

SUPPLY OF CLAY - MESSRS. WUNDERLICH LTD.,  
LAUNCESTON

Acting on instructions received from the Director of Mines, the writer visited Launceston on 1st and 2nd November in connection with clay supply difficulties being experienced by Wunderlich Ltd., at their glazed terra cotta tile factory at Kingsmeadows. The problem was outlined by Mr. R. Skinner, manager of the factory and Mr. D. Crowder, geologist to the company.

The Kingsmeadows factory was erected several years ago on a site believed to carry good supplies of clay suitable for the manufacture of terra cotta tiles. The clays in the factory pits are upper members of the Launceston Tertiary Series and are there of two types:-

(a) A siliceous poorly plastic clay.

(b) A siliceous plastic clay.

The two varieties differ only slightly in chemical composition, the chief difference being in the grain size and consequently in the plasticity. Analyses of the two types are given in the table appended.

When the factory commenced operations the clays on the site were to be used in the proportion of 4 parts of type (a) to 1 part of type (b). It was soon found, however, that these proportions did not give a workable body and, after experiment, it was decided to use the two clays in equal proportions. This gave a body which was workable, fired well at 1000 - 1010°C and took a good glaze. Owing, however, to insufficient investigation having been made of the quantity of material available on the site, it was shortly discovered that, at the normal rate of consumption, the factory pits would be depleted in a relatively short time. Arrangements were therefore made by the company with the Australian Aluminium Production Commission whereby the company was granted the right to strip the clay overburden overlying a bauxite deposit at St. Leonards some five miles from the factory. This clay is apparently of good quality, is of good to very good plasticity and, when used with type (a) clay from the factory site in the proportions of 1 to 1 gives an eminently workable body. The arrangement was therefore a happy one as the company had access to several million yards of plastic clay and the Commission was enabled to have a bauxite deposit stripped of overburden.

The procedure in the factory is to obtain during the period December to April sufficient clay supplies to last for the twelve month period and store the material in drying sheds. Approximately 3,500 yards of each clay are used in a year. When dry, the materials are blended in correct proportions by volume, mixed to a plastic state, and extruded by a non-deairing pugmill. The material is cut to suitable size on extrusion, formed into tile shapes on a machine using plaster dies, dried in racks and fired in rectangular downdraught (Mitchel Type) kilns. Fettling is at present done by hand but this process is shortly to be incorporated in the tile-making machine. Maximum temperature in the kiln is 1010°C (controlled by pyrometer) and the tiles are salt glazed. The factory is modern and efficient and the process is a simple one.

During April-May of this year, shortly after St. Leonards clay began to be used in the factory, kiln losses increased sharply from a normal 6 - 7% to as high as 43% and the general quality of the product began to deteriorate. The immediate causes were:-

Deterioration of Quality

- (1) The general appearance over the whole surface of the tile of fine interlocking cracks.
- (2) An increase in the total shrinkage from 6 - 7% to 10 - 12%
- (3) The poorly glazed condition of the tiles.

Losses

- (1) In many cases the cracks became so frequent and so large that the tiles were useless and had to be discarded.
- (2) Many tiles, especially those in the inner portions of the setting were almost devoid of glaze and had to be discarded for this reason.

The three features, occurrence of hair cracks, high shrinkage and poor susceptibility to glaze are all normal characteristics of high alumina clay bodies and the difficulties being encountered at present are solely due to the use of St. Leonards plastic clay. In the list of analyses appended, Nos. 6, 7, 8a and 8b all show alumina content 32.8 - 37.0%, silica content 42.3 - 45.8% and ignition loss 13.5 - 14.8%. Samples Nos. 1, 2 and 4, being types (a) and (b) from Kingsmeadows show alumina content 21.3 - 25.4%, silica content 55.9 - 58.3% and ignition loss 8.9 - 10.0%. No analyses of the various mixes used are available. However, on the above figures, it can be deduced assuming a blending in each case in the proportions of 1 to 1 that the following would be the compositions of the bodies.

- (1) Kingsmeadows siliceous clay and Kingsmeadows plastic clay.  
24% alumina      57% silica      9.5% ig. loss
- (2) Kingsmeadows siliceous clay and St. Leonards plastic clay  
29% alumina      50% silica      12% ig. loss

It is thus evident that, if tiles are to be made satisfactorily without resort to special methods in manufacture, the percentage of alumina in the green body must not be allowed to rise above a maximum of 25 per cent.

There are two ways in which the difficulties may be overcome using the present clays.

(1) By the addition of grog. This consists of ground fired material of the same composition as the green ware. This process is normally used in the manufacture of high alumina refractories and is designed to overcome the twin difficulties of high shrinkage and hair cracking. It is estimated that, in the present instance, the incorporation of 20 to 30 per cent of grog would be required, the exact amount would need to be determined by experiment. Difficulties which this solution would entail are:-

- (a) The necessity of firing blocks of material for the production of grog.
- (b) The provision of pans and screens
- (c) The high rate of wear on the plaster dies.
- (d) The poor finish on the final article owing to dragging of the grog particles through the clay during fettling.

This solution would not overcome the poor glazing at all.

(2) The increasing of the silica percentage in the green body and the consequent reduction of the alumina percentage by the addition to the body of pure silica in the form of sand. This material is available (river sand) from Perth in reasonable quantities. In order to reduce the alumina percentage to a safe level approximately 10 per cent of sand would be required. It is probable that the sand would require panning before incorporation. This and the percentage required would need to be determined by experiment. In any case there would be increased wear on the dies though this would not be so great as would occur if grog were used. As the percentage of alumina would be reduced by this method, not only the shrinkage and cracking difficulties would be overcome, but also the glaze susceptibility would be improved. In fact the body would be of almost the same composition as that used before the introduction of St. Leonards clay into the body.

Both the suggested expedients involve additional manufacturing processes with consequent increased costs. In the writer's opinion they can be considered as "stopgaps" only to enable the factory to continue manufacture in the meantime with the clays on hand. From the long term point of view it is considered strongly advisable to discontinue the use of St. Leonards plastic clay except as detailed below. According to the manager, ample supplies of siliceous clay are available either in the factory property or near at hand. The problem, therefore, resolves itself into one of finding a suitable plastic clay of alumina content below 25 per cent. Three possibilities were discussed:-

(1) At the present time, the company is engaged in grid boring a portion of the St. Leonards deposit. It is possible that portions of the deposit, particularly the upper portions are of sufficiently low alumina content to be suitable. It is suggested that two samples be taken from each bore and chemical analyses made.

(a) Top six feet of clay.

(b) Total depth of clay to the bauxite floor.

Three cases can occur:-

(a) The whole deposit may be of alumina content above 25 per cent, or portions below this figure may be too small to be separated. In either case the deposit must be condemned in toto.

(b) Patches of low alumina content of reasonable size may be found.

(c) It may be found that the upper six feet is generally below the critical figure for alumina content. In each of these cases, selective quarrying of the deposit will resolve the problem.

(2) In the general area St. Leonards - Cora Lynn - Relbia - Kingsmeadows, a number of outcrops of plastic clay of the Launceston Tertiary Series were observed by the writer during a previous investigation. A search of this area would reveal likely deposits which could subsequently be investigated from a detailed technical and economic point of view.

(3) Attention was drawn by the manager to a deposit of plastic clay at Loira near Beaconsfield and an inspection was made. The clay appears to be suitable but the writer is doubtful of the quantity available and considers the distance from the factory to be too great for economic working especially in view of the facts under (2) above.

Summarising, then, it may be stated that:-

- (1) The difficulties at present being encountered are solely due to the use of high alumina clay.
- (2) The critical percentage of alumina in the body is approximately 25 per cent.
- (3) Using present stocks, shrinkage and cracking difficulties may be overcome by the use of grog. This would not improve the glaze characteristics.
- (4) The incorporation of pure silica would overcome all three main difficulties. The percentage to be added would need to be determined by experiment but would be in the vicinity of 10 per cent.
- (5) From the long term point of view it is considered that a plastic clay containing under 25 per cent of alumina should be substituted for the St. Leonards clay. It is possible that portion of the St. Leonards deposit may be suitable but failing this suitable material should occur within 5 - 7 miles from the factory.
- (6) The Loira deposit is considered a poor proposition but could be investigated if no other suitable deposits are found nearer to hand.

APPENDIX

Copy of Report of Mines Department Laboratory dated  
23 May 1952

Regd No.	257 - 1	Plastic clay	Kingsmeadows
"	" 258 - 2	" "	High Street
"	" 259 - 3	Siliceous clay (Surface)	Kingsmeadows
"	" 260 - 4	" " (deep)	"
"	" 261 - 5	Plastic clay (Believed good)	Storage Shed
"	" 262 - 6	Plastic clay (Suspected Bauxitic)	" "
"	" 263 - 7	Plastic clay (Believed good)	St. Leonards
"	" 264 - 8a	Plastic clay (1 ft above bauxite outcrop)	" "
"	" 265 - 8b	Plastic clay ( 2 ft above bauxite outcrop)	" "
"	" 266 - 9	Bauxitic outcrop	" "

ConstituentSample Numbers

1    2    3    4    5    6    7    8a    8b    9

## P E R C E N T

SiO <sub>2</sub>	57.0	55.0	55.9	58.3	50.9	42.3	47.7	42.8	45.8	38.7
Al <sub>2</sub> O <sub>3</sub>	25.4	26.9	24.8	21.3	29.3	37.0	32.8	36.9	35.3	33.6
Fe <sub>2</sub> O <sub>3</sub>	5.6	5.0	7.5	9.0	4.7	3.4	3.0	3.7	2.9	11.7
TiO <sub>2</sub>	0.5	0.7	1.0	0.8	0.9	1.4	1.0	1.0	0.9	0.8
Ig. Loss	10.1	10.1	9.5	8.9	12.3	14.8	13.5	14.2	13.9	14.0

(Signed) W. MANSON.  
CHIEF CHEMIST AND METALLURGIST.

(Sgd.) B.L. Taylor  
B.Sc. A.M.A.I.M.M.  
GEOLOGIST

The Director of Mines,  
HOBART.

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