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R.687. Investigation on Smithton dolomite

H.K. Wellington

This investigation was the result of approaches by the Circular Head Dolomite & Trading Company and by a selling agent of that company, G. Atkinson.

As the company has before it a proposal to export coarse dolomite to New Zealand it wished to have investigated:

(1) Its present operations and product, and

(2) alternative methods of producing the current product and the coarser export product.

Accordingly the quarry and plant were visited by the Chief Chemist and Metallurgist who took samples for subsequent use in the investigation.

The current products were sized and assayed. Crushing and grinding tests were made using rolls and dry ball milling. Comments have been on present practice and on the results of the tests made.

PRESENT OPERATIONS

The dolomite is blasted in a quarry then picked up by a payloader and dumped into the hopper of a portable screening and crushing plant located on the quarry floor near the face being worked.

A vibrating feeder with a finger grizzly at the discharge end feeds a 400 mm x 250 mm Jacques jaw crusher. The undersize and crusher discharge are belt conveyed to a trommel with 10 mm and 6 mm diameter holes. The trommel undersize is dumped, the oversize (-40 mm +10 mm) is stockpiled before carting by truck to the mill some distance away.

At the mill the dolomite is either stockpiled or dumped in the hammer mill feed bin. The hammer mill is fed by a belt feeder the product passing through the hammer mill grates which are set at about 3 mm. The crushed product is stockpiled for shipment in bulk or bagged. The moisture content of the hammer mill feed cannot be too high hence stockpiling at the mill is also a drying operation. The -10 mm material is now discarded because it does not dry out sufficiently for milling.

Comments

Most of the broken dolomite in the quarry was under 50 mm so that the jaw crusher has very little work to do and the grizzly on the feeder would not be able to pass all that is undersize. The small size of the broken dolomite probably arises from excessive blasting, too many holes and too much explosive. The jaw crusher probably reduces this already fine material still further thereby providing further undersize which is being discarded at the present.

The stockpiled dolomite both at the quarry and mill is in the open and hence its moisture content is largely governed by the weather. Wet weather would stop operations if feed had to come from stockpiles.

New type hammers, long hinged bars, instead of the individual small hammers were being experimented with; one factor being supply difficulties with the small hammers.

Samples

Sample 741232 was supplied by G. Atkinson of Spreyton whose company is a selling agent for Circular Head Dolomite. This sample was submitted as representative of the final product.

Sample 741336 was taken by the Chief Chemist and Metallurgist from the stockpile of finished product in the storage shed at the mill.

Samples 741337, 741338 were taken from broken material in the quarry by the Chief Chemist and Metallurgist.

Sample 741339 was taken from a band of non-dolomite in the quarry by the Chief Chemist and Metallurgist.

Sample 741340 was coarse dolomite supplied by the company and stated to be 'export size'. A random selection of several large pieces was made to obtain an assay sample.

PROPOSED EXPORT VENTURE

There is a proposal to back load ships bringing bentonite to Stanley from New Zealand with screened dolomite which would then be pulverised on arrival in New Zealand.

This would mean the present proceesing would have to be re-organised as the present mill feed would become the export product and the present waste undersize would become the mill feed.

This export market was stated to require a plant production of screened dolomite in excess of 20 t/h whereas present production was stated to be 6-8 t/h of pulverised dolomite with a maximum production of 1000 tonnes per month.

Sizing analyses

Sample 741340. This sample of 'export size' dolomite was screened with the following result:

Screen aperture (mm)	*% Mass*	*Cumulative % Mass*
+38.10	28.4	28.4
+19.05	48.5	76.9
+9.53	19.4	96.3
+4.75	3.3	99.6
-4.75	0.4	100.0

From this it was concluded that the export product should pass a 50 mm screen and be retained on, say, a 15 mm screen.

Samples 741232, 741336. These two samples are of final product and sized as follows:

Screen aperture (μm)	*741232*		*741336*	
	% Mass	*Cum. % Mass*	*% Mass*	*Cum. % Mass*
+2360	-	-	6.9	6.9
+1180	0.1	0.1	21.4	28.3
+600	4.7	4.8	21.5	49.8
+300	17.2	22.0	15.0	64.8
+150	19.1	41.1	9.7	74.5
+75	13.2	54.3	5.9	80.4
+38	8.9	63.2	3.8	84.2
-38	36.8	100.0	15.8	100.0

These sizings which are plotted on the accompanying graph show a very wide variation in the sizing of the dolomite product.

An inquiry to the Tasmanian Department of Agriculture yielded the following information:

(1) The finer the dolomite the better as far as use by plants is concerned but if too fine it would blow away from the farm on which it was being spread.

(2) The dolomite, as it is marketed as a fertiliser, should conform to the *Stock Medicines and Fertilisers Regulations* 1954 sizing specifications for ground limestone (i.e. 100% to pass 3.2 mm and at least 50% to pass 510 μm).

Both samples conform to the 100% -3 mm requirement but 741336 has 53% +500 μm and hence does not meet the second condition (fig. 42).

As the hammer mill grates were being replaced at the time of the visit by the Chief Chemist and Metallurgist Sample 741336 probably represents the product from worn grates.

Moisture content of dolomite product

The two samples of the final product were assayed for moisture content with the following results:

Sample No.	*Moisture (%)*
741232	0.4
741336	1.5

A variation like this or greater is to be expected from present operating conditions.

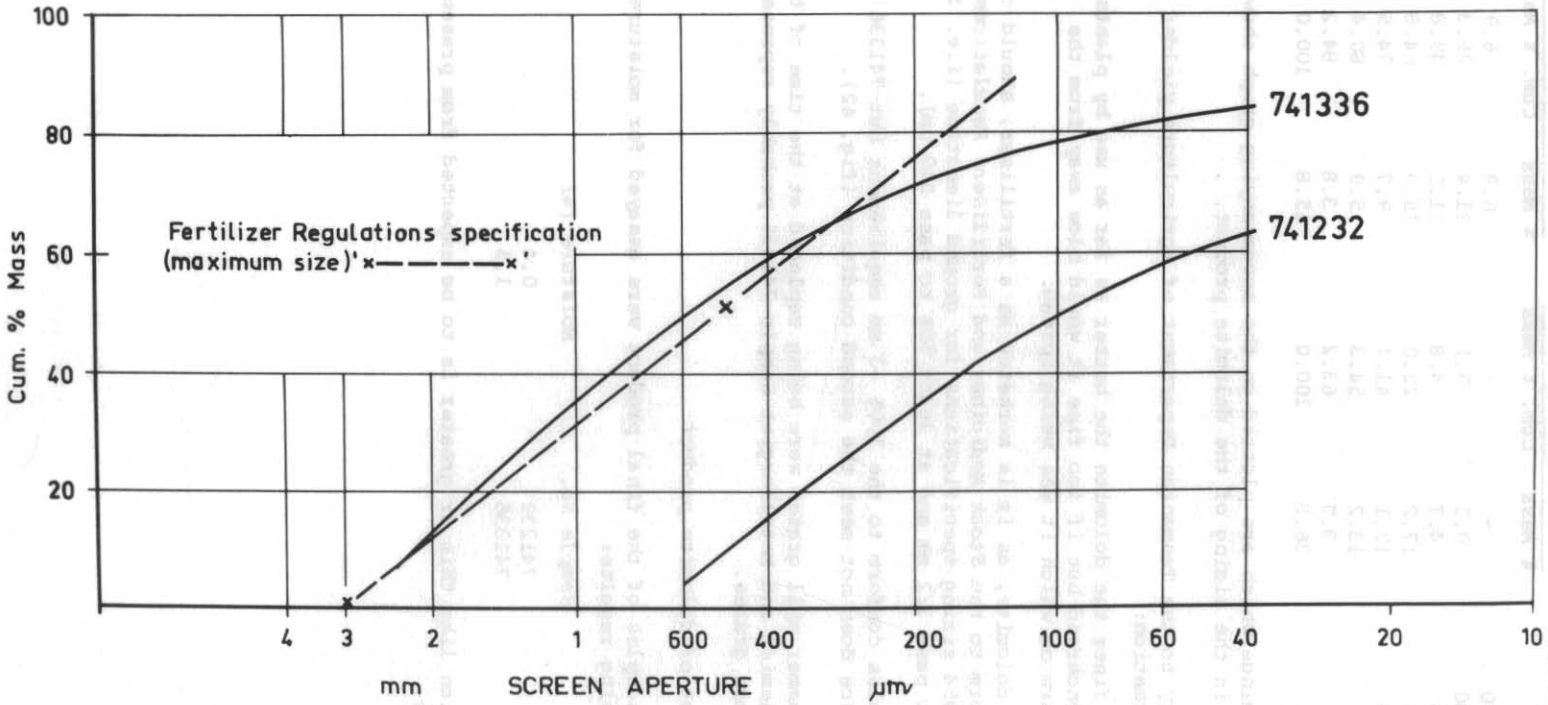

Figure 42. *R.687. Sizing analyses, present production.*

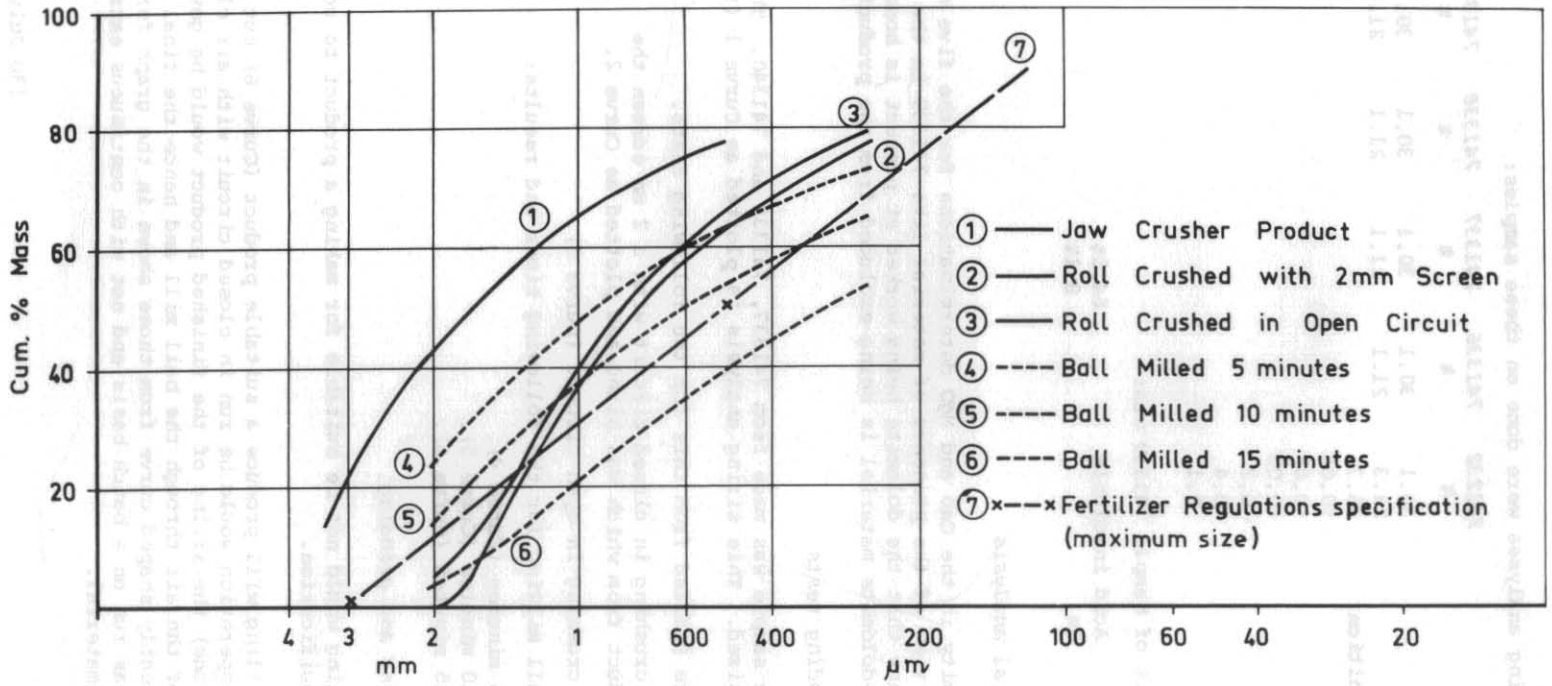

Figure 43. *R.687. Sizing analyses of laboratory jaw crusher, rolls and ball mill products.*

Analysis of samples

The following analyses were done on these samples:

	741232 %	*741336* %	*741337* %	*741338* %	*741340* %
CaO	30.1	30.1	30.1	30.1	30.1
MgO	21.3	21.1	21.1	21.1	21.4
Loss on ignition	46.7				
MnO	<0.05				
P_2O_5	<0.05				
Al_2O_3	<0.05				
Fe_2O_3	0.2				
SiO_2	0.4				
H_2O	0.1				

The analysis of Sample 741339 was:

Acid insoluble	64.5%
Fe	8.1%

Comment on chemical analysis

The uniformity in the CaO and MgO determinations for the five samples is remarkable in view of the presence of material like 741339 in the quarry face. It does show that the dolomite being worked at present is homogeneous and that the non-dolomite material is being excluded from the product.

Crushing and grinding tests

A composite sample was made from 741337, 741338 and 741340. This was jaw crushed and sized. This sizing analysis is plotted as Curve 1 (fig. 43).

Samples were riffled from this for the following tests.

(1) Rolls crushing in closed circuit with a 2 mm screen the product from which was sized and plotted as Curve 2.

(2) Rolls crushing in open circuit (Curve 3).

(3) Dry ball milling for the following times and results:

(1) 5 minutes (Curve 4).
(2) 10 minutes (Curve 5).
(3) 15 minutes (Curve 6).

Comment on crushing and grinding

Rolls crushing would not be suitable for making a product to conform to the sizing specification.

Dry ball milling will produce a suitable product (Curve 6) but as a dry ball milling operation would be run in closed circuit with air classification (a cyclone) the sizing of the finished product would be governed by the velocity of the air through the ball mill and hence the final product may have a differently shaped curve from those shown in the graph for the ball mill which was run on a batch basis and not with continuous extraction of the undersize material.

[30 July 1974]