Copy3

COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1962/26

PRELIMINARY REPORT ON MANGANESE DEPOSITS GROOTE EYLANDT, NORTHERN TERRITORY.

by

P.W. Crohn.

PRELIMINARY REPORT ON MANGANESE DEPOSITS

GROOTE EYLANDT, NORTHERN TERRITORY.

by

P. W. Crohn.

RECORDS 1962/26

CONTENTS

PRELIMINARY REPORT ON MANGANESE DEPOSITS

GROOTE EYLANDT, NORTHERN TERRITORY.

SUMMARY

At least five separate occurrences of manganese-rich material are known on Groote Eylandt. They consist dominantly of pisolitic material and are believed to have been formed under swamp conditions, due to the precipitation of manganese carried in solution from outside the area of the present deposits.

Only one of the occurrences has so far been examined in detail. This is situated about three quarters of a mile south-west of the Groote Eylandt Mission settlement, and consists of a group of small outcrops, scattered over an area of about 3,000 feet by 200 feet, with a possibility of substantial extensions in adjacent soil-covered areas.

Five pits have been sunk on this deposit. One did not find ore of economic grade and two were stopped before fully penetrating the ore body because of hard going. The remaining two pits penetrated respectively 3'9" of material averaging 45.4% and 3'0" of material averaging 46.8% Mn, the latter including 1'3" of material assaying 56.8% Mn. All assays refer to samples which had been crushed and screened.

Further testing of the occurrences is strongly recommended, but the main difficulty in the exploitation of these deposits is likely to be the high cost of transport from the island.

INTRODUCTION

The manganese occurrences on Groote Eylandt were first noted by Mr. P. R. Dunn, of the Bureau of Mineral Resources, in the course of a regional survey in 1960.

During a one-day visit on November 27, 1960, some specimens from one of these deposits (Location A of this report), were collected by Mr. Dunn and the writer, and four of these were subsequently assayed at the Bureau of Mineral Resources laboratory, Canberra, with the following results :-

Sample 1	50.5% Mn	Typical outcropping material, somewhat iron-stained.
Sample 2	50.0% Mn	
Sample 3	55.4% Mn	High-grade pisolitic material.
Sample 4	51.7% Mn	Solid re-precipitated material.

As a result of these encouraging indications, a further visit to the island was made by the writer from December 12th to 21st, 1961. During this visit, the deposit at Location A was mapped, and five pits were sunk on it. Other deposits in the vicinity were also inspected briefly.

A "Permit to Enter" for the purpose of prospecting for minerals on Groote Eylandt is currently held by the Superintendent of the Groote Eylandt Mission, and the investigation described in this report was carried out with the assistance of the Mission staff and native labour. The help and hospitality of the staff at Groote Eylandt and Umbakumba Missions is gratefully acknowledged.

Groote Eylandt Mission is situated on a permanent stream about three miles from the west coast of the island and Umbakumba Mission on the shore of an almost land-locked lagoon near the north-east tip of the island. These are the only European settlements.

GENERAL GEOLOGY

Groote Eylandt has an area of nearly 1,000 square miles and consists mainly of flat-lying or gently dipping Upper Proterozoic sandstones, in places with a thin cover of Cretaceous sediments. With the exception of Central Hill, no part of the island exceeds 200 feet in height, but the topography of some of the larger sandstone outcrop areas is quite rugged on a small scale.

The Proterozoic sandstones are best developed in the southern, central and eastern portions of the island. Dips are generally less than 10 degrees, but cross-bedding on a large scale is frequently present. There is also extensive surface silicification, which in places has given the rocks the appearance of a quartzite.

The Cretaceous sediments predominate in the north-western portion of the island, and are well exposed in the vicinity of Thompson's Bay, on the north coast. These sediments consist mainly of thin-bedded purple and brown sandstones and shales. At Thompson's Bay, dips are to the east at up to 5 degrees, elsewhere exposures are generally too poor to determine the attitude of these beds. From their general appearance, they seem to be relatively rich in both iron and manganese, and may be the source rocks of some or all the manganese occurrences on the island. At a point about eight miles north-north-east of the Groote Eylandt Mission settlement, a grit bed composed of quartz grains in a manganese-rich matrix occurs at the base of this Cretaceous succession, where it rests on the Proterozoic sandstones.

The only other formations older than Recent in age occurring on the island are scattered laterite cappings and nodular and pisolitic deposits, including the manganese deposits. These are probably Tertiary. Recent formations include alluvium, dune sand and coastal accumulations of mud and sand.

MANGANESE OCCURRENCES

Five separate groups of manganese occurrences are known on the island at the present time, each consisting of scattered outcrops of mainly pisolitic material. All are within five miles of the Groote Eylandt Mission settlement (Plate 1). The occurrences at Locations A, D and E are very similar, each lying on a flank of a low quartzite ridge, and each being about 2,000 to 3,000 feet long and about 200 feet wide. However, owing to the presence of a very extensive soil cover, these surface dimensions do not necessarily give a true indication of the size of the actual mineable deposits, which could only be outlined by detailed testing. The occurrences at Location F consist of several smaller deposits, separated by areas of low-grade manganiferous and ferruginous pisolitic material, and probably resting on Cretaceous sediments. Locations B and C are part of a large area of low-grade manganiferous material which, on present indications, does not contain any deposits of economic grade.

The distribution and nature of these deposits suggest they originated in swampy conditions, due to the precipitation of manganese carried in solution from outside the area of the present deposits, and probably derived in the first place from the Cretaceous rocks of the island. Other deposits may therefore be found in soil-covered areas wherever similar swamp conditions formerly existed, and no consistent relation of these deposits to the underlying bed-rock should be expected.

LOCATION A.

This deposit is situated three quarters of a mile south-west of the Mission settlement, and is the only one which has been mapped in detail at the present time (Plate 2). Surveys were by tape and compass, with offsets by pacing. Blazed trees (E.1 to E.7 and W.1 to W.9) were used as reference points.

Scattered outcrops of fair to good quality manganese occur over a north-west trending area approximately 3,000 feet long and up to 400 feet wide, with an average width of about 200 feet. To the north-east, the manganiferous material abuts on to the flank of a gently sloping quartzite ridge, and the limits of the occurrence on this side can generally be determined with reasonable accuracy, but to the south-west the outcrops pass beneath soil cover and extensions may occur in this direction.

Of the five pits so far dug to test this deposit, No.2 was apparently situated in a shallow portion of the deposit and contained no ore of economic grade, while No.3 and No.5 were stopped in fair quality ore, due to hard going, after penetrating into it for a distance of about 15 inches each. Of the two deeper pits, No.1 penetrated three feet nine inches of fair quality ore, including one foot three inches of good quality ore (see attached table of assay results). Both of these pits bottomed in low-grade manganiferous material, and the depth of bed-rock under the deposit is still unknown.

It is apparent from the work carried out to date that the better quality material occurs as horizontal or sub-horizontal layers interbedded with lower grade material. The horizontal extent of these better quality layers is not known; they may be continuous throughout the deposit or may consist of a number of separate lenses.

The amount of testing carried out on the deposit to date is quite insufficient to establish the reserves of various classes of ore, but it does give some indication of the possible extent of the deposit and enables a programme of further testing to be laid out.

Sampling

All assays for the current investigation were carried out at the Australian Mineral Development Laboratories, Adelaide.

Sampling was done by both channel and chip samples. All channel samples were treated by crushing to quarter-inch size and screening out the minus 12-mesh fraction, thus eliminating much of the earthy and clayey interstitial matter from the pisolitic ores. In the case of massive ore, the same procedure was followed, but the benefit in up-grading was probably less marked for such material. The proportion of fines eliminated in this way ranged from 16 percent in the high-grade massive ore from No.4 pit to 41 percent in the pisolitic material from No.1 pit and in the low-grade material from No.2 pit. The average for the seven samples was 30 percent.

It seems likely that better results in up-grading could be obtained on nearly all samples by crushing to about three-quarter inch size, followed by rumbling, and finally by screening and/or washing. However, until this has been experimentally verified, it would be unwise to rely on being able to obtain products of better quality than those assayed during the current investigation.

It is apparent from visual examination that the better-quality material is the harder and more resistant, and is therefore better represented in outcrop. For this reason, chip samples will consistently give higher assays than channel samples. In the case of this deposit, the four specimens collected in 1960 plus three chip samples taken in 1961 averaged 51.8% Mn. This was confirmed in No.4 pit, where a chip sample of the pisolitic layer gave an assay of 49.0% Mn, compared with a channel sample of 39.7% Mn after discarding fines. On this basis, the chip samples from No.3 pit (50.4% Mn) and from outcropping material in the vicinity of point E.6 (55.5% Mn), probably correspond to material which would bulk about 41% Mn and 46% Mn respectively.

For the purposes of this report, screened material of better than 50% Mn (equivalent to about 79.4% MnO_2 if all the manganese is present as pyrolusite) is classed as high-grade ore, and screened material of better than 40% Mn (about 63.5% MnO_2) as medium-grade.

Possible Reserves

The work which has been done on this deposit to date is only sufficient to give a preliminary indication of the possible extent and distribution of material of various grades.

Not all the area containing outcrops of manganiferous material is underlain by mineable ore, as seen by the disappointing results in No.2 pit. On the other hand, the good results of No.4 pit show that the deposit extends at least some distance under the soil cover to the south-west of the outcrop area, and in fact this pit contained the best quality material found. An estimate that this extension will at least compensate for those parts of the outcrop area in which mineable manganese is lacking is therefore regarded as conservative. However, the proportion of high-grade material (better than 50% Mn) within the deposit cannot be estimated at the present time, and will depend largely on the possibility of evolving improved methods of up-grading the bulk of the material by simple physical processes, as indicated in the previous section.

Further Testing

For adequate testing of this deposit, it is suggested that pits should be spaced at 50-foot centres on lines spaced 200 feet apart and aligned at rightangles to the long axis of the deposit. The lines should be continued to the south-west until the limits of the deposit are reached, which may be several hundred feet beyond the limits of the outcrop area. At least some of the pits should be dug to bed-rock, which may occur at a depth of 20 feet or more, in order to test the possibility that additional layers of good-quality manganese ore may occur beneath the known ones. In order to gain a rapid picture of the extent of the deposit, initial pitting could be at 100-foot centres on lines 400 feet apart, and the remaining pits dug at a later date.

At the same time, a systematic investigation into the best method of up-grading the material by simple physical processes, such as rumbling, screening, washing and possibly heavy-media separation should be undertaken on representative samples of material from the deposit. A full investigation of the physical and chemical constitution of the better-quality ore is also desirable in order to determine whether any of it is suitable for chemical rather than metallurgical purposes.

OTHER DEPOSITS

Deposits at Locations D and E, respectively situated five miles south and one and a quarter miles west of the Mission, appear from brief inspections to be comparable in size and type of material to that at A. Similar test programmes will therefore be required to evaluate them.

The various small deposits from one to one and a half miles north and north-east of the Mission, which have been grouped as Location F on Plate 1, may have a total outcrop area comparable to that of Deposit A, but no detailed testing programme can be suggested until some further surveys have been carried out.

Locations B and C are part of a large area of poorly exposed nodular and pisolitic material which underlies the Mission settlement itself, but which on present indications is unlikely to contain any mineable deposits of manganese. A chip sample of outcropping material on the track between the Mission garden and the Top Crossing (Location C) assayed 38.4% Mn, probably corresponding to a bulk composition of about 30% Mn in the underlying material, and a grab sample from a three-foot layer of nodular material exposed in a septic tank excavation at the Mission Superintendent's house assayed only 12.4% Mn (Location B).

No other outcropping occurrences are known at the present time, but further prospecting may indicate other localities of interest. For prospecting for non-outcropping deposits, the area of approximately four miles by two miles between deposits A and D is regarded as being the most favourable, but to cover this area even on a 1,000-foot grid would involve more than 200 test points, so that pitting is not likely to be feasible and some sort of drill or auger will be required. It is not recommended that this work should be undertaken until considerably more information on the outcropping deposits has been accumulated.

MINERALS OTHER THAN MANGANESE

During this investigation, the opportunity was taken to sample the laterite formed on Cretaceous rocks at Thompson's Bay. This was found to consist of an upper nodular or pisolitic layer, up to four feet thick, underlain by a massive layer with some vertical solution pipes, up to fifteen feet thick. Samples from both these layers were assayed for iron and alumina with the following results :-

Pisolitic laterite	23.4% Al_2O_3	25.8% Total Fe
Massive laterite	27.6% Al_2O_3	12.9% Total Fe

This indicates that this laterite is not suitable as an ore of either iron or alumina.

EXPLOITATION OF THE DEPOSITS.

It is clear from the work done on the deposits to date that there would be no difficulty in obtaining a few hundred tons of high-grade material by hand-picking outcropping material and mining selected portions, say of the massive layer in the vicinity of No.4 pit. As an example, mining of a one-foot layer for a radius of 20 feet from any given point would yield

about 100 tons on the basis of a density of 10 cu. feet per ton and 80% recovery.

However, if the deposits are to be exploited systematically, costs of mining and transport will have to be kept to a minimum, and an assessment of the total resources of the island will have to be undertaken before detailed plans for the working of these deposits can be considered.

Moreover, since sales of manganese ore are almost entirely by contract, it will be necessary to ensure that a satisfactory market is available for the product; it is likely that the most favourable terms could be obtained by negotiating on a long-term basis.

In general, mining costs should be low, since all deposits can be open-cut and no overburden other than soil or rubble is anticipated. Transport will present a more serious problem, since no deep-water anchorage is known on the west coast of the island. Transhipment at sea from lighters, which is at present used for landing stores for the Mission, is probably not feasible for other than high-grade ore because of high handling costs. On the other hand, it is unlikely that dredging of a channel could be justified unless the mineable reserves on the island could be shown to be very large indeed, - possibly of the order of a million tons or more. This is not impossible on present indications, but it is clear that a very extensive testing programme would be required to prove reserves of this magnitude. As an alternative, it may be possible to locate a deep-water anchorage on the east coast of the island, but such an anchorage would be less protected, and the necessary surveys, access roads and loading facilities would still amount to a very considerable outlay of capital and effort.

RECOMMENDATIONS

The next step in the evaluation of these deposits should be the testing of Deposit A, by pits spaced at 100-feet centres on lines 400 feet apart, concentrating especially on the postulated soil-covered south-western extension of the deposit.

At the same time, some surface mapping of the deposits at D, E and F should also be carried out, and two or three scout pits sunk on each of them.

It is suggested that this work be carried out by the Mission authorities in conjunction with the Resident Geological Section, Darwin, during the coming dry season, and that planning for the actual exploitation of the deposits should be deferred until then.

Darwin, N.T.
8/2/1962.

TABLE I

ASSAY RESULTS

		Sample No.	REDUCED BY SCREENING from ozs	to ozs	ASSAY % Mn
No.1 Pit					
0" - 6"	Soil Cover				
6" - 39"	Pisolitic Mn-rich material (3'9" - 45.4%)	199553	77	45	44.0
39" - 51"	Massive and slabby Mn-rich material.	199561	36	26	49.2
51" - 84"	Clayey sand with disseminated Mn pisolites	199562	40	25	30.0
No.2 Pit					
0" - 6"	Soil Cover				
6" - 24"	Manganiferous material, becoming siliceous near base.	199552	39	23	27.4
No.3 Pit					
0" - 9"	Soil with some cobbles and nodules of Mn-rich material.				
9" - 24"	Massive Mn-rich material persisting beyond bottom of pit. (Probably equivalent to about 41% Mn in bulk material)	199558	(chip sample)		50.4
No.4 Pit					
0" - 9"	Soil Cover				
9" - 33"	Soil with disseminated Mn pisolites becoming massive near bottom.				
33" - 54"	Layer of Mn pisolites, well cemented. (Chip sample 199556 assayed 49.0% Mn)	199564	40	29 (3'0" - 46.8%)	39.7
54" - 69"	Hard massive Mn-rich material	199565	54½	46	56.8
69" - 96"	Earthy manganiferous material relatively soft.				
No.5 Pit					
0" - 9"	Soil Cover				
9" - 24"	Massive Mn-rich material persisting beyond bottom of pit.	199563	34	27	42.2
OTHER SAMPLES					
	Surface outcrops within 50 ft of point E.6. (Probably equivalent to about 46% Mn in bulk material)	199557	(chip sample)		55.5
	Outcrops between Mission Garden and Top Crossing (Probably equivalent to about 30% Mn in bulk material)	199560	(chip sample)		38.4
	Grab sample from septic tank excavation at Mission Superintendent's House.	199559	20½	15	12.4

PLATE 1

GROOTE EYLANDT
MANGANESE DEPOSITS

GULF OF CARPENTARIA

LOCATION F.

Airstrip

LOCATION E.

LOCATION C.

Mission

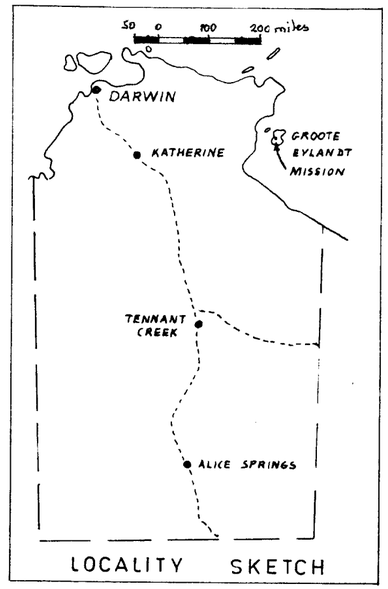
Farm

LOCATION A.

LOCATION B.

LOCATION D

T N



LOCALITY SKETCH

SCALE

1 0 1 2 3 miles

Known manganese deposits

Other localities referred to in text of report

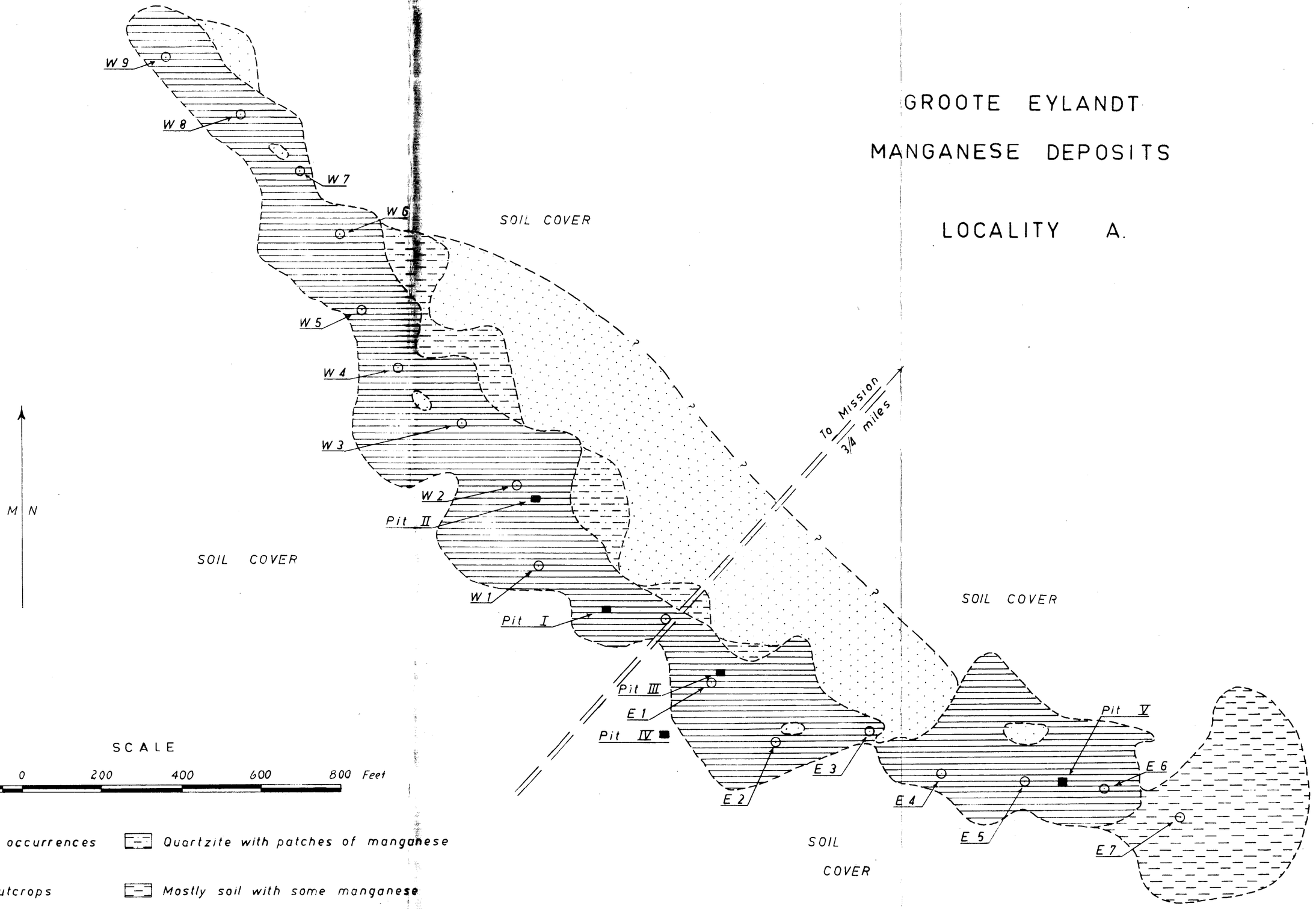
Main areas of quartzite outcrops mainly from air photos

Main tracks

To accompany Record 1962/2

PLATE 2

GROOTE EYLANDT
MANGANESE DEPOSITS
LOCALITY A.



To Accompany Record 1962/26