

SILICA AT ULVERSTONEINTRODUCTION

An earlier report of the same title was written on 9th November, 1942. The present report contains essentially the same substance as regards the commercial estimation of the deposit, but modified views are expressed as to the origin of the material, and details of recent sampling, together with relevant laboratory determinations, have been included.

The investigations on which both reports are based have been concerned principally with an area known as the "silica pits", and with quartzitic rock formations which appear to be genetically connected with the material exposed in the silica pits. Sand for road making and general constructional purposes has been worked in other parts of the district, but these are unrelated deposits and were not regarded as coming within the scope of the investigation.

LOCATION

The silica pits are situated on a Crown Reservation about one mile south-westerly from 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. Both pits are included in Mining Lease No. 11744/M, 5 acres, in the name of Allan Pearson. Commercial production has amounted to a little over 1,000 tons of siliceous material which has been shipped to Melbourne, the buyers being S.N. Rodda Pty. Ltd., and Minerals (Vic.) Pty. Ltd.

NATURE OF THE MATERIAL

The commercial silica is virtually a rock flour and occurs as the principal component of a formation which includes quartzitic boulders and fragments of all sizes. The deposit is considered to have been derived from reef quartz and from associated silicified slates and sandstones.

In parts of the exposed faces, traces of the original rock structure are preserved in fragments irregularly distributed through the unconsolidated material which forms the bulk of the deposit. Some of these are very friable and form an intermediate stage between hard rock and rock flour. Others can be handled without difficulty and have been subjected to close examination. The parent material appears to have undergone 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 characterized 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.

Under the microscope, the unconsolidated silica appears as an extremely fine sand composed of angular quartz particles of uneven grain size. Where uncontaminated, the material is usually a pure white in colour, and this

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has been one of its chief commercial attributes, a premium being paid by the buyers on colour purity,

#### ORIGIN AND GENERAL GEOLOGY

In the immediate vicinity of the silica pits exposures are too poor to permit of a 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, gravels 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 is considered to have been derived from the same material as the bulk of the silica 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 is encountered. These rocks are intensely folded and in some parts highly contorted. The general strike is meridional and the dip, due to over-folding, is constantly westerly. The slates belong to the series which has been termed Cambro-Ordovician, and may be of Lower Ordovician age.

Similar slates with interbedded sandstones and pebble beds are exposed intermittently along the beaches for a considerable distance westerly from Ulverstone. The intense folding persists throughout the series and in parts the beds have been compressed and sheared into a series of ptygmatic folds. In the pebble beds the individual stones are elongated along the flow lines and have developed a schistose cleavage.

The slates and sandstones are traversed by numerous quartz reefs and have themselves, in some parts, become almost completely silicified. This intrusion of quartz, which was probably more or less contemporaneous with the folding and shearing, has resulted in the development of reef quartz, quartzite and quartz schist. These rocks are plentiful in the area and in some parts carry more than

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98 per cent of silica.

The silica mined at the pits is regarded as being derived from these quartzitic rocks. It may be merely a phase of the formation in which particularly intense shearing and crushing took place subsequently to the intrusion of the quartz, but it is more probably part of a transported deposit resulting from glacial attrition, assimilation and re-deposition. The distinction is important as it has a direct bearing on the probable persistence of the deposit, both as regards areal extent and depth. Unfortunately, it is not at present practicable to make any definite assumptions in the matter, but the position should become clarified in the early stages of any prospecting campaign.

#### QUANTITY AVAILABLE

No useful effort has been made to prove the volume of commercial silica available in the vicinity of the pits. Little is known concerning the area or thickness of the deposit, and the percentages of contaminated material and overburden can be estimated only from limited observation in the two pits. For this reason no tonnage estimate can be placed on the deposit as a whole, and the following calculation has been based only on the probable persistence of conditions prevailing over a limited area around the pits, without any reference to the possible ultimate output capacity of the deposit.

The height of the silica face so far exposed, averages about 15 feet. In parts silica has been taken out for 5 or 6 feet below the quarry floor and an augur hole is said to have penetrated 15 feet of silica below the quarry floor. The pit owner estimates quarry wastage at about 50%, and the overburden appears to average about 10 feet.

It is reasonable to assume that the silica extends at least from the pit on the Leven River to the pit at the railway bridge and thence on towards the bank of Stinking Creek. This embraces an area of about two and three-quarter acres which, with an average thickness of 15 feet, would yield from 60,000 to 70,000 tons gross, representing about 30,000 to 35,000 tons of product of the grade at present marketed.

Even this comparatively small quantity cannot be regarded as proved. As may be seen from the accompanying plan suggestions have been made regarding the sinking of prospecting shafts but so far no work of value has been carried out.

#### PROSPECTING

Testing work should in the first place be directed towards proving the above quantity and, at the same time, determining whether the depth factor can be increased. The present quarry floors are about 5 feet above high water level and, in view of the permeable nature of the material, it would probably be difficult to keep deep workings dry. With a changed outlet for the product, it may happen that the present practice of selective mining is not necessary, and in this event it would be quite practicable to dredge the silica from below water level.

Approximately six shafts of from 25 feet to

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50 feet in depth would be required to define the position in the immediate vicinity of the pits. These shafts should also enable a better understanding of the structure to be reached, and with this knowledge, the testing work could be extended further afield with maximum economy. Before undertaking a testing programme of this nature it would be desirable to have an objective tonnage and grade set for the investigation.

If the objective tonnage were not realized in the area near the pits, scout-prospecting could be carried out on the indications on the downstream side. Attention could also be directed towards the possibility of utilizing quartz or quartzite from the many outcrops in the district in place of the rock-flour material now being worked.

#### QUALITY OF THE SILICA

Reference has already been made to the quarry rejection of about 50 per cent of the silica. This is made principally on account of colour contamination. The upper part of the formation, near the contact with the boulder wash, is in many parts badly stained with limonite. Banded limonite stains are also encountered in isolated parts of the body of the deposit.

The assay results quoted below show that the permeable rock-flour mass of the silica pits carries much less iron than the hard quartzite or quartz schist. This suggests that the ground water is actively leaching iron from the silica, and that the limonite stained bands are instances of re-precipitation under abnormal conditions. Laboratory tests are at present being carried out to determine whether the iron content of the hard rock can be reduced by acid treatment or magnetic methods.

Contamination in the pits also results from seepages rich in iron and organic matter. These are mainly due to poor surface drainage and would be practically eliminated if constant working, accompanied by advance stripping of overburden, were established.

Stained portions of the silica and inclusions of hard quartzite are the most obvious reasons for rejection of material. There is, however, a further variation in quality which may or may not result in rejection. This seems to arise from the original nature of the material, that is, whether reef quartz, silicified sandstone or silicified slate.

It is not practicable to classify any appreciable percentage of the material in terms of its origin, but where reef quartz is identifiable the colour is very good except that there is a tendency for the precipitation of limonite along shear planes. The silicified slate is, in parts, recognisable by a slight darkening in the colour, by the presence of minute quantities of white mica, and by a slight tendency towards a clay-like texture. Fragments of silicified sandstone may also be marked by a slight colour variation.

When the material is dried and mixed these differences are no longer discernable but, together with the staining, they have been sufficiently important to cause a rather high quarry waste and a lack of uniformity in the crude product. For the purposes of an industry which requires chemical purity, rather than colour purity, the variations may be less important, particularly if

small quantities of alumina are not objectionable.

A transcription of a preliminary report from the Mines Department Laboratory, Launceston, follows. In this report Sample No. 37 is the only one relating to the present commercial product. This sample consisted of about 200 lbs. of silica sand obtained from four different parts of the quarry faces. It may be regarded as representative of the average first-quality commercial product.

The other samples are all of quartzite from various parts of the district. Should any of them prove amenable to beneficiation, or otherwise commercially attractive work could be undertaken with the object of determining available quantities and costs of production.

The only other official sample of Ulverstone silica is that referred to in the original report. This was a grab sample from the pits and assayed:-

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

LABORATORY REPORT

		<u>Description of Samples</u>	
Reg. No.	37	Silica Sand	Ulverstone (A. Pearson)
"	"	38	Quartzite
"	"	39	"
"	"	40	"
"	"	41	"
"	"	42	"
"	"	43	"
"	"	44	Mixed pebbles and schist
			Goat Island.

Preparation of samples for analysis.

No. 37. This sample contained a small proportion of coarse material which was reduced by rolling and finally by a jaw crusher (M.S. plates) to minus 5 mesh. A sample of the minus 5 mesh material was reduced to minus 100 mesh for an assay sample in a wedgewood mortar. Iron contamination would be low but some material from the wedgewood mortar would occasion contamination.

Nos. 38-44 (Quartzites). These samples contained no fine material and it was necessary to reduce them by jaw crusher to minus 1/4 inch size, and final reduction to a fine powder to a size suitable for analysis by grinding in a pulveriser fitted with hard cast iron discs. Iron

contamination would be high and all iron removable with a permanent magnet was rejected from the samples before submitting them to analysis.

LABORATORY REPORT CONTD.

The iron content of these samples is higher than No. 37 and variable. Reduction of samples to a fine powder is necessary for analysis and although it may be possible to use equipment which would not cause contamination such equipment is not known to us. An alternative which would reduce possible contamination would be by sampling to produce small chips and reduction to a semi-powder in an agate mortar. However, analysis of a partially ground powder would be slow and expensive and the method of sampling would have limited accuracy.

<u>ANALYSES</u>								
	Registered Numbers							
	37.	38.	39.	40.	41.	42.	43.	44.
Silica	98.16	98.98	99.14	98.18	98.46	98.44	98.44	95.72
Iron Oxide	0.02	0.24	0.24	0.80	0.44	0.26	0.27	0.66
Alumina	1.04	0.52	0.37	0.48	0.66	0.76	0.80	2.02
Loss on Ignition	0.50	0.22	0.20	0.34	0.10	0.12	0.08	0.32
Titanium Oxide	0.02	Trace	0.01	0.02	0.02	0.02	0.03	0.08
Lime	0.03	0.01	0.02	0.02	Nil.	0.02	Nil.	0.01
Magnesia	0.08	0.04	0.02	0.04	0.07	0.06	0.06	0.13

Sizing analysis of Reg. No. 37 after reduction of oversize to minus 5 mesh by reduction in a jaw crusher etc.

<u>Screen Size</u>	<u>Percent Weight</u>	<u>Percent Cum.</u>
+10	4.18	4.18
+22	7.02	11.20
+44	3.34	14.54
+60	3.74	18.28
+72	1.27	19.55
+100	1.54	21.09
+150	3.18	24.27
+200	3.58	27.85
-200	72.15	100.00

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Sizing Analysis of Reg. No. 37 after reduction as above and elutriation to reject quartz etc. of a nominal grain size of 20 microns.

<u>Screen Size</u>	<u>Percent Weight</u>	<u>Percent Cum.</u>
+22	11.08	11.08
+44	4.68	15.76
+60	1.56	17.32
+85	2.13	19.45
+100	0.78	20.23
+120	1.51	21.74
+150	2.92	24.66
+200	9.00	33.66
-200	66.34	100.00

Sgd W. St. C. Manson  
CHIEF CHEMIST AND METALLURGIST

D. R. Dickinson  
EXTENSION OFFICER

Department of Mines,  
HOBART

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