus 16 mesh fraction was washed in a centrifugal classifier and the overflow treated twice in a 3-inch hydraulic cyclone at 30 lbs. per sq. inch using a $\frac{3}{8}$ inch vortex finder, and a 9/16 inch spigot to give an asbestos concentrate.

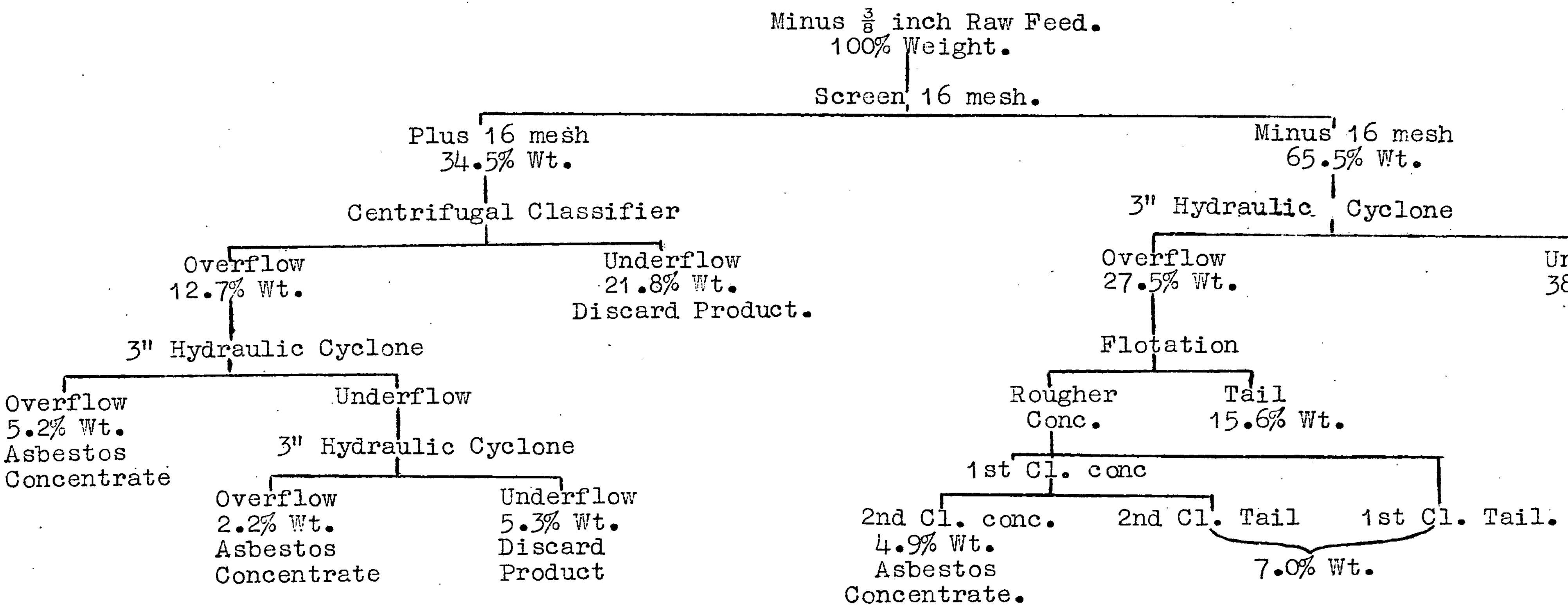
The minus 16 mesh fraction was desanded in the 3-inch hydraulic cyclone, and the overflow thickened for flotation. The reagents used were-

Oleic acid in ethyl alcohol.	4 lb/ton.
"Manoxol" (sulphosuccinate).	0.2 lb/ton.
Sodium Carbonate.	3 lb/ton.

The flow sheet shows the materials balance, with a total recovery of 12 per cent by weight of the original feed as asbestos concentrates.

NOTE – Percentage weights are all based on the original feed.

COMBINED FLOTATION AND WASHING TESTS.



7. PRACTICAL APPLICATION AND ESTIMATES.

7.1 Application.

Part of the product was used with magnesia in the laboratory to make experimental mixes for heat insulation of ducts. It was mixed in various proportions for trial, but 75 per cent asbestos and 25 per cent magnesia appears most suitable.

The pug was easy to mix and was readily trowelled. It was much superior to magnesia alone in ability to stick to a metal surface, and in freedom from cracks when dried.

Radiation tests from areas of one square foot, at temperature up to 600^{o}C showed the heat transfer rate to be similar to commercial insulation mixes.

Sample of asbestos concentrates of ten pounds weight were sent to various firms providing an insulation service, and to the major paint companies. In all cases the reports were satisfactory and one firm requested a large sample to enable industrial tests to be carried out. From these preliminary enquiries it was concluded that a market existed in Australia for approximately 2,000 tons per year of this type of asbestos, and that first estimates should be based on proposed sales of 1,000 tons per year.

7.2 Estimated Cost of Production.

There is not sufficient evidence available at this stage for a close estimate of costs as experimental work has not been carried to finality on a sample which represents a large tonnage of ore. However, if five per cent recoverable asbestos is assumed for the ore grade, and 1,000 tons per year for the production, then a plant capacity of 20,000 tons of ore per year is required.

Power and water are available within a few miles of the area and it is assumed that an extension of these services would be provided by the authorities concerned. A small plant for crushing and screening, a cyclone section for the sands, a flotation section for the fines and units for drying and bagging the product would cost approximately £100,000. If it is assumed that the ore is delivered from an open cut for 20 shillings per ton, and processed for 25 shillings a ton, the cost per ton of product would be as follows-

Mining	£20
Milling	25
Interest & Dep.	15
Total	£60

8. CONCLUSIONS.

The laboratory experiments indicate that asbestos with a consumption limited to 2,000 tons per year could be made from low grade Robertstown ore. Material for these particular uses is at present imported and costs from £70 to £110 per ton. Robertstown material could be marketed for approximately £60 per ton if the ore contained five per cent recoverable asbestos. The quantity of raw material to justify such a venture would be of the order of 250,000 tons. The mining cost allowed in the estimate assumes that the ore can be obtained by open cutting provided the overburden to ore ratio is no greater than two to one.

REFERENCES.

1. Jack, Lockhart R. Dept. of Mines, South Australia, Mining Review No. 33, p. 48, Dec. 1920.
2. Gartrell, H.W. Dept.of Mines, South Australia, Mining Review, No. 50, p. 40, June 1929.
3. King, D. Dept. of Mines, South Australia, Geological Report No. 394. (Unpublished).

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