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DEPARTMENT OF MINES

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CLAY FROM WEATHERED APLITE AT ARDROSSAN

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OBJECT - To consider treatment and uses of weathered aplite from a coastal occurrence near Ardrossan.

SAMPLE - Preliminary inspection was made on material exposed on the cliff face. Petrological examination by Mr. A. Whittle gave rock as a Kaolinised aplite, almost completely altered except for occasional remnant grains of felspar. Approximately 57 per cent of the material was clay, the remainder quartz with grain size between 1 mm and 7 mm. Specific gravity 2.3

Chemical analysis of the rock was made by Mr. T. W. Dalwood with the following results:-

Silica	69.92
Alumina	17.95
Ferric Oxide	0.35
Ferrous Oxide	0.01
Magnesia	0.33
Lime	0.06
Soda	1.20
Potash	0.42
Water at 100° c	1.62
Water over 100° c	6.21
Titanium Dioxide	0.13
Sulphur trioxide	0.54
Chlorine	2.01
	100.77
Less oxygen equivalent to Chlorine	0.45
	100.32

The material used for the mineral dressing tests was obtained from No. 4. Borehole. This gave a typical section of the deposit, from 55 to 105 ft. showing very little ironstaining. The chlorine content was probably lower than for the surface sample. A composite sample was made from the core recovered from this intersection.

LABORATORY TREATMENT.

The dry clay from the bore core was friable enough to break up when lightly hit with the back of a shovel. The crushed material was fed at an even rate with a vibrating feeder into a vortex mixer for pulping with water. The pulp overflowed to a 3 cone hydraulic classifier to allow the quartz to settle. The overflow containing the clay was caught in large tubs and allowed to settle overnight. The water was decanted and the thickened clay treated in a pressure filter. The filter cake was dried at 105° C.

No unusual difficulties were noticed in the treatment. Some of the coarse quartz settled out in the vortex mixer. In an effort to overcome this by increasing the pulp density in the mixer, the vortex was not sustained and the new feed tended to float.

The clay pulp settled quite rapidly in the tubs, giving a clear overflow and a well defined line of demarcation at the clay surface.

A sample of thirty pounds yielded the following results:-

Spigot	1	43.4 Percent Weight	Clean quartz
	2	4.6	Mostly quartz
	3	2.3	Quartz with a little clay
Overflow		49.7	Clean clay

USES OF THE APLITE :

The aplite as mined has a limited use in ceramics where china clay and white quartz are part ingredients of the pulp used in a slip casting process.

The main usefulness however is for the elutriated clay. A report submitted by Mr. A. J. Gaskin of the Geology School of the University of Melbourne is given. It should be noted that the material he used was washed from a sample from the cliff face of the deposit.

Physical Properties

Colour : Faint yellowish tinge persists in the washed clay, due to finely disseminated limonite produced by disruption of limonite "clots" visible in raw untreated aplite.

Grit and Impurities: Although 50-52% of the raw material consists of angular quartz particles, these are readily removed by washing through a screen or by levigation. There is a considerable gap between the particle size of the quartz (mostly greater than 100 mesh) and the clay fraction.

Plasticity Weakly plastic, about normal for a china clay. Modulus of rupture 88 lbs 1 sq. in. dye adsorption 26 ml. /gm., benzidine test negative.

Soaking, drying etc. Easily broken down from the dry state on soaking in water. Defloculents have little effect on the clay fraction.

Firing characteristics.

In an oxidizing atmosphere at 1000° C white with faint pink tinge (when wet) Linear shrinkage from dry state 3.6%.

1100° C White as above, shrinkage 4.2%

1200° C White faint cream tent some cracks developing shrinkage 9.3%

1300° C Pale Cream, hard but not vitrified, slight warping and cracking shrinkage 14.3%

1400° C Pale Cream, Vitrification becoming apparent, shrinkage 15%

Remarks . A large proportion of medium quality china-clay may be recovered from this Kaolinised igneous rock, which has been tentavely classed as an "aplite". Although not as white in either the raw or fired state as the Wiame Williamstown washed clay this material is much more plastic.

Mr. Gaskin attached some interesting observation to his report from which these notes are drawn.

1. The washed clay is grit free and could be used as a paper filler.

2. The clay is suitable for use as a filter in rubber and plastics industries. The colour is not bright enought for the bulk of the paint trade requirements.

3. The clay is suitable for use in the ceramic and refractory industries as a "china clay" of medium quality. The plasticity is higher than that of Williamstown and Longwood washed clays. The colour of fired products using Woocalla clay would be improved by admixture with this clay.

The quartz produced by washing the clay is remarkably free from clay and limonite. Apart from the low-price fields of gravel and concrete aggregate this quartz should be suitable for glass manufacture, and to a limited extent in ceramic work.

DISCUSSION

The great problem with low price industrial minerals such as clays is to produce large quantities of dependable quality within the competitive price range.

Points favouring this possibility with the Ardrossan Clay deposit are-

1. The large size and constant composition of the ore body.

2. Several alternative methods of mining, all of which will cost only a few shillings per ton due to natural advantages of a thick deposit close to the shore(See Mining Report)

3. Ease with which the clay may be washed to give a grit free product. The clay recovery is high for an igneous Kaolin source.

Preliminary tests to seperate the clay by dryscreening were unsuccessful, and wet screening was discarded in favour of hydraulic sizing as better seperation was obtained.

No detailed estimates of washing costs have been attempted, since much would depend on the location of the washery and tonnage to be treated daily.

Water requirements would be approximately 100 gallons per ton of final clay, or 50 gallons per ton of ore treated. This water should be of good quality. It is doubtful whether this quantity will be available for some time at Ardrossan. Shipment to Adelaide before treatment would have no disadvantages if markets for the quartz discard could be found sufficient to at least pay for its transport.

Costs in Adelaide for a plant treating 100 tons of aplite per day would be in the order of ten shillings per ton, or one pound per ton of finished clay. (Recovery 50 per cent) The capital expenditure required would be approximately £20,000.

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