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SUPPLY OF CLAY FOR MCHUGH BROS. PTY LTD, LAUNCESTON

INTRODUCTION:

Instructions received from the Director of Mines in connection with the above problem were to make " a close study of the products, the clays being used, the deposits from which the clays have been or are being obtained, and the progressive arrangement of such beds in the Launceston Tertiary Basin or the occurrence of similar clays in other localities ..... to make a brief study of the problem and to advise on a general programme of investigation or work." The investigational work was carried out from 25th July, 1950 to 1st August, 1950 inclusive and consisted of three parts :-

(a) Investigation of the present clay pit.

(b) Investigation of the products and manufacturing methods.

(c) Search for likely areas for new clay deposits.

In this work a map prepared by S. Warren Carey as Plate 111 accompanying a paper entitled "Geology of the Launceston District" published by the Queen Victoria Museum, Launceston 1946 was used as a basis for field work.

MATERIALS AT PRESENT IN USE :

Three basic materials are used :-

(a) Clay

(b) Sand

(c) Grog.

Clay: This is obtained from the Company's pit at the southern end of Glen Dhu Street approximately half a mile from the works in Wellington Street. The pit is worked in the summer and sufficient material brought into the works to last for the year. Details of the pit and the available reserves will be found in a later section. The working methods consist of opencutting the face, stacking the clay for drying (which takes from two to five days depending on the weather) loading on to trucks by means of a front-end-loader, and trucking to the works. At the works it is stored in large bins under cover. The cost of clay delivered into the bins is 18/4 per yard.

Sand: Sand is obtained from river deposits at Perth. It is supplied under contract and costs 18/6 per yard delivered at the works. It also is stored in bins under cover.

Grog: This is ground, fired ceramic material and is made at the works by dry-panning brickbats, broken pipes etc. The cost of the material is low, the only cost involved being that of grinding.

Products: The products are typical of a normal pipe works. The chief product is glazed pipes in usual sizes from three inch to nine inch diameter. Larger sizes are made

to special order. Bends, junctions, gully traps and sinks in sizes to fit the stock pipes are also made. In addition, the following products are made intermittently:-

(a) Agricultural pipes

(b) Semi-firebricks

(c) Fireclay blocks

Manufacturing Methods:-

General preparation of all materials is similar for all products. The materials are blended in correct proportion by volume (measurement by shovelsful) and fed into a horizontal rotating dry pan. The ground material is elevated to a hopper from whence it falls by gravity into a horizontal mixer consisting of an open trough with two opposed worms. Water is fed into the mixture which is kept at the correct consistency by the operator. No moisture tests are made. Provided the operator is experienced and works conscientiously, this is as good a method as any. From the mixer, the material falls to a hopper from which the flow is controlled into a pugmill. This is the usual type of mill without de-airing chamber and extrudes a column of clay of approximately 10" x 4" cross-section. From this point onwards, the process differs according to the product being made.

Glazed Pipes: The mixture consists of four parts of clay to one part of sand by volume for the smaller pipes. For nine inch and larger pipes a small proportion of grog is added to make the mix more open and so lessen the possibility of cracking during drying.

The clay is extruded from the pugmill in large pieces and stacked for one or two days to mature. It is then elevated by conveyer belt to the top of a vertical pipe machine. There are usually two of these machines available but one is not working at present. The pugged and matured clay is fed into the pipe machine by hand. The machine is controlled at floor level by the pipe maker. The pipes are extruded singly and removed from the machine by hand. Fettling is done at the machine and the pipes elevated to the loft by belts. This method of conveyance is poor and a lift is being installed. This will eliminate much damage to the green pipes.

Bends and Junctions: Mixture is the same as for pipes. Large bends are made on the pipe machine by hand in the usual manner, the column being bent by the operator while it is being extruded .... Each bend is checked on a plaster of paris mould before being transferred to the loft for drying. For short bends and junctions, the component parts are made on the pipe machine and fitted together in the sticking shop by hand. The process is known as "sticking".

Gully Traps and Sinks: Mixture is the same as for glazed pipes. Clay from the pipe machine goes to the moulding shop where it is pressed into plaster of paris moulds, the whole process being a hand one and requiring much skill on the part of the operator.

All the above processes are standard ones and have proved satisfactory for many years past. In the present instance no alteration to the production line is considered necessary except perhaps to improve handling methods. Efforts are being made in this direction.

Agricultural Pipes: The mixture consists of five parts of clay to one part of sand. The poorer grade of clay available in the present pit is normally used for this product. The manufacturing process is again standard and is the same as for glazed pipes except that, as there is no flange, there simply extrudes a column of clay of circular cross-section which is cut off at correct intervals by means of a wire. The process is, therefore, much speedier.

Semi-Firebricks: The mixture consists of three parts of clay to two parts of grog. No sand is used. The first part of the process is similar to the manufacture of wirecut bricks except that no oil is used on the die of the pugmill. A column of clay extrudes from the pugmill, is cut off into large pieces which are then pushed sideways through a series of vertical static wires forming a series of pieces of clay somewhat larger than a standard brick. After maturing, these pieces are then pressed singly on a press into correct size. The bricks are, therefore, of the single-press type.

Fireclay Blocks. Mixture consists of one part of clay to one part of sand. The rough pieces are made on the pugmill in the same manner as for semi-firebricks. Final forming is by hand ramming into wooden moulds. The process is slow, laborious and costly and is used only for special shapes which either do not lend themselves to machine pressing or are of such limited application as not to warrant the expense of die-making. It is usual for this process to be reserved for the manufacture of special shapes from highly refractory clays, the final product commanding a high price. It is the writer's opinion that this branch of the present company's activities is probably uneconomic.

Drying: This again follows the standard procedure in this branch of the heavy clay industry. The ware is stacked on openwork floors on a "loft" around the kilns. The floor of the loft is normally about ten feet above the level of the floor of the kiln. The openwork floor allows a circulation of warm air around and inside the pipes. It is necessary to turn the pipes from time to time as the side nearest the kiln dries quicker. If turning is not done the pipes tend to bend or crack.

Firing: At the present time five beehive kilns are in operation. Four are for glazed ware and one is a "dry" kiln reserved for agricultural pipes and firebricks and blocks. A start has been made on the construction of an additional glaze kiln. The kilns are the normal down-draught beehive type with chequered floor and with a central smokestack. One has eight fireboxes, two have nine and the remaining two, ten. Ware is stacked almost to the roof of the kiln (an unusual feature) and the presence of the central smokestack assists greatly in keeping the ware rigid during firing. Rejects due to ware broken in the kiln are rare. A recording pyrometer is used in conjunction with two thermocouples which can be moved

from one kiln to another. Normal kiln schedule is one week firing and one week cooling, a total of two weeks from the time the wicket is closed till the time the ware can be unloaded. The kiln schedule calls for a gradual rise of temperature up to 1100°c. to 1140°c., a short soaking period during which salting is carried out, then a gradual steady fall. The final stage of cooling is hastened by blowing air into the kiln by means of a fan. This appears to be satisfactory although it is a reversal of the usual method. The blowing of air directly into a hot kiln tends to crack the ware. The drawing out of heated air, the usual method, allows the air to be drawn in through the the fireboxes to become slightly warmed by contact with the bagwall before striking the ware. As stated, however, this does not seem to be necessary in the present instance.

Normally one kiln is lit each week on Thursday or Friday and one kiln commences to unload each week on Monday morning. From January 1st to July 15th 1949, 29 kilns were burnt, an average of one per week. For the same period this year 37 kilns were burnt, an average of 1.3 per week.

Test Results: No systematic test work was contemplated or desirable at the moment. The following details are the results of some preliminary test work to serve as a basis for future work if such is deemed necessary.

(a) Particle size grading:

The following were selected for study:-

(1) Regd. No. 598 Perth sand as delivered to the works.

(2) Regd. No. 599 Mixture for 6" pipes as delivered from dry pan and before going to mixer. Consists of four parts clay to one of sand.

(3) Regd. No.600 Grog as delivered from grog pan.

	598	599	600
10 percent weight	-	0.3	33.2
+22	0.2	1.0	23.2
+60	15.6	3.3	16.8
+100	33.3	6.2	6.0
+150	27.0	6.0	4.5
+200	13.0	3.8	3.0
- 200 By difference	10.9	79.4	13.3

(b) Moisture Content:

Material taken from mixer and stated to be of correct consistency for manufacture of 6" pipes gave a moisture content of 22.2%.

(c) Porosity of Fired Material:

Samples were taken from what was stated to be a good kiln and submitted to the standard water absorption test with the following results:-

(1) Pipe taken from near the floor of the kiln - 10.9% porosity

(2) Glazed brick from near top of kiln - 7.9% porosity

All tests were carried out by the Department of Mines Laboratory, Launceston.

Present Clay Supply:

A plan of the present clay pit is attached to this report. The company owns two blocks of land fronting Glen Dhu Street and Rose Lane. The eastern frontage is to be unformed Thomas Street. Parallel to Rose Lane and approximately 230 links south thereof, the unformed Lilly Street separates the two blocks. The total area of the two blocks is 1 ac. 3 r. 32-2/3p. plus the unknown area of Lilly Street. Between Thomas Street and Westbury Road (subparallel to Thomas Street) is the site of the old clay pit of Hutton's Brick Works. This pit had to be abandoned some years ago owing to encroachment upon the highway.

Superimposed on the plan is an outline of the present pit and location of boreholes put down during the present visit by the company under Mines Department supervision. Logs of these boreholes are attached as an appendix to this report.

It will be seen that good clay extends over an area having a frontage of 90 yards to Glen Dhu Street and 67 yards to Rose Lane. This area stands at an average elevation of 9 feet above the level of Glen Dhu Street and of the available area approx. 900 sq. yards have been excavated to street level. It has been shown that good clay extends to a depth of at least 10 feet below street level and methods have been devised to excavate to this depth. The total volume of clay proved and available is therefore made up as follows:-

To level of Glen Dhu Street	-----	15400	cub. yards
Below level of Glen Dhu Street	-----	18000	" "
	Total	33400	" "

Within this area portion of the clay must be left as a batter to hold up the various roads. Approx. 10 per cent will be required for this purpose reducing the available clay to 30,000 cub. yards. Approx. another 10 per cent must be allowed for poorer grade clay not suitable for glazed ware but possibly suitable for agricultural pipes. This gives a final figure of about 27,000 cu. yards of clay available in the present pit.

To date consumption of clay has been in the vicinity of 30 cub. yards per week. This is being stepped up and it is expected that the average consumption will be about 60 yards per week. The expected life of the pit is therefore of the order of 9 years. There are, however, reasons why the whole of the available material may not be able to be removed from the pit. The area is within the city boundary and it is possible that the company may be prohibited from working the pit at some future time before it is exhausted. Other economic considerations may also operate against the company. It is safe therefore, to give the pit a life of between five and seven years.

Deposition of Clay in Launceston Tertiary Basin:

The sequence of events in the Launceston and Midland area following the intrusion of the Jurassic dolerite sill is as follows:-

(1) A long period of denudation culminating in the Oligocene in the production of a peneplain surfaced with dolerite. Normal weathering processes were replaced by chemical disintegration of the dolerite producing a crust of lateritic bauxite.

(2) An intense period of faulting followed in the Lower Miocene blocking out the present highlands and producing between the Ben Lomond Horst on the east and the Western Tiers on the west two troughs.

(3) Normal erosion processes then commenced to operate, the newly formed streams draining from the highlands into the troughs in which lacustrine or estuarine conditions prevailed. In these troughs the Launceston Tertiary Series waslaid down.

(4) In pliocene times there was a small outpouring of basalt which was of major importance along the northwest coast but of only minor importance in the Launceston area.

(5) Following the filling of the troughs, there was a rise of sea-level in Pleistocene times. The sea invaded the Tamar trough and reintroduced estuarine conditions therein.

(6) Following the rise in sea level, base level was attained in many of the small streams with a consequent deposition of alluvium in recent times.

The only series therefore likely to contain workable deposits of pottery clay is the Launceston Series of middle to upper Miocene age. As stated above,this series was laid down in intermontaine basins of troughs. Initially the conditions were probably estuarine grading later to lacustrine as the troughs began to fill up. The penultimate stage was

probably a series of small lakes interconnected by serpentine streams. The rise of sealevel brought this stage to a close and initiated the present deposition of alluvium.

It is necessary, therefore, to consider the sequence of sedimentation in the troughs. Following the raising of the highlands, young streams were produced which began rapidly eroding the elevated blocks. The first sediments in the troughs would be coarse, poorly sorted gravels, which would be followed by finer gravels and grits. The gravels tend to be widespread and form the base of the series. The succeeding grits grade into coarse and fine sands and are more discontinuous being more in the nature of coalescing deltaic deposits. The clay phase of the series followed the sand phase and probably did not commence until the broad lakes of the troughs had become silted up and broken down into a series of smaller lakes. Deposition of clay involves two special conditions which are not necessary for the coarser arenaceous materials:

(1) The predominance of chemical as opposed to physical weathering in the supply areas.

(2) Calm and still water conditions in the depositional areas.

The condition of chemical weathering in the supply areas indicates deposition later in the series and the condition of still water in the depositional areas implies deposition in comparatively small and discontinuous amounts.

Summing up then, it can be stated that :-

(1) All pottery clays in the Launceston district are to be found in the Launceston Tertiary Series.

(2) Such clays are to be found near the top of the series and rest on gravels, grits or sands.

(3) It is not expected that clay in important amounts will be found in the series below gravel, grit or sand beds although thin bands of clay may be found associated with such beds.

(4) The workable deposits of clay are likely to be discontinuous and to vary to some extent both laterally and vertically.

Prospecting for Fresh Clay Deposits:

This was undertaken in the light of the above analysis of the sequence of events in the Launceston district and consist of the systematic traversing of all roads located on or near Launceston Series deposits. Areas within the city boundary were automatically eliminated for aesthetic and economic reasons. There is, for instance, an extensive area of clay extending northwards from the present pit, underlying the new school near the

Junction of the Bass and the Midland Highways and extending at least as far north as Campbell's Potteries. This same area also extends beneath and eastwards of the Bass Highway from the pit. No portion of this area could now be worked as a claypit and no attention was given to it. Similarly an area of good clay that has been revealed by excavations for the new building for the Old Men's Home near Normanston Road, had to be eliminated on the same grounds.

A traverse of the scottsdale Road to a point one mile east of 7EX broadcasting station revealed that the Launceston Series in this area consists mainly of the gravel and grit phase. Excavations for a new water main provided a good section of the country for several hundred yards. A small patch of Launceston Series resting on dolerite occurs at Ravenswood but also appears to be low down in the Series and is not likely to contain clays.

At St Leonards there occurs a patch of good clay overlying bauxite but this area is not available having been taken up by Wunderlich Ltd. Further prospecting on this area would be warranted.

South of St Leonards a series of post holes have been dug along the side of the road. From the point at which the High Tension Line crosses the road down to Corra Lynn several good clay prospects were noted in these borings. The area is fairly flat and few outcrops were seen. This area may repay investigation though it is rather far from the present works.

Along the West Tamar Road commencing at a point one and a half miles from the Trevallyn Bridge, there is a patch of Launceston Series showing promising clay outcrops. This area is mostly cut up into building blocks, however, and it is doubtful if it would be worth while prospecting.

Approx. one mile along the Bass Highway from its junction with Wellington Street another small patch of Launceston Series is shown on the map. On the eastern margin of this is located the new brickworks of Hutton Bros. The material being used here is a rather sandy phase of the clay series. Bricks are pressed. About a quarter of a mile west from the brickworks, are located the works of the Launceston Silica Brick Company. This Company is using the grit and sand phase of the Launceston Series in the manufacture of concrete products. An investigation on both sides of the Bass Highway revealed that the area of Launceston Series is rather more extensive than is shown on the map. The area was by no means fully investigated but good clay was seen in several cuts, post-holes etc. In particular one good patch is revealed in a waterhole scooped out by a bulldozer recently. This hole is located on a private road used as an access to a timber area and which goes south from the Bass Highway at a point two and a half miles from Wellington Street. The whole of this area would bear systematic investigation which was not possible during the present visit. It is likely, however, that deposits of Launceston Series will be comparatively thin in this area. Such deposits here occupy slight

depressions in the dolerite and it is expected that the dolerite bottom will be found within perhaps thirty to forty feet in most places.

Deposits of clay are likely at many places along the Hobart Road as far as the turnoff to Relbia. In fact two pottery works, Machim's Brickworks and Wunderlich Ltd. are located in this area. The area is being developed as a housing settlement, however, and it is doubtful if land for claypits could now be purchased there, at least within reasonable distance of the main highway.

A road leaves the Hobart Road some five miles south of Launceston and travels in a general south-easterly direction to cross the Midland Railway at Relbia. After crossing the railway the road turns north and parallels the Hobart Road back to Launceston keeping within three-quarters of a mile of the North Esk and meeting the Scottsdale Road. From Relbia the road swings away from the railway, coming back to it about three road miles from Relbia Station. This three miles traverses undulating country which shows good prospects for clays. From a point about one mile north of Relbia station and for a distance of between one and one and a half miles clay outcrops fairly consistently along the shallow road cuttings. One and three quarters of a mile north of Relbia station a hole for water has been scooped out near the road on the eastern side. This shows good clay of the type being used at the works. A brief investigation shows that the clay is likely to extend over a reasonable area. The undulating nature of the country would make the opening of a clay pit a simple matter. Several cross roads connect the area with the Hobart Road and the distance from the works is under five miles. This is regarded as the most likely prospect seen during the present investigation and it is strongly recommended that the area be systematically investigated. The district has been developed as farms and not investigation has been made into the availability of land for sale. It is considered that this is a question for the company to investigate. Caution is needed in such enquiries as the price is liable to jump considerably if it becomes known what purpose the land is required for.

Summarising the clay prospects then, it may be stated that the Relbia deposit is the most promising from a technical point of view and probably from an economic point of view also although this point requires further study. The area is within reasonable distance of the works. Failing this, the area along the Bass Highway could be investigated although it is not considered that the deposits along here will have such good characteristics and are liable to be sandy and perhaps discontinuous. Finally, the area near St Leonards where clay is known to exist over the bauxite, and the area near Corra Lynn could

be investigated. No opinion of the technical characteristics nor extent of these deposits can be given at the moment. The question of transport is likely to be important in relation to this area.

Suggestions for Further Investigation:

Investigation of the areas suggested should follow along these lines :-

(1) A closer and more systematic search for outcrops than has been possible so far.

(2) Scout boring to a depth of up to twenty feet in likely areas, visual assessment of the cores, followed by firing of trial handmade blocks in the commercial kilns. At this point a preliminary selection of one or more likely areas can be made.

(3) It is then necessary to bore the selected areas on a grid such as has been adopted in the investigation of the present pit. Bores to be spaced between twenty and one hundred feet depending on the size of the area and put down to twenty feet. Systematic testing of the cores follows. It is not necessary to fire a sample from each bore but only to fire samples showing different physical characteristics. The idea is to obtain a knowledge of the variation of the clay over the area. If possible some bores should be put down as deep as possible to test the actual depth of the deposit. If undue variation is found over the area it may be necessary to space the bores closer together. Finally from the results of the boring and firing tests it should be possible to assess

(a) the quantity of material available and

(b) the variations within the deposit.

It is unlikely that clay of exactly the same character as is at present being used will be found. Broadly speaking there are two variables in ceramic production :-

(a) The raw material or materials

(b) The production methods.

Adjustment of one or both of these variables is usually necessary when a new raw material is being introduced.

(a) The raw material or materials: The technical characteristics of the new materials must be determined in relation to those of the old materials. Under this heading come the following - plasticity, drying and firing shrinkage, green, dry and fired strength, degree of vitrification at various temperatures, tendency to warp or crack, ability to "take" the glaze, cost of material.

(b) Production methods: Factors which may be varied include the following; blending of materials, in this case clay with sand; size grading of mixed materials;

moisture content of pugged clay; size of green ware; kiln heating and cooling schedule; maximum temperature of kiln.

At the moment these factors can be mentioned only and no indication can be given of the way in which variations may have to be made. The guiding principle is to determine the characteristics of the proposed new materials by a series of firing tests and then to adjust the various production variables in order to produce a final product as good as or, if possible, better than is at present being made. Such a project requires a competent ceramic investigator.

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A.M.A.I.M.M.
Geologist

Zeehan
24th August, 1950

BORELOGS

Bore 2	3 ft.	Brown surface clay	
	3 ft.	Reddish white plastic clay)	good clay
	4 ft.	White plastic clay	
Bore 3	2 ft.	Brown clay	
	8 ft.	White plastic clay with yellow) and red bands	" "
Bore 4	3 ft.	Brown clay	
	1 ft.	Very red plastic clay)	" "
	6 "	White plastic clay becoming red at bottom of hole	
Bore 6	3 ft.	Brown clay	
	3 ft.	Very red plastic clay	
	2 ft.	White plastic clay with flecks) of red	" "
	2 ft.	Very yellow plastic clay	
Bore 7	7 ft.	Sl. brownish plastic clay with red flecks)	" "
	3 ft.	Yellow plastic clay	
Bore 8	1 ft.	Brown surface clay	
	9 ft.	White plastic clay with patches) showing yellow and red flecks	" "
Bore 9	1 ft.	Brown clay	
	3 ft.	Very red plastic clay grading down to yellow)	" "
	5 ft.	White plastic clay with yellow and red flecks	
Bore 10	10 ft.	Sandy yellow brown poorly plastic clay	
Bore 11	5 ft.	White plastic clay with red and yellow flecks)	" "
	5 ft.	Deep red brown less plastic clay with sandy layers	
Bore 12	10 ft.	Very plastic yellow clay grading down to white and then yellow at) bottom of hole	" "
Bore 14	1 ft.	Poorly plastic brown clay	
	3 ft.	White plastic clay with yellow flecks)	" "
	5 ft.	Yellow plastic clay	
	1 ft.	Rather sandy deep red clay	
Bore 15	1 ft.	White plastic clay with yellow flecks	
	2 ft.	Yellow plastic clay)	" "
	7 ft.	Yellow plastic clay with red flecks	
Bore 16	4 ft.	White plastic clay	
	6 ft.	White plastic clay with much) yellow flecking	" "
Bore 17	3 ft.	White plastic clay with yellow flecks)	" "
	7 ft.	Yellow plastic clay	
Bore 18	10 ft.	Yellow plastic clay showing thin) bands of white and red	" "

Bore 19	5 ft.	White plastic clay with yellow flecks		
	4 ft.	Yellow plastic clay	)	Good clay
	1 ft.	White plastic clay		
Bore 21	10 ft.	Sandy clay, dark colour	)	Very poor
Bore 22	4 ft.	Yellow to white plastic clay		
	2 ft	Yellow plastic clay	)	Good clay
	4 ft.	White plastic clay		
6 Bore 23	7 ft.	Reddish white plastic clay		
	2 ft.	Yellow plastic clay	)	" "
	2 ft.	White plastic clay/ Yellow		
Bore 25	5 ft.	Sandy reddish clay		
	5 ft.	Yellowish white plastic clay	)	" "
Bore 26	3 ft.	Sandy reddish clay		
	2 ft.	Reddish yellow plastic clay	)	" "
	5 ft.	White plastic clay		
Bore 27	5 ft.	Sandy brown clay		
	5 ft.	Reddish white plastic clay	)	" "
