PREFACE

This is the first of the series of publications to be issued dealing with the sand deposits of Tasmania. A systematic investigation of the known deposits has not been attempted owing to the many demands upon the time of officers for other and more pressing works, but sufficient data relating to a few sands have been assembled for presentation in report form.

The writer therefore has pleasure in submitting the information contained in this report to those interested in the production of sands for any commercial purpose.

INTRODUCTION

PRELIMINARY STATEMENT

The importance of gaining a thorough knowledge of the sand resources of the Island is manifest to all and particularly to thoseputting this substance to industrial use. Of late, a large number of enquiries have been received at the Office of the Mines Department with reference to deposits situated close to railways and waterways. Attention, therefore, is directed at present to those only within easy reach of main lines of transport.

GENERAL STATEMENT

In this volume two only of the easily accessible deposits will be described, namely:-

1. The sand deposits of Avoca
2. The sand deposits of Tamar Valley.

and

THE AVOCA SAND AND GRAVEL DEPOSITS.

These beds of sand lie along the east bank of South Esk River and are confined within the Leona and New Henbury leases held by the New Henbury Tin Mining Company and the intervening freehold and Crown land. A road, half a mile in length, connects the Leona leases with the Fingal Railway at a recently constructed Siding which is 53 miles by rail from Launceston. They are thus favourably situated as regards lines of transport and centres of marketing.

The new Henbury leases are likewise connected with the railway.

ORIGIN AND NATURE OF THE MATERIALS OF THE SANDS AND GRAVELS

The various unconsolidated materials that make up these deposits consist of grains of white quartz and white, yellow and pink felspars. In proportion the quartz greatly predominates over the other components. These minerals represent the waste or disintegration products of the coarse-grained granitic rocks that form the mountain range along the east side of South Esk Valley. They, as phenocrysts of the granite, formed the bulk of that rock and represent its more stable components. The decomposition of the interstitial minerals by the chemical and physical actions of rain, frost, changes of temperature and wind led to the gradual disintegration of the granite, and torrential waters, carrying the detached particles along gutters to the valley floor, deposited them in the forms of alluvial fans. (It may be stated here that intrusive igneous rocks such as granite for example have been formed at temperatures

and pressures very much higher than those prevailing at surface and their minerals therefore are actually in a state of unstable equilibrium and are more easily susceptible to change than sedimentary rocks.) During the processes of accumulation and natural assortment the greater part of the Koalinitic interstitial material was eliminated by the fast-flowing waters and transported to the main drainage channel. In that manner were formed the deep and extensive deposits of evenly - assorted lightly-compacted sands along the front of South Esk River.

Associated with the particles of quartz and felspar is a little fine to coarse cassiterite (tin oxide), which, in some parts, is found in proportions varying from 0.4 to 1.0 lb. per cubic yard. Some of the deposits have already been depleted of their stores of cassiterite and in the processes of sluicing have been ridden of residual clayey matter and thus conditioned for direct use in construction works.

DEPOSITS

The deposits, for the purpose of this report, may be separated into three classes, namely:-

1. Accumulations from tin ore - sluicing operations;
2. Sands containing tin ore;
3. Sands barren of tin ore

1. Two large tailing dumps belong to the Company, one at
   a. Leona Workings, the other at
   b. New Henbury Workings.

(a) At Leona Mine the dump of tailing sand, estimated by the manager at 100,000 tons, is 10 to 25 feet deep. It lies near the East bank of South Esk River in the valley of Gilligan Creek, and is easily accessible by the road that connects the Mine with the railway siding half a mile distant.

An examination of the sands shows that almost the whole of clayey matter has been washed from them and that very little vegetable organic matter such as roots, leaves, and bark remains. The material, therefore, as it stands is ready for use in road-making and other construction purposes. An analysis by E.E. Kurth showed that the organic matter remaining amounted to little more that 1/100 of one per cent, which, with the exception of a few fine root fibres, could be detected only by elutriation of the sand with water; and that the clay and fine silt which remained in suspension in the washing water amounted only to 1.4 per cent of the sand, leaving 98.6 per cent of clean gravel and sand.

(b) Similar materials to those of the Leona Mine have been dumped at the New Henbury Workings after sluicing them from the associated tin ore. These tailing dumps, however, are smaller containing not more than20,000 cubic yards, and the sands are not free from vegetable organic matter.

2. In the valleys of all the streams leading from the mountain range between Leona and New Henbury are deposits of granitic detritus containing tin ore. As a rule the tin ore content is not high, in few places exceeding 0.5 lb. per cubic yard, but in the process of sluicing for tin ore the sands at the same time might be washed, graded and dumped into bins. Combining the several operations and putting to use almost the whole of the material handled profitable results should accrue.

The saving of tin ore in itself may prove unprofitable, and the by-products (sands and gravels) may become of greater value, but it could be separated at little extra cost without modifying the process of treatment of such material, the company has a large reserve.

3. Sands almost barren of tin ore would be treated and handled in a similar manner: namely by breaking down, washing, and conveying through the agency of water. Of such deposits an almost unlimited reserve remains between Leona and New Henbury. In that area granitic detritus, 10 to 30 feet deep, occupies the gently sloping piedmont country and extends to river bank.

COMPOSITION

It is possible from the data appearing in the sub-joined table of analyses to calculate the relative proportions of quartz and felspars. That is unnecessary, however, because the analyses clearly show that the great majority of the particles are of quartz and the rest of felspars.

Quarts is almost undecomposable, and the equally hard felspars that have survived the attacks of agents of decomposition, will remain stable almost indefinitely under ordinary atmospheric conditions.

TEXTURE AND STRUCTURE.

The size and shape of particles is conditional by the size and shape of the phenocrysts of the granite of which they were essential components. An examination of the granite reveals an intergrowth of quartz and felspar at some places and a porphyritic phase at others. On the whole the rock is of coarse texture and alletriomorphic. In consequence the detached grains of quartz appear roughly spherical in outline but with prismatic sides and sharp edges. The felspars are more elongated in outline in conformity with their original shapes as phenocrysts of the granite.

In the granulometric tables, hereunder, complete analyses of grainsize are given and also the average grainsize. Few particles are found greater than half-inch diameter although a high proportion is retained on 10-mesh. It will be noted that 75 per cent is retained on 30-mesh.

Table of Analyses following:-

TABLE OF ANALYSES

Registered Number.	Texture of Sand	Nature of Sand	Condition	Silica	Ferric Oxide	Alumina	Lime	Magnesia	Potash and Soda.
1697	Coarse to fine	Granitic waste consisting of quartz phenocrysts with a little felspar.	washed	86.6	1.7	5.1	trace	0.14	4.6

The following analyses of sample 1697 show that the greater parts of the felspars and the vegetable matter are contained in the finer material:

Mesh	Silica %	Ferric Oxide	Alumina %	Magnesia %	Loss on Ignition %
Retained on 10	89.2	2.0	5.8	0.22	0.10
" " 40	80.4	1.43	11.17	0.36	1.0
" " 60	80.4	1.71	11.49	0.36	1.0
" " 100	79.4	2.43	13.37	0.36	1.6

The other undetermined constituents are potash and soda. Lime is present in traces only. Ignition loss accounts for moisture and vegetable matter, the latter being in insignificant proportion.

GRANULOMETRIC TEST

One of the most important features of a sand is its grainsize or, as it is termed, its texture which is determined by granulometric analysis as follows:

A 100-grain sample is passed through a series of screens the material retained on each screen being collected, weighed and noted. Since the sample weighs 100 grains, the weight recorded as retained on each screen is the percentage retained on the screen. The cumulative percentage of all material that would be retained on any given screen if that screen alone were used can readily be determined. In order to gain some idea of the relative fineness of texture and to be able to express this in one figure, the average fineness of the sample is calculated in the following manner.

The percentage of material passing through each screen and retained on the next small is multiplied by the mesh of the screen passed through. The results so obtained are totalled and divided by 100, the resultant being the average fineness. In other words if all the grains of a sample were brought to one average size they would just pass through a screen whose mesh was equal to the average fineness of the sample.

Granulometric Analysis following:-

Granulometric Analysis.

Sample Number	1697		Kurth											
condition	washed		washed		washed		washed		washed		Washed		washed	
Mesh	per cent	Cumulative %	per cent	Cumulative %	per cent	Cumulative %	per cent	Cumulative %	Per cent	Cumulative %	Per cent	Cumulative %	Per cent	Cumulative %
Retained on 10	35.4	35.4												
" " 20	24.5	60.0	58.02	66.24										
" " 30	14.5	74.5												
" " 40	6.5	81.0	13.30	79.54										
" " 60	9.5	90.5	7.31	86.85										
" " 80	4.2	94.7	3.16	90.01										
" " 100	1.8	96.5	-	-										
" " 120	1.0	97.5	5.15	95.16										
" " 200	2.5	100.0	2.76	97.92										

AVERAGE FINENESS

No. of Sample	Average Fineness
1697	32.47
Kurth	35.54

Utilisation.

The study of the sands and gravels and the results of tests made on samples have already been dealt with and tabulated in a previous section. From these results it is clear that they are quite suitable for use in cement and bitumen concretes. As a source of supply for Launceston and neighbourhood at a reasonable cost these deposits may become of considerable public importance, and at the same time provide the chief source of revenue of the Company.

A close grading of these sands might lead to the opening of other markets. That is a matter for early consideration. At present the Company intends to market one grade of material only and that for road construction and concrete work.

The presence of coarse pebbles up to inch in diameter need not cause anxiety nor necessitate screening if the material is required for concrete or bitumen road construction. Moreover, a higher maximum is permissable for quartz than for some other materials used in those works. The following extract from "The Commonwealth Engineer" with reference to bitumen carpeting may prove of interest.

"As the completed carpet is from $\frac{1}{4}$ inch to $\frac{3}{8}$ inch, in thickness, requirement (e) may be met by the presence of a proportion of material coarser than $\frac{1}{4}$ inch, and it has been found by experience spread over a number of years that it is necessary to have at least 25 per cent of such material and that 40 per cent is a most desirable figure. The maximum size allowable is found to be from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch after rolling, which means that for screenings and gravels which do not crush under the roller a maximum of $\frac{3}{4}$ inch is required; whereas for quartz gravel, scoria and clinker a maximum of $1\frac{1}{2}$ inch may be allowed as the roller will crush the material to $\frac{1}{2}$ - $\frac{3}{4}$ inch, and in doing so drive it well into the carpet."

"It may therefore, be stated that $\frac{3}{4}$ inch screenings crushed from hard clean stone, and free from dust, fulfil the requirements laid down, Quartz gravel and quartz tailing, volcanic scoria and clinker may be allowed a maximum size of $1\frac{1}{2}$ inch; but must comply with the elutriation test and the grading limits given as follows:- elutriation loss not more than 3 per cent; passing 10-mesh sieve, not more than 50 per cent, and preferably not more than 40 per cent, passing $\frac{1}{4}$ inch mesh screen, not more than 75 per cent, and preferably 60 per cent."

"River gravels containing hard, tough stones should comply with these tests and be limited to $\frac{3}{4}$ inch maximum size."

"Taking everything into consideration the Leona and New Henbury gravels and sands meet these requirements fully. For such and similar uses these materials are particularly valuable.

Proposed Method of Operation

As the result of a visit from D. C. Finlayson of Finlayson Bros. & Co. Pty. Ltd., the following recommendation has been made by him:-

The gravel deposit is of a nature that lends itself to economical working and a Drag Line Scoop plant is recommended for working it. This consists of a double-drum, friction-driven winch mounted on a strong wood frame, a steel bucket of special construction, a flexible steel wire rope, a grizzley screen, a storage bin and an oil or steam engine or electric motor of 15 I.H.P. This plant is designed to deliver 150 cubic yards of gravel and sand per day into loading bins and can be operated by two men.

The total cost of the plant would not greatly exceed £200, and the estimated cost of handling into bins would work out at less than one shilling per cubic yard."

Motor lorries will be used in the carriage of the material from the storage bin to the railway trucks. At the siding a ramp has been constructed in order to facilitate loading.

When working the primary deposits the process of treatment would be after the following manner:-

the material, on account of the gradual slope of the surface and bedrock towards the river, would be broken down by water under pressure and transported by that agent along sluices to the screening and washing plants, which would consist of a number of trommels of the requisite perforations. Tin ore would be separated in the sluice-boxes and Kaolin would be removed in the processes of screening and washing. Bucket elevator would be attached to the screening plant to raise the graded materials to storage bins.

Costs of Treatment and Transport.

The cost of treatment would depend upon the magnitude of the operations and the process to be employed. Breaking down, sluicing, screening, washing, and elevating into bins would not cost more than one shilling a cubic yard if the present water-power supply be put to use for those purposes.

Transport from storage bins to the railway line and loading into trucks if a self-discharge truck be used should not cost more than 1/6d. per cubic yard. Railway freights to Launceston would perhaps amount to 8/- per cubic yard.

The costs of production and transport to market would then be:-

Cost of breaking down and treatment	1s. 0d.
" " Motor transport	1. 6d.
" " Railway "	8. 0.
	10. 6d. cubic yrd

At that figure a considerable profit would accrue to the Company for the market price for such material in Launceston is about fifteen shillings per cubic yard.

A. McIntosh Reid,
DIRECTOR OF MINES. 3/1/1929.