

LOCATION AND ACCESS.

The sand quarry of Mr. T. E. Gates is situated on a 4 acre block owned by Mrs. M. E. Gates in Coleman Street Moonah. Access is gained from the main road from Hobart to Launceston by means of Amy Street and Coleman Street. The quarry is approximately 20 chains west of the main road and $3\frac{1}{2}$ miles from Hobart. The Hobart to Launceston railway passes about one mile to the east of the quarry.

TOPOGRAPHY

The surface in the vicinity of Moonah is flat and lowlying and does not exceed 100 feet above sea level. To the east the hill above Risdon rises to an elevation of about 200 feet, while to the immediate west of the quarry another hill rises to somewhat greater elevations. Between these two hills the surface is flat with a gentle slope to the north-east in the direction of the Derwent River in which direction the drainage is discharged.

GEOLOGY

The hills to the east and west of Moonah are composed of diabase (or as it is locally known, ironstone, greenstone or bluestone) of Upper Mesozoic age. This diabase was intrusive into Permo-Carboniferous or Trias-Jura strata which have been entirely removed by denudation from this particular locality.

The low lying ground between these hills is covered by a thick accumulation of black soil and Recent hill detritus consisting mainly of pebbles of diabase.

Underlying these recent deposits throughout portion at least of the district, deposits of Tertiary age occur as shown by the sections exposed in the quarry. These exposures show from 40 to over 60 feet of loosely compacted sandstones. The bottom layers are somewhat coarse in grain and at some places contain beds composed of boulders of decomposed diabase. The beds towards the top of the quarry are much finer in grain and diabase boulders are absent. The dip of the sandstones is irregular due to current bedding, but the general dip is to the north-east at low angles. The sandstones vary in colour from white to yellow and light brown due to the presence of oxides of iron. Concretions of iron oxides and also of limestone occur, the latter being arranged along definite bedding or other planes.

No fossils have been found in these sandstones but they can with certainty be correlated with other Tertiary deposits along the margins of the River Derwent and are probably of lower Tertiary age. They represent sediments deposited in the shallow waters of probably a lake which occupied the valley of the Lower Derwent in Tertiary times.

The bottom of the sandstone beds is not visible at present in the quarry, but from information received from Mr. Gates it consists of a soft material identifiable as decomposed diabase. This bottom is stated to rise to the south-west and the sandstones thin out in that direction. Solid and undecomposed diabase outcrops on the hill outside Mr. Gates' property to the south-west. The boundary of the sandstones and diabase is approximately the south western boundary of the property and this represents the shore of the former lake.

Sand. The sandstones which are exposed in the quarry were discovered during the sinking of a shallow pit in which it was intended to bury a dead animal. The sandstones were found to be very loosely compacted and disintegrated readily into sand. A contract was immediately entered into and the sand obtained by means of shafts. This method was soon abandoned in favour of quarrying and an approach was cut into the deposits from the North-east.

The particles of sand vary in size from coarse (up to $\frac{1}{8}$ inch) to fine, the coarser sandstones occurring, as indicated above, in the bottom layers and the finer ones toward the top. The sand grains are sub-angular but all edges have been rounded off by the action of the waters of the lake in which they were deposited. The sandstones are remarkably free from clayey material though in some of the upper layers a small amount of this material is included in them.

The present quarry is roughly circular in shape with a diameter of approximately two chains, the approach into the quarry being from the north-east. The greatest depth worked is reported as 64 feet on the northern side. The bottom of decomposed diabase has been encountered at depths of between 40 and 50 feet in other parts of the quarry and this may be taken as the average depth of the sandstones in the vicinity of the quarry. As already mentioned above the boundary of the sandstones may be taken as that of the south-western boundary of the property and the thickness will be found to diminish as the boundary is approached. As regards the extension of the beds in other directions they will be found, except where removed by later denudation, to occur around the flanks of the diabase hill which arises to the south west. Extensions may, therefore, be looked for to the north-west, north-east and south-east. An increase in thickness of the sandstones is expected to the east in which direction the deeper waters of the lake would have existed, but this increase need not necessarily be large. There is a gradual fall in the present surface in that direction and this would reduce the thickness of the existing beds in that direction. Therefore, there exists the possibility of other quarries being opened on these deposits in the vicinity of the present quarry site.

There has been a large demand for the sand from this quarry, and calculations based on the dimensions prove that 500,000 to 600,000 cubic feet have been removed from the quarry. The sand has been used for all purposes in connection with building and construction work such as making concrete and mortar for bricklaying and plastering work. It is stated that particular beds and parts of the quarry are suitable for different purposes and can be supplied accordingly.

Refractory Material. The owner of the quarry reports that underlying the sandstones he has always found a soft material which he thought suitable for making fire-bricks. Unfortunately, at the time of the writers visit, this material at the bottom of sandstones was not visible, having been covered by falls of sand from the sides of the quarry. However on the eastern side of the quarry the writer was shown material reported to be identical with that from the bottom. This material clearly represents completely decomposed diabase which occurs as pebbles and large boulders, layers of which are interbedded with the sandstones. The presence of these boulders is due to the proximity to the shore of the lake.

It would, therefore, appear that the bottom of the quarry is occupied by decomposed diabase. This is supported by the fact that diabase outcrops within a few chains to the south-west and undoubtedly underlies the Tertiary sandstones and must, therefore, have formed the bed of the Tertiary lake. The decomposition of the diabase was caused partly by surface weathering before it was covered by the lake, but mainly by the action of the waters of the lake during its submergence.

A representative sample was taken from top to bottom of the large boulder (2 to 3 feet diameter) of decomposed diabase visible in the quarry. The outside of this boulder was stained brownish due to oxides of iron, but the interior was light-grey in colour. Approximately equal portions of these two differently coloured portions were included in the sample with probably, however, an excess of the brownish material. If the underlying material consists mainly of the greyish variety, it is probable that it will be found to have a lower content of ferric oxide than that shown in the sample obtained.

The sample obtained was analysed in the Geological Survey Laboratory, Launceston, with the following results. (See Table I)

An analysis of a fresh sample of diabase from Launceston is shown for comparison. The decomposition has resulted in the removal from the diabase of all the soluble constituents such as ferrous oxide, lime, magnesia, alkalies in the form of bicarbonates. The resulting material shows a corresponding increase of silica and alumina due to the removal of the above, and also of ferric oxide due to the same cause and also oxidation of some of the ferrous oxide. This decomposition with the removal of the soluble constituents (which are also fluxing materials and therefore undesirable from the point of view of refractory material) has rendered the remaining material more or less satisfactory for use for refractory purposes.

The material represents the decomposed diabase actually in place and has not been resorted. Its physical properties are such that it cannot be strictly termed "clay" although it is of similar composition. The rational analysis calculated from the ultimate is given in Table II.

TABLE II

Clay Substance	64%
Quartz	29%
Others	7%
	<u>100%</u>

Table I	S A M P L E	
	Decomposed Diabase, Moonah Per Cent	Fresh Diabase Launceston Per Cent
Silica (SiO ₂)	58.40	52.49
Alumina (Al ₂ O ₃)	25.34	16.44
Ferric Oxide (Fe ₂ O ₃)	3.76	2.60
Ferrons Oxide (FeO)		5.30
Lime (CaO)	0.52	11.71

Constituent	Decomposed Diabase, Moonah Per Cent	Fresh Diabase Launceston Per Cent
Magnesia (MgO)	0.44	6.81
Soda (Na ₂ O)		2.06
Potash (K ₂ O)		1.09
Titanium (TiO ₂) Oxide	1.70	0.62
Ignition Loss	9.50	
Water under 110°C		0.15
Water		1.42
	99.66	100.06

As regards the possible use of this material as a "clay" the high content of ferric oxide precludes its use for any product in which colour is not required, as this material when burned will be highly coloured. This examination was made from the point of view of determining the suitability for the manufacture of firebrick and this aspect only will be dealt with. It must be remembered however, that the material might, if tested, prove to be suitable for coloured products.

From the point of view of refractory material it is essential that the fluxing impurities present should be small in amount. In the analysis above it is seen that the lime and magnesia content are comparatively low, but that of ferric oxide and titanium oxide are fairly high. The fusion point was determined by means of Segar cones and it was found to be near Cone 30 or approximately 1700° Centigrade. Ries considers that no clay should be classed as a fire-clay unless its fusion point exceeds that of Cone 27 or 1670° Centigrade. The fusion point of the decomposed diabase is above this limit and can therefore be considered from this stand point as a fire-clay or refractory material.

The material was found to possess a small amount of plasticity, but other properties such as texture, tensile strength and porosity were not determined.

Conclusions - Recommendations.

It has been seen above that the decomposed diabase which underlies the sandstone in the quarry has a chemical composition, fusion point and perhaps plasticity which renders it suitable for use as a refractory material for the manufacture of fire-bricks, gas and zinc retorts, furnace linings &c. Other essential properties required for this purpose such as texture, tensile strength porosity, shrinkage &c. were not, however, tested, and, in fact, the development of the deposit does not at present warrant such tests.

The main detrimental feature of the material is the high content of ferric oxide. This lowers the fusion point, but in spite of this the fusion point is 1700° and is, therefore, fairly satisfactory. Further the presence of such an amount in a manufactured

50

firebrick would be objectionable as fused material in contact with the brick would tend to dissolve the ferric oxide and thus corrode the brick. However, as pointed out above a fully representative sample may not contain such a large proportion of ferric oxide.

The facts however justify a certain amount of work being performed to further test the deposit. This should take the form of sinking several shafts from the bottom of the quarry through the decomposed diabase. This will determine the thickness of the decomposed diabase and will also enable large representative samples to be obtained. A series of bore-holes should also be sunk in order to determine the extension or otherwise beyond the quarry.

This extension should be sought in the north-west, north-east and south-east of the quarry under the Tertiary sandstones which occur in these directions. No extension of the decomposed diabase is possible to the south-west where the undecomposed diabase outcrops at the surface.

If the extent and thickness are such that large quantities of the material are available, the testing of the bulk samples from the shafts and bores could then be proceeded with. Further analysis could be made and the fusion point, porosity, texture, shrinkage and tensile strength could also be determined. It would also be advisable to have a large sample tested by a manufacturing works, where articles, for which it is intended that the clay be used, are made.

If these tests are favourable, consideration could then be given to the question of working the deposit and the processes of manufacturing &c.

P.B. Nye

GOVERNMENT GEOLOGIST.

13th December, 1923.