

67-486

153001

HINTERLAND GEOLOGY OF NORTHERN TASMANIA

in vicinity of

PLANET OFFSHORE MINERAL LEASE

EL 3/66

by

MICROFILMED

G. Campe and T. Watts

of

CUNDILL, MEYERS AND ASSOCIATES

for

PLANET MINING COMPANY

INDEX

	Page
INTRODUCTION	1
REGIONAL DRAINAGE PATTERN - NORTHERN DRAINAGE BASIN	1
(1) Cape Grim to Wynyard	1
(2) Wynyard to Ringarooma Bay	1
REGIONAL GEOLOGY	2
(1) Cape Grim to Wynyard	2
(a) Stratigraphy	2
(b) Economic Geology	2
(2) Wynyard to Ringarooma Bay	2
(a) Geological and Tectonic History	2
(b) Igneous Activity	3
(c) Stratigraphy	4
(d) Economic Geology	7
HINTERLAND GEOLOGY IN RELATION TO THE PLANET MINING COMPANY OFFSHORE BASE	10
MAPS: FIG. 1 HINTERLAND DRAINAGE AND MINERALISATION MAP, NORTHERN TASMANIA	
REFERENCES:	11

INTRODUCTION

Planet Mining Company Pty. Limited offshore lease extends from Table Cape eastwards along the high water line to Weymouth, north along longitude $147^{\circ}10'E$ to latitude $40^{\circ}50'S$, east along this latitude to longitude $147^{\circ}20'E$, north along this longitude to latitude $40^{\circ}40'S$, east along this latitude to longitude $147^{\circ}50'E$, north along this longitude to latitude $40^{\circ}30'S$, west along this latitude to $145^{\circ}10'E$, and diagonally to Table Cape on the coast. The lease covers 3 900 square miles and is situated in Bass Strait in Tasmanian Waters. It adjoins, to the west, E.L. 20/65 of Planet Mining Company Pty. Limited (Phosphate Rock) and adjoins in part, to the east, E.L. 26/65 of Planet Mining Company Pty. Limited (Phosphate Rock). The lease boundaries are shown in fig. 1.

The lease extends about 40 miles into Bass Strait, which is a submerged platform with water depths of about 300'. The bottom topography is relatively flat with only gentle slopes.

REGIONAL DRAINAGE PATTERN - NORTHERN DRAINAGE BASIN

The drainage basin can be divided into two distinct areas, Cape Grim to Wynyard in the North West and Wynyard to Ringarooma Bay in the North and North East.

(1) CAPE GRIM TO WYNYARD

This area has restricted northerly drainage with the drainage 18 - 24 miles south of the coast. The drainage of N.W. Tasmania is dominated by the Arthur River System which flows west into the Southern Ocean. The rivers entering the Bass Strait between Cape Grim and Wynyard are minor N-S rivers, namely the Welcome, Montague, Duck, Black and Flowerdale Rivers.

(2) WYNYARD TO RINGAROOMA BAY (NORTH AND NORTH EAST TASMANIA)

This area is characterised by more extensive N-S drainage reaching inland about 60 miles. The principal rivers are the Emu, Levin, Forth, Franklin, Mersey, Tamar, Blanket Creek, Pipers, Little Forester, Great Forester, Tomahawk, Boobyalla, Ringarooma, Ancestral, Mussel Roe, and the Esk River System. Of these the Tamar and Esk system is the largest, draining most of the central eastern Tasmania, and approaching within one mile of the eastern coastline.

REGIONAL GEOLOGY

The regional geology of the Hinterland area of the offshore lease is best described under the Drainage Units.

(1) CAPE GRIM TO WYNYARD

(a) Stratigraphy

Over 15 000' of younger Pre-Cambrian sediments occur, no igneous rocks being present. The Cambrian sequence is poorly exposed and relatively undifferentiated. In general three north-south trending patches of Cambrian rocks are present representing remnants, preserved by folding and faulting, on the west flank of the Rocky Cape Geanticline. A total of 5 000' of lavas, tuffs, breccias, conglomerates and siltstones are present. Permian rocks (tillites and sandstones) occur on the eastern fringe of this area.

Marine Tertiary rocks (limestone) occur as isolated outcrops as do the non marine gravels, sandstones etc. Tertiary basalts on the other hand are very widespread. Finally recent sands and gravels form a deep cover in many places.

(b) Economic Geology

The only mineral occurrence noted between Cape Grim and Wynyard is in the Montague Swamp on the Montague River. Here extensive gravels have been found to contain Chromium and Titanium. A sample assayed gave the following results:-

Percentage Heavy Minerals = 2.86%
 Composed of: Magnetic Chromium concentrate 2.83%
 (55.8% Cr₂O₃, 12.8% Al₂O₃, 16.3% Fe, and
 10.3% Mg) and Non Magnetic Concentrate 0.03%
 (7.5% Sn, 40.8% TiO₂, and 5 dwts/ton Au)

(2) WYNYARD TO RINGAROOMA BAY

(a) Geological and Tectonic History

Sedimentation in Pre-Cambrian times was controlled by the existence of the Tyennan geanticline consisting of old metamorphosed Pre-Cambrian rocks extending from Burnie to the south west coast. On the east and west flanks of this geanticline the younger Pre-Cambrian miogeosynclinal sediments of the Rocky Cape

group and its correlatives were deposited. This geanticline, although partially submerged, continued to affect sedimentation during Cambrian times with north east-south west trending restricted basins receiving the bulk of the Cambrian sediments.

By Ordovician times geosynclinal sedimentation largely ceased and shallow water shelf type sedimentation prevailed. Silurian and Devonian rocks are almost completely absent in the west of the area being represented only by very limited unstable shelf deposits. In the east, Silurian and Devonian rocks are very widespread and are comprised of an arenite-lutite assemblage which also reflect the unstable shelf conditions that prevailed at the time. Permian sediments are fairly widespread and indicate deposition in an extensive stable shelf area in an Arctic to Sub-Arctic climate. Extensive tillites occur especially at the base of the sequence. With the retreat of the ice and denudation of the land mass a dominantly mudstone sequence was deposited. The close of Permian sedimentation is marked by the presence of coal.

Sedimentation continued into the Triassic with arenaceous rocks being deposited in shallow water conditions. Sedimentation recommenced in the Tertiary with the deposition of marine and non-marine sediments, and recent sediments deposited in a non-marine environment are widespread in the north east.

Spry (1962) has recognised three major tectonic stages in Tasmania:-

- (i) Geosynclinal stage - Pre-Cambrian to Devonian
- (ii) Orogenic stage - Mid Palaeozoic
- (iii) Epeirogenic stage - Permian to Tertiary
(characterised by prevailing shelf conditions)

(b) Igneous Activity

In the area under consideration the Igneous activity may be summarised as follows:-

- (i) Older Pre-Cambrian - Dolerites (now amphibolites)
- (ii) Younger Pre-Cambrian - Dolerites, Basalts
- (iii) Cambrian - Extrusive sodic and potassic lavas and intrusive serpentinites.
- (iv) Devonian to Carboniferous - Plutonic granites
- (v) Permian - Minor tuffs present related to distant vulcanism

- 005
- (vi) Jurassic - Tholeiitic dolerite
 - (vii) Tertiary - Olivine basalts, minor alkaline basalts.

Cambrian ultra basics outcrop near Beaconsfield and these are associated with osmiridium and nickel mineralisation.

The Devonian to Carboniferous granites are widespread east of Pipers River and consist of granodiorites, tin granite, diorites, greisen veins, porphyries and quartz veins. These were emplaced close to the surface and show little contact affect on the intruded Silurian-Devonian Mathinna Group beds. They are of the cupola type, with the tin granites and greisen veins close to the top of the granite mass. Subsequent weathering and erosion removed the Mathinna beds and distributed large amounts of tin ore (cassiterite).

The Jurassic tholeiitic dolerites are common, especially in the east and north east and have been emplaced as thick sills.

The Tertiary basalts are widespread throughout the area, especially in the hinterland from Burnie to Devonport, and in the north east where the basalt is generally in old river valleys, having displaced the streams to their present positions.

(c) Stratigraphy

Pre-Cambrian

The Pre-Cambrian of the area outcrops only to the west of the Tamar River and has been subdivided into a metamorphosed and unmetamorphosed group. The age relations within and between these groups is somewhat obscure, subdivision being made on degree of metamorphism and tectonic style. Because of the isolated nature of the outcrops there has been a tendency to assign group and/or formation status to each group of outcrops.

(i) Metamorphosed Group (older)

Medium grade Pre-Cambrian metamorphics occur throughout the area west of the Tamar River. Age relations are in considerable doubt and include at least in part, correlatives of the younger Pre-Cambrian Rocky Cape group. Garnet schists, amphibolites, and metamorphic quartzites have been recognised throughout this area, particularly in the Upper Forth River, where Spry (1958) has shown the presence of regionally metamorphosed sediments in the headwaters of the Mersey and Forth Rivers. He gives the following succession:-

Top

Rocky Cape Group

153007

Ulverstone Metamorphics

Bottom

Forth Metamorphics

(ii) Unmetamorphosed Group

This group is represented by the Rocky Cape group and its correlatives. The sequence is:-

Top	Cave Quartzite	1 500'
	Port slate and quartzite	1 500'
	Bluff Quartzite	1 500'
	Cowrie Siltstone	3 500'
	Burnie Quartzite and slate	5 000' ?
		<hr/>
		13 000' +
		<hr/>

The Smithton dolomite and its carbonate equivalents to the west and east appear to represent the far offshore equivalents of the Cave quartzite.

Cambrian

Cambrian rocks occur extensively throughout the area of the Tamar River. A typical sequence measured in the Dial range near Ulverstone is:-

	Formation	Lithology
Top	Westbank beds	Limestone, cherts, etc.
	Tea Tree Point Megabreccia	Breccias
	Radford Creek formation	Greywacke, siltstone
	Motton Spillite	Spillitic lavas
	Barrington Chert	Cherts
	Hardstaff unconformity	-
	Kateena formation	Greywacke, siltstones
Base	Lobster Creek volcanics	Acid tuffs and lavas

The sequence is one of coarse and fine clastics and sodic and potassic lavas. Extensive lateral and vertical variations occur both with and between formations. Southwards (basinwards) the sequence shows a gradation to a relatively clastic-free sequence.

007

Ordovician

The Ordovician system is collectively known as the Junee group and rests unconformably on Cambrian and Pre-Cambrian strata except in the Beaconsfield area where there is a conformable gradation from the Cambrian. The idealised sequence is:-

Top	Fenestella shale
	Gordon limestone
	Florentine Valley sandstone
	Caroline Creek sandstone
	Owen conglomerate
Base	Jukes conglomerate

The sequence represents 6 000' of shallow water and terrestrial sediments deposited on a slowly sinking shelf area near the margin of the Tasman geosyncline. The basal conglomerates (Owen and Jukes) represent an alluvial fan deposit succeeded by the marine Caroline Creek sandstones. The sequence above the Caroline Creek sandstone indicates clearer water sedimentation, with encroachment of the sea over the denuded source area.

Silurian - Devonian

The sediments of this group are not well represented to the west of the Tamar, where there are only rare patches of the Eugene group (Silurian) and the Eldon beds (Devonian which give evidence of the prevailing unstable shelf conditions).

To the east of the Tamar (i.e. N.E. Tasmania) Silurian-Devonian rocks of the Mathinna group are very widespread. The sequence is an arenite-lutite one with sandstones, siltstones and claystones and their metamorphic equivalents. There is also a change from a dominantly arenaceous sequence in the east to a dominantly lutitic sequence in the west. The thickness of this sequence is 6 000' +, and the sediments commonly shown structures, suggestive of turbidity currents, with intervening periods of quiet sedimentation.

Permian

The Permian sequence is well represented to the east of Scottsdale with only rare occurrences to the west. An idealised sequence is:-

Top	Cygnet Coal measure	Coals
	Fern Tree Group	Shales

Malbeena Sandstone	Siltstones and sandstones
Cascades Group	Sandstones
Mersey Group	Conglomerates, shales
Golden Valley Group	Limestones, mudstones
Quamby Group	Mudstone
Base Wynyard tillite	Tills, tillites.

At the commencement of the Permian, ice covered a large area of Tasmania with consequent tillite dominated lithology. With the retreat of the glaciers, marine, sheet like deposits covered most of the till. The sheet like form suggests a shelf rather than a geosynclinal environment with the influence of the subentic climate being shown by the poorly sorted ice rafted sediments which occur throughout. Evidence of the progressive moderation of the climate may be seen with the decrease in glacial phenonema upwards.

During most of the Permian the north east was a land mass and only isolated outcrops of Permian strata occur.

Mesozoic

Triassic sedimentation in the area was restricted to a roughly NW - SE trending strip between Launceston and Scottsdale. The sediments are composed of lacustrine and fluvial protoquartzites, lithic arenites, lutites, monor fine grained conglomerates and coal beds with a total thickness of between 1 500 and 2 000 feet. The Triassic rests in part conformably and in part disconformably on the Permian beds. In the NE it may have lapped on to the Devonian granites.

Cainozoic

Cainozoic non marine sediments are widespread in the central and NE of the area, and marine sediments are restricted to the Wynyard area. The marine beds consist of about 80 feet of sandstone and sandy limestone, which rests unconformably on Permian rocks and disconformably on basalt.

The non-marine sedimentation consisted largely of sands, gravels, clays and coals with thicknesses up to 900' in the Tamar Graben which was formed in early Cainozoic time.

The relative depression of the land which resulted in the coal deposits, continued into Oligocene and early Miocene times, until finally the sea moved into Bass Strait and the severance

009
of Tasmania from the mainland was effected. Subsequent fluctuation in sea level, and periods of uplift, particularly in lower Pliocene times and Late Pliocene/early Pleistocene times (Kosciusko uplift) resulted in Tasmania being rejoined to the mainland.

At the close of the Pleistocene ice ages, a general rise in sea level accompanied the melting of the ice, and Bass Strait was once more invaded by the sea.

There is evidence for a slight subsequent re-emergence, in areas of Victoria, where raised wave cut platforms and shell banks may be seen along parts of the coastline. Raised beaches, 15 feet high, have also been reported from parts of the northern coast of Tasmania.

(d) Economic Geology

Mineralisation in the western half of the area is not very extensive.

The limited mineralisation that does occur follows the general Western Tasmanian trend of Pre-Devonian sediments and is affected by several tectonic and igneous phases, more specifically the lower Palaeozoic basic intrusives and the later Devonian granite intrusions.

The mineralised areas may be enumerated as follows:-

(i) Beaconsfield

Up to 1914, 854 600 oz of gold have been produced from Beaconsfield. Quartz veins carrying gold are fairly common throughout the north coast area but Beaconsfield provided the only large production. These quartz vein type deposits are apparently not related to the granite intrusives, and are similar to the deposits to the west of the Tamar at Lefroy. A small deposit of Osmiridium related to serpentines, is also present in the area. The serpentines in part are overlain by clays and laterite and in these there is nickel mineralisation with assay values up to 1%.

This area could be favourable as a source area for offshore mineral concentrations of gold and osmiridium.

(ii) The Rocky Cape group of the Pre-Cambrian shows minor quartz-hematite deposits carrying traces of copper and gold in the Penguin-Rocky Cape area.

(iii) Du Cane area.

Between Mt. Cackleigh and the Fenion thrust Galena, sphalerite, chalcocopyrite, pyrite and arsenopyrite mineralization is reported in sulphide lodes. This deposit has been explored but is not considered economic.

In Barn Bluff copper mines in the valley of the Commonwealth Creek, mineralization occurs in chloritised basic rocks and in the actinolite bearing zones of quartzites. Minerals present include pyrite, arsenopyrite, specularite, pyrrhotite, and subsidiary chalcocopyrite, silver and gold. Maximum assay values reported from this prospect are:-

Copper 1.65%
Gold Trace
Silver 6.3 oz/ton

Wolfram and Cassiterite have been reported from the east side of the Forth valley in quartz veins enclosed by quartzite and mica schist.

(iv) Devonport Area.

Pyrite mineralization along Dial Creek occurs in a breccia close to the margin of the Lobster Creek volcanics.

Manganiferous hematite replaces Cambrian conglomerates in the area of co-ordinates 40315E and 9279N.

Heavy minerals are present at Parkers Ford, carrying 67% ilmenite and small amounts of Anatase, Brookite and Rutile.

Burns (1964) reports rutile (Quaternary deposits) in the area as follows:

<u>Locality</u>	<u>Co-ordinates</u>	<u>Rutile</u>	<u>Deposit</u>
Mouth of small creek in Clayton River	41845E 92790N	0.29 lb/cu.yd.	Stream bed
Clayton River upstream from Little Clayton Junct.	41895E 92715N	0.32 "	Creek bank
Little Clayton upstream from Orchard Creek Junct.	41815E 92505N	1.16 "	Stream bed
Orchard Creek	41720E 92545N	0.75 "	Stream bed
"	41720E 92500N	0.64 "	Creek bank
"	41735E 9244N	2.36 "	"
"	41750E 9244N	2.04 "	Stream bed

The source of this material has not been located but is considered to be in the divide between the Little Clayton River and Orchard Creek.

In the vicinity of Penguin a number of Silver-lead shows have been investigated. These are generally associated with the Beachcraft megabreccia and the Cambrian keratophyre stocks. The mineralization occurs as small veins containing chalcocopyrite, pyrite, tetrahedrite, galena and arsenopyrite.

At Hardstaff Creek-Levin River junction, quartz and galena veins are reported.

At Dial Creek and Station Creek (40518 927850) pyrite and chalcopyrite replacement occurs in the breccia at the edge of the Lobster Creek volcanics.

In the Cassler district there are occasional traces of gold.

In the Middlesex mineral district (this includes the Moins area) approximately 25 miles southwest of Devonport, wolfram, cassiterite and accessory molybdenum occur adjacent to the Balconth and Dove Devonian granites. Bismuth-gold and silver-lead mineralization is also present.

Moins district has produced cassiterite, wolfram and bismuth from narrow quartz veins in metamorphosed sandstone and impure limestone.

In the eastern half of the area there is extensive tin mineralization in the Devonian tin granites and greisen veins. Deposits are both vein and alluvial types with alluvial deposits being rather limited. In the north east the original alluvial tin leads which were formed in the Tertiary have been partly redistributed along the present Ringarooma, Mussel Hoe and Boobyalla rivers. In the Ringarooma deposits there is also often a trace of gold. Fluctuations in sea level has probably changed the course of these rivers since the original leads were deposited, and it is possible they may all have entered Bass Strait through the Ringarooma Bay area. However, as the Offshore lease does not include Ringarooma Bay but lies further north west, the possibility of an economic concentration of tin in the lease from these deposits is small. The tin deposits of the Blue Tier Anchor Mine, Aberfoyle, Storeys Creek etc. are generally vein deposits and the drainage here flows into Ringarooma, Mussel Hoe or the South Esk River. There are no significant alluvial deposits of tin in the South Esk river though it probable that considerable quantities were transported towards Bass Strait especially in the Tertiary. However, due to the high specific gravity of tin and the distance to Bass Strait it is unlikely that a concentration of tin would be found this distance from its source.

In the eastern half of the area there are also several areas of gold mineralization, in the Lefroy Goldfield and minor associated goldfields. These all lie to the north and north north west of Launceston. The deposits are in quartz veins in Bathurst beds and there is generally no nearby outcropping Devonian granite.

The Lefroy Goldfield was the largest producer, with a production of about 175,000 oz. gold and an estimated 5,000 oz. alluvial gold. The main lode at Lefroy was mined to 1200' though values generally decreased below 400' or less.

The Lisle Goldfield was the largest producer, with a production of 250,000 oz. This deposit lies on the Bessell Ridge which runs into Andersons Bay. Anderson Bay is outside the lease area.

C12

Beck Creek Goldfield produced smaller quantities than the Lefroy and Lisle goldfield, generally from veins, with some alluvial production.

The Lefroy and Beck Creek goldfield both are drained by rivers that run into Bass Strait in the permit area and it is possible that there is some gold in the offshore areas.

At Mathinna a considerable amount of gold was mined from quartz veins in the Mathinna beds. The deposits are similar in type to those in the Lisle mineralized areas. Production from the area was about 290,000 oz. gold.

There are no recorded heavy mineral deposits in this eastern half of the area though there are verbal reports of a small heavy mineral show in the vicinity of Bridport.

HINTERLAND GEOLOGY OF NORTHERN TASMANIA IN RELATION TO PLANET
MINING CO. PTY. LTD. OFFSHORE LEASE.

Rocks in the hinterland area range from Pre-Cambrian to recent and include sedimentary, metamorphic and igneous rocks. Mineralization occurs throughout the area but generally only sporadically. In the North East of Tasmania mineralization is common over a wide area. Minerals present consist of sulphides, gold, tin, nickel, heavy minerals and osmiridium.

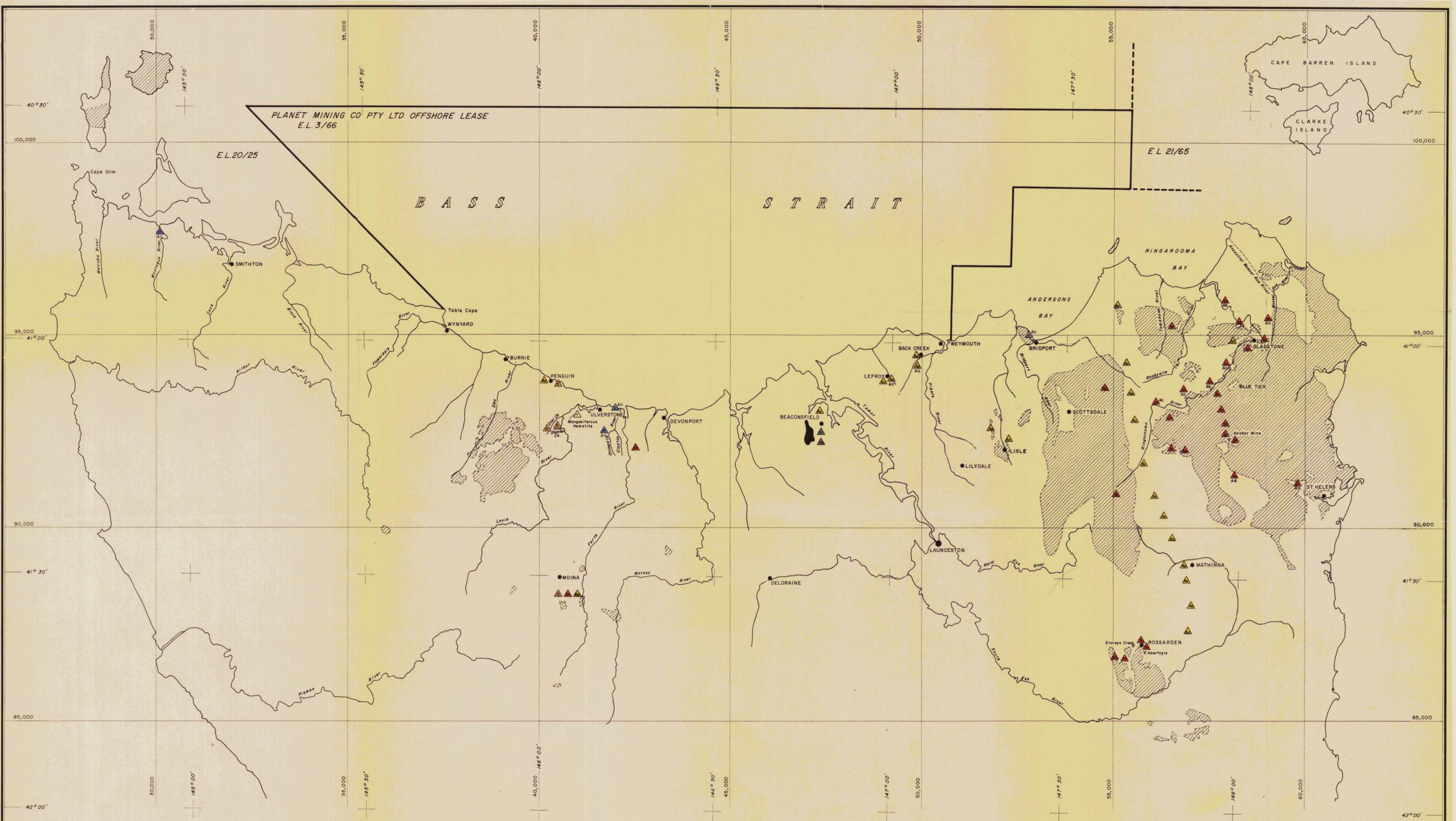
From a study of the geology and drainage, certain areas are considered to be likely sources for offshore accumulation of minerals. The initial subsurgence of Bass Strait occurred in Oligocene time, and its repeated later re-emergence would result in a dispersal of earlier deposits, or in a reworking along earlier river courses and coast lines. The rise in sea level during late Pleistocene times would allow the present river systems to superimpose its effect on the earlier cycles for only a period of possibly 10,000 years. For this reason only mineral deposits close to the coast could be expected to have an offshore distribution pattern related to present river mouths.

Areas considered to be possible source areas are the Beaconsfield-Lefroy-Lisle areas for gold, the Beaconsfield area for osmiridium the Ringarooma River - Blue Tier areas for tin and possible gold, the Bridport area for heavy minerals, the Devonport area for rutile, the Montague area for heavy minerals and the Forth River area for Tin. Offshore areas adjacent to these localities would appear to be the most immediately prospective portions of the Planet Lease.

013

REFERENCES.

- 1962 The Geology of Tasmania
Spry A. & Banks R. R.
Jour. Geol. Soc. of Aust. Vol. 9 Pt. 2.
- 1938 Spe F. B. & Blake F.
The Geology and Mineral Districts of Tasmania
Bull. Geol. Surv. Tas. Bull. 44.
- 1903 Holverson W. H.
Report on the Mineral Resources of the districts
of Beaconsfield and Salisbury.
Report Dept. of Mines.
- 1960 Alluvial Gold, Bessells Creek, Launceston.
Tech. Rep. No. 5. Tas. Dept. of Mines.
- 1964 The Geology of the Beaconsfield Gold Field
Tech. Rep. No. 8. Tas. Dept. of Mines.
- 1965 The Geology of Lefroy Goldfield.
Tech. Rep. No. 9. Tas. Dept. of Mines.
- 1956 Assay Results - Montague Swamp Area.
Tech. Rep. No. 1. Tas. Dept. of Mines.
- 1955 Geology of Australian Ore Deposits. Vol. 1
5th Empire Mining & Metallurgical Congress Vol. 1
- 1965 Geology of Australian Ore Deposits.
6th Com. Mining & Metallurgical Congress Vol. 1



PLANET MINING CO PTY LTD OFFSHORE LEASE
E.L. 3/66

E.L. 20/25

E.L. 21/65

B A S S

S T R A I T

CAPE BARREN ISLAND

CLARKE ISLAND

LEGEND

- Cambrian Ultra Basics [Symbol]
- Devonian - Carboniferous Granites [Symbol]
- Mineral Deposits
- Tin [Symbol]
- Gold [Symbol]
- Osmiridian [Symbol]
- Nickel [Symbol]
- Heavy Minerals [Symbol]
- Rutile [Symbol]
- Sulphides [Symbol]
- Alluvial Deposits All

**NORTHERN TASMANIA
DRAINAGE AND MINERALIZATION MAP**

153015

SCALE: 1" = 8 Miles
Miles 10 5 0 10 20 30 Miles

5 cm

TO ACCOMPANY REPORT ON
HINTERLAND GEOLOGY OF NORTHERN TASMANIA
IN VICINITY OF PLANET OFFSHORE MINERAL LEASE
by
G. CAMPE & T. WATTS
of
CUNDILL, MEYERS & ASSOCIATES