Geology.

Although the slopes of the hills are largely covered with surface soils, there are sufficient rock outcrops and shafts to show that the country rocks consist of several types, amongst which the most important are normal granites, with their accompanying pegmatitic veins, epidiorite dykes, fine silky micaceous schists, quartzites and andalusite schists. With the exception of the first two, the remainder are old sedimentary types, which have been metamorphosed into their present form. These sediments are without doubt of Pre-Cambrian age and are possibly counterparts of the same rocks which occur in the Yilgarn, Coolgardie, N.E. and N. Coolgardie Goldfields, and which in many instances carry gold-bearing lodes and reefs.

The area had previously been examined by Professor Clarke, who has also mapped a narrow strip of country containing the same types, lying west of the Midland railway line and extending from Moora north to Mingenew.

Origin of the Gold.

The origin of the gold is, in my opinion, due to two sources: (a) ironstone leaders, (b) quartz leaders or reefs.

In a shaft sunk by Brown near the boundary of P.A. 45 he has cut through a series of ironstone leaders, one of which he assured me gave traces of gold sufficient to indicate that this is undoubtedly one of the sources. The shaft has been sunk near the edge of a heavy laterite covering in a rock which has every appearance of a weathered granite, though it may possibly be a gritty arkosic sediment. The frequent occurrence of quartz floaters and vein quartz in some of the other shallow shafts would suggest these as a second possible source of the gold, though so far no one seems to have found quartz veins carrying gold.

Occurrence of the Gold.

As far as could be ascertained, small quantities of gold are scattered over quite a considerable area, so far mostly on the hill slopes on the southern bank of Yiniding Creek. I am led to believe that the richest claim is in the creek bed. Gold has also been reported as occurring on a branch creek which passes through P.A. 51.

The gold I saw was what is usually termed "rough shotty," that is, fairly coarse angular pieces from a few grains in weight up to a reported piece of two ounces.

In comparison there is apparently very little fine gold.

The gold-bearing dirt on the slopes of the hills is shallow and lies on a clay or rock bottom. So far no deep ground has been found on the slopes. In the bed of the creek the wash is sometimes deeper, but owing to the steep sides has no great width.

As there are many on the field who have had little experience in mining, it would perhaps be as well to sound a note of warning as to the disabilities which will arise when the rainy season commences. In the first place it will not be practicable to use the dry-blowers or shakers, for the loam containing the gold has quite a large quantity of clay contents and will not readily dry sufficiently to be suitable for this treatment. If there is any intention of sluicing the material in the creek bed, the dirt should be thrown out before the creek commences to run, otherwise it will be found very difficult to work.

There is still another point that may be useful to the prospector. It is evident that nothing big in the way of alluvial gold will be found on the slopes or the upper reaches of Yiniding Creek itself, but if the gold found on the slopes is indicative of what may have been washed away in the past ages, there is at least a chance of richer accumulations occurring in the more extensive alluvial flats lower down the stream, and possibly in the Avon River itself. I therefore advise those who hold unpayable claims and who wish to continue prospecting, to try out the lower ground on a possibility, rather than continue where there is little or no hope of success.

Conclusions.

There is no doubt that small quantities of surface or alluvial gold occur over a considerable area at the head of Yiniding Creek, and I consider there is just a possibility of deeper auriferous alluvial ground being found on the flats lower down the creek, or in the Avon River.

There is also, of course, a chance of finding ironstone or quartz leaders carrying payable gold.

At present the number of men, 102 on the day of our visit, is excessive, and till something more promising is found, further prospectors should be discouraged from going on to the field.

4.—REPORT ON THE COASTAL LIME-SANDS.

(T. Blatchford, B.A.)

Owing partly to a discovery of a lime sand deposit near Quininup Brook which yielded a result of 84 per cent. lime carbonate, and partly the need for soluble lime compounds for agricultural and pastoral purposes, an investigation of this deposit was required, which eventually lead to several other coastal lime sand deposits being examined, the results of which are as follows:—

Geology.

Lime sand dunes occur right along the fringe of the western coastline from Augusta on the south to at least as far north as Geraldton on the north.

The origin of these heaps is no doubt due to the breaking up of marine shells by wave action against the beaches, and winds mixing these fragments with sand and heaping the particles up into dunes and ridges.

In all instances the composition is essentially the same though the proportions of sand and shell vary very considerably; the former—sand—apparently predominating near the mouths of rivers—for example, at Bunbury and Fremantle. At the base of some of the heaps, and particularly on the shoreline, black sand (magnetic iron oxide) and titaniferous iron are evident, but not in the main heaps themselves, which are relatively free of these heavier fractions.

Quininup Brook Deposit.

The Quininup Brook deposit lies a short distance in from the coast and seven miles south of Yallingup.

The deposit forms a fringe on the southern edge of the high ground north of the brook.

Systematic sampling was started by sinking shafts to depths of 4-8 feet at 5-chain intervals. After opening out some 14 of these holes it was evident that the deposit would not contain a large tonnage of high-grade lime sand, also that over most of the deposit was a covering, varying from 1 ft. 6 ins. to 4 ft., and that in many cases the lime sands were lumpy and at times contained bands of hard limestone. Investigations here were therefore stayed and a search further afield was made for larger deposits free from lumps and bands and closer to railway communication.

Sand Dunes south of Quininup Brook.

Some half-mile south-west of the deposit already referred to is a large sand dune which extends from the back of the old homestead right to the ocean beach.

A grab sample from this sand heap yielded 78 per cent. total carbonates.

This deposit would be a far more promising deposit than the first examined, despite the fact that it is slightly lower grade, for it is very much larger, more accessible, and the grains of sand are free and clear of rubbish. The great objection was that it did not lie close to an existing railway line.

Boranup Sand Dune.

The lime sands at Boranup form a huge sand dune several miles in length and in width, with a depth in places of at least 200 feet. The sands are free of lumps and veins, but as it has buried a forest the trunks and branches of the trees will be found on excavating the heap. The eastern edge of the deposit lies quite close to the existing railway running from Busselton to Augusta.

Samples taken from the face near the railway gave an average of 85.23 per cent. total carbonates.

The favourable features of this deposit are its high grade in carbonates, accessibility, very large tonnage, and its uniformity in texture.

As it lies but a few chains from an existing railway the capital outlay would be relatively small, if any considerable quantity of the deposit was to be transported.

Busselton Deposit.

In the vicinity of the Busselton Cemetery, and at the terminus of the railway yards, a considerable quantity of lime sand can be found lying between the beach and the cemetery fence.

The average carbonate contents (70.7 per cent.) of this deposit are lower than the two previously referred to. By picking, a grade of 75 per cent. could be obtained but not in very large quantities. On the other hand, capital outlay would be unnecessary unless large quantities were required, and railway freight would be considerably reduced when compared with the Boranup deposit, for the use of the sand for all localities north of Busselton.

Fremantle Deposits.

Samples taken from the sand dunes near Robbs Jetty were very low, the total acid soluble carbonates being only 40-45 per cent. Some two to three miles further south and in the vicinity of the bathing sheds the grade is considerably higher, reaching 70.57 per cent.

On very reliable information I am led to believe that the grade still increases as you go further south, till eventually it rises, in the vicinity of Rockingham, to 90 per cent. This would be at the terminus of the old private timber line from Mundijong and distant from that station about 15 miles.

If this class of lime is required in quantity for centres such as Waroona, the orchards round about Perth, Harvey, etc., this deposit would no doubt be worthy of consideration provided cheap transport could be obtained over the private line.

Appended are certificates of analyses of the Boranup, Quininup, Busselton, and Fremantle samples:—

Material: Two samples of calcareous sand from the Boranup Sand patch:—

Lab. No.	1607/31 (1) Top.	1608/31 (2) Side.
Acid soluble calcium oxide, CaO	45·00%	45·00%
equivalent to calcium carbonate, $CaCO_3$	80·30	80·30
Acid soluble magnesium oxide, MgO	3·30	3·62
equivalent to magnesium carbonate, $MgCO_3$	6·90	7·75
Acid soluble phosphoric oxide, P_2O_5	0·11	0·10

The two sands are both excellent materials for lime dressing of sour soils. For agricultural purposes the comparatively low magnesium carbonate is of equal value to the calcium carbonate, and should be added to it to arrive at the total neutralising and base-exchange value of the sands.

Material: Lime sands from Boranup Sand Patch:—*

Lab. No.	1979/31 (1)	1980/31 (2)	1981/31 (3)	1982/31 (4)
Calcium oxide	41·61	46·53	45·75	43·59
equivalent to calcium carbonate	74·26	83·04	81·66	77·80
Magnesium oxide	3·105	3·423	3·303	3·150
equivalent to magnesium carbonate	6·50	7·16	6·91	6·59
Total carbonate	80·76	90·20	88·57	84·39
Phosphoric oxide	trace	trace	trace	trace

*Locations: (1) South-East corner of Boranup sand patch.
(2) Sample from top of dump, 200 yards North of (1).
(3) Half-way down slope, same locality as (2).
(4) Bottom section, same locality as (2).

Material: *Samples of Lime Sands from Quininup Sand Hill*:—

Lab. No.	1854/31 (1)*	1855/31 (2)*	1856/31 (3)†	1857/31 (4)*	1858/31 (5)†	1859/31 (6)*
Calcium oxide, CaO	39·60	47·67	48·90	47·52	25·44	48·09
equivalent to calcium carbonate, $CaCO_3$	70·66	85·06	87·25	84·79	45·37	85·81
Magnesium oxide, MgO	3·61	3·12	3·27	2·93	1·49	2·88
equivalent to magnesium carbonate, $MgCO_3$	7·56	6·52	6·83	6·14	3·12	6·03
Total carbonate	78·22	91·58	94·08	90·93	48·49	91·84
Phosphoric oxide, P_2O_5	·128	·087	·124	·809	·111	·165

NOTE.—* (1), (2), (4) and (6) from surface to 3 feet.
(6) is an average of 11 samples from surface to 3 feet.
† (3) and (5) from 3 to 6 feet.

Material: *Samples of Lime sands from Busselton.**

Lab. No. ...	3059/31 (1)	3060/31 (2)	3061/31 (3)	3062/31 (4)	3063/31 (5)	3064/31 (6)	3065/31 (7)	3066/31 (8)	1983/31 (9)	1984/31 (10)
Calcium oxide ...	36·30	35·94	37·68	36·74	35·10	35·07	38·70	38·25	37·65	38·91
equivalent to calcium carbonate ...	64·78	64·14	67·24	65·56	62·64	62·58	69·06	68·26	67·20	69·42
Magnesium oxide ...	2·74	2·78	2·70	2·96	2·84	2·77	2·80	2·83	3·204	2·910
equivalent to magnesium carbonate	5·73	5·82	5·65	6·20	5·93	5·79	5·86	5·92	6·70	6·09
Total effective carbonates	70·51	69·96	72·89	71·76	68·57	68·37	74·92	74·18	...	...
Insoluble in acid ...	28·34	28·87	26·45	26·49	29·22	29·71	23·56	23·22	73·90	75·51

*Locations.—(1) to (5) Depth 1 to 4 feet
(6) and (7) Depth 4 to 8 feet } Near Esplanade Hotel ... P_2O_5 trace trace
(8) Beach sand
(9) Opposite Esplanade Hotel.
(10) Near North-West corner of Cemetery.

Material: *Lime Sands from Sand heap near Bunbury Jetty*:—

Lab. No.	1985/31
Calcium oxide	14·82%
equivalent to calcium carbonate	26·45
Magnesium oxide	1·044
equivalent to magnesium carbonate	2·18
Total carbonate	28·63
Phosphoric oxide	trace

Material: *Lime Sands from near Robbs Jetty, Fremantle** :—

Lab. No.	3122/31 (1)	3123/31 (2)	3124/31 (3)
Calcium oxide	23·16	21·51	36·84
equivalent to calcium carbonate	41·33	38·38	65·73
Magnesium oxide	1·35	1·24	2·31
equivalent to magnesium carbonate	2·82	2·59	4·84
Total effective carbonates	44·15	40·97	70·57
Insoluble in acid	54·24	57·13	27·94

*Locations: No. 1.—Opposite Robbs Jetty.
No. 2.—From where sand was taken for making sand bricks.
No. 3.—Three miles south from Robbs Jetty, near bathing shed opposite delicensed hotel.

(Sgd.) EDWARD S. SIMPSON,
Government Mineralogist and Analyst.

5. REPORT ON DISCOVERY OF TIN NINE MILES SOUTH-WEST OF GREENBUSHES.

(T. Blatchford, B.A.)

Geology.

Although the underlying rocks are almost completely covered with a mantle of laterite there are sufficient outcrops and shallow workings to show that the country rock consists of either a granite or a gneiss, through which have intruded typical tin-bearing pegmatite dykes. It would therefore appear that this area is a continuation of the Greenbushes mineral belt. In all cases the rocks were too weathered to examine in detail.

The Occurrence of the Tin.

Apparently tin (*i.e.*, black tin or tin oxide) was found in small pieces, lying at the surface, by J. Donovan, who informed me he was really prospecting for gold, not tin, in the hilly country lying between Nannup and Greenbushes.

The present discovery is in a narrow watercourse running in an east-south-easterly direction.

The prospectors have recovered quite an appreciable amount—224 pounds—from a trench in this watercourse and quite good prospects can still be obtained from shallow shafts sunk deeper in the bottom of this trench.

Following up the tin on the northern bank of the creek by a series of workings in the form of shallow costeens and shafts from 12 to 15 feet deep, the tin has been located for a distance of over 100 yards. I attach a sketch plan* showing the relative positions of the more important of these workings. There were only traces of tin in shaft marked A, but samples taken from B and C yielded 0.76 and 0.05 per cent. of tin oxide respectively.

In shaft C there is a distinct footwall to the tin-bearing material, which dips to the east. This footwall rock is without doubt a gneissic form of granite.

*Plan not published.