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SILICA AT ULVERSTONE

There are several localities in the Ulverstone district from which sand has been obtained for road and general building purposes. This report deals only with the area known as the "silica pits", an occurrence from which about 1,000 tons of siliceous material has been shipped to Melbourne, the buyers being S.N. Rodda Pty. Ltd. and Minerals (Vic.) Pty. Ltd.

The pits are situated on a Crown Reservation about one mile south-westerly from the Ulverstone Railway Station. The reservation traverses the southern bank of the Leven River and follows an indentation made by the mouth of Stinking Creek. The silica is exposed along the north-easterly side of this indentation and thence for a few chains down stream along the bank of the Leven. It has been opened up by two small pits, one on the river bank, and one on the indentation adjoining the bridge on which the Nietta Branch Railway crosses Stinking Creek.

From a geological point of view the formation is quite unusual. The silica has been derived from the alteration in situ of massive quartz, which appears to have been subjected to intense shearing strains with a resultant development of granulitic texture. In thin section it is seen that the original quartz crystals have been cracked or broken, and that more or less complete recrystallization has taken place. These secondary crystals are characterised by undulose extinction and there is a pronounced parallelism in the optical orientation giving the rock a schistose appearance. In the sections prepared no minerals other than quartz are identifiable.

The commercial material is, in general, almost a rock flour and could best be described as a quartz mylonite. In part, however, the original rock structure is preserved in masses which superficially resemble reef quartz, but which can usually be crumbled by hand to a fine powdery condition. These masses are distributed irregularly through the unconsolidated material exposed over the greater part of the quarry faces.

Under the microscope the unconsolidated silica appears as an extremely fine sand composed of excessively angular quartz particles of uneven grain size. Where uncontaminated the material is usually a pure white in colour, and this has been one of its chief commercial attributes, a premium being paid by the buyers on colour purity.

A grab sampled from one of the quarry faces analysed at the Mines Department Laboratory, Launceston, showed the chemical composition to be,

Silica.....	98.70%
Alumina.....	0.70%
Ferric Oxide.....	0.02%
Loss on Ignition..	0.58%

The alumina and ferric oxide may have been deposited by percolating ground waters, or may be present as a silicate mineral residual from the original wall rock. The ignition loss is probably due to included organic material, and to the hydration of the alumina and ferric oxide.

In the immediate vicinity of the silica pits exposures are too poor to permit of any definite interpretation of the geological structure. The deposit is usually overlain by a more or less flat lying band of coarse wash containing rounded pebbles of quartz, quartzite, conglomerate, chert jasper etc. Above this there may be a finer quartzitic wash passing upwards into the normal flat-lying Pleistocene sands and clays which form the surrounding land surface.

Massive quartzite boulders occur both in the silica itself and in the sands immediately overlying it. The quartzite varies in appearance from a granular to an almost opaline type. It is usually very hard and frequently the boulders have an opaque white border and a vitreous interior.

In thin section the quartzite is seen to comprise two generations of crystalline quartz. From field associations, and from the size and optical condition of the primary quartz grains it appears to have been derived from the material forming the bulk of the deposit. Some of the boulders are iron-stained, even in the interior, but with this exception no minerals other than quartz are identifiable.

To the south of the pits the older structures are obscured by basalt and by heavy basaltic soil. To the north and west the formation is bounded by the Leven, here about a third of a mile wide. To the north-east, along the bank of the river, evidence of the silica bearing formation persists discontinuously for about 20 chains at which distance a belt of black slates, or mudstones, is encountered. These rocks are intensely folded and in some parts highly contorted. The general strike is meridional and the dip, due to the over-folding, is constantly westerly. The slates belong to the series which has been termed Cambro-Ordovician, and may be of Lower Ordovician age.

The slates are exposed again along the Ulverstone beach and have, in places, been more or less completely replaced by quartz. On both sides of the Leven River estuary there are unusually massive formations of quartz and silicified slates. Although it has not been practicable to trace the material of the silica deposit along its strike, it may reasonably be considered as a special phase of the massive quartz formations exposed on the beach. Support is lent to this view by the fact that isolated fragments of partially silicified slate may be found in one part of the silica pits.

It is suggested, then, that the silica has been formed by the intense shearing of massive Devonian, or Epi-Devonian, quartz occurring in Cambro-Ordovician slates. The shearing was probably associated with the regional diastrophism responsible for the folding and contorting of all the older rocks in the district. Evidence of intense shearing stresses is provided by the occurrence on the beach west of Ulverstone of a considerable area of "stretched pebbles" of a quartzitic nature: These are interbedded with the slates in a complex system of flow, or ptygmatic, folding.

The availability of the commercial silica is not governed primarily by the distribution of the quartz formation but by the localisation of the special phase in which the quartz has undergone shearing sufficiently intense to cause complete shattering. Unfortunately there is no definite evidence available as to the trend and extent of that phase.

For this reason any prospecting campaign should be based on the known exposures, and should be aimed both at determining the extent to which the silica persists under the flat sands and clays, and at establishing some structural control so that wasteful shaft sinking may be eliminated as far as possible. There is an apparent association between the quartzite and the silica which may prove helpful as the quartzite outcrops are easy to locate. This relationship should be carefully watched in all prospect shafts. A tentative layout of ten shafts, which could form part of an ultimate grid, is shown on the accompanying plan. It would be desirable to sink the majority of the shafts to 25 or 30 feet. Two or three shafts in selected positions should be carried further to test the formation below water level.

On the present quarry faces the overburden averages eight or ten feet, but below that depth portion of the silica is badly discoloured by banded limonitic layers which pursue irregular courses across the quarry faces, and which have arisen from the rhythmic precipitation of iron from solution.

Since the silica mass is quite permeable the contamination of parts of the deposit by solutions is to be expected. For present uses, in which colour purity is of first importance, the operator of the pits estimated that nearly 50 per cent of the material is rejected and dumped. This quarry waste is due to :-

- (1) Iron staining. The iron may have originated from the oxidation of pyrites in the slate wall rocks, but hematite occurs in the district and the normal ground water may be carrying iron in solution. There is also a very delicate pink stain in isolated parts; this is probably due to minute traces of manganese and should not be detrimental.
- (2) Inclusions of quartzite: These are essentially the same material as the silica but are usually extremely hard.
- (3) Inclusions of slate wall rock. These were observed in one corner only and are unimportant.
- (4) Intrusions of overlying sediments. These represent irregularities in the silica surface and are in indeterminate quantity.
- (5) Contamination due to seepages rich in organic matter. These are due to poor surface drainage and would be practically eliminated if constant working were established.

The average vertical extent of material available is not known because the silica has not been followed in depth, except in a few high grade patches where it was taken out for five or six feet below the quarry floor. By this method vertical faces exceeding twenty feet have been exposed. An auger hole, all in silica, is said to have penetrated for fifteen feet below the quarry floor, which is about five feet above high water mark. Workings below water level would be difficult to keep dry, but if the demand were sufficient, and if the formation were proved to persist in depth, it would be quite practicable and economical to establish a system of dredging.

The silica that at present can reasonably be regarded as being in sight under an average of approximately ten feet of overburden extends from the pit on the Leven River to the pit near the railway bridge, whence it passes under the railway and continues for an unknown distance towards the bank of Stinking Creek. Assuming an average face of fifteen feet of silica, and quarry waste at a rate of fifty percent, there would be about 25,000 tons of selected material in this section.

The greater part of this tonnage would be on Mining Lease 11744/M, and on Lease Application B3M/42, both in the name of Allan Pearson. The remainder would be on Lot 350, R.L. Mason, owner. Three or four shafts would be required to prove this quantity, but on available evidence the above may be regarded as a conservative estimate, and there is every expectation that prospecting work would at least justify it.

As regards further tonnages the outcrop north-easterly from the river pit proves an extension in that direction, and the formation exposed there near water level may extend across the Crown Reservation into Lot 350. The overburden in this section would possibly be appreciably heavier. There is another outcrop further down stream which also may extend inland. North-westerly across the river there is a quartzite area which may merit prospecting.

Although no work has been carried out on these areas, and no definite statement is possible, it is reasonable to anticipate that they would contain sufficient silica to carry the prospective output to 100,000 tons or more. The proving of such a quantity, if well conceived, would not be unduly expensive.

Before considering the extraction of silica from under heavy overburden the depth of formation in the vicinity of the existing pits should be ascertained. These pits are conveniently situated, and it is likely that by working to greater depths tonnages to meet all immediate requirements could be obtained from a comparatively small area with a minimum of expenditure on prospecting and stripping, and a minimum wastage of land surface.

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