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EXPLORATION
DEPARTMENT

Report No. 793

REPORT ON FIELD WORK

E.L.13/65 S.W. TASMANIA

1967 - 68

Melbour April, 1969

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Exploration Department

Report on Field Work in Exploration Licence 13/65, South-west Tasmania during 1967-68 field season.

by

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Melbourne April, 1969.

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SUMMARY OF FIELD WORK - 1967-68 SUMMER

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WEST COAST AREA

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SUMMARY OF FIELD WORK - 1967-68 SUMMER (SEE FIG.2)

WEST COAST AREA

1. DOUBLE COVE BELT.

Complete coverage of geology at 1" to 2000', by examination of coastal and stream sections systematic stream sediment sampling at ¼ mile intervals, and discovery of well-defined area of anomalous Cu, Zn, and Ni values associated with gabbro and andesite immediately S.W. of Double Cove in an area of aeromagnetic anomaly.

Magnetic anomalies 128 and 129 opened up, and detailed geophysics (magnetic and E.m.), and geology (1" to 100') completed. No further work done on anomaly 128, but are diamond hole drilled into Anomaly 129, Deep Creek iron body. Hole abandoned at 331 feet but 70% pyrite and 30% hematite at 317'.

2. HIBBS BELT.

Completion of geological mapping at 1" to 2000' in northern part of belt, and completion of stream sediment sampling. Nothing really significant from geochemical reconnaissance, but isolated highs.

Extension of bulldozing and consequent delineation and detailed mapping at 1" to 400' of asbestos bearing area at Noddy Creek. Costeaning of asbestos zone and detailed logging. Report on area, and estimation of asbestos reserves.

Detailed magnetic, E.m. and S.p. surveys at 25' spacing of lines 100' apart along western margin of ultrabasics at Noddy Creek. E.m. anomaly clearly outlined, and ore shallow diamond drill hole into peak of anomaly. Drill penetrated serpentinized pyroxenite and laminated sillstone before being abandoned at 299'. Cause of anomaly determined as 11 feet of graphite with common pyrite occurring on contact.

Soil sampling carried out over anomalous area immediately prior to drilling.

Brief re-examination of diorite and andesite at Timbertops, and ultrabasics at Fern Creek and Hibbs Lagoon. Only insignificant asbestos discovered.

2.(a) Southern Portion of Hibbs Belt

Geological mapping at 1" to 2000' and geochemical reconnaissance of area of Cambrian sediments, ultrabasics and gabbro, and lamprophyre between Hibbs and Endeavour Bays, including lower Spero River. Ultrabasics and gabbro fairly well outlined, and streams carrying anomalous zinc and nickel discovered draining into Hibbs Bay (between Hibbs and Lagoon and Point Hibbs.)

3. Mainwaring Belt (including Lewis River-Elliot Bay area)

Closer geological examination of Mainwaring and Urquhart Rivers, and South Cypress, Copper and Sassafras Creeks, and coastal traverse from Mainwaring to Little Rocky River, with resulting examination of Low Rocky Point Granite, and volcanics and sediments at base of Cambrian geosynclinal succession. Discovery of large zones of intense dynamic metamorphisim, and native copper in Mainwaring River, copper staining in Urquhart River, and chalcopyrite at Copper Creek and between Urquhart River and Cypress Creek, and pyrite at South Cypress Creek.

Extension of geochemical sampling along coastal area between Urquhart and Mainwaring Rivers, and detailed sampling along Cypress and South Cypress Creeks, and in south fork of Urquhart River. Highly anomalous values for copper, zinc and nickel continued, and indicated main source in area between headwaters of Cypress and South Cypress Creeks in thick scrub covered area.

Ground magnetic and E.M. survey commenced in lower Lewis River area but suspended because of malfunction of E.M. gun. Soil sampling also partially completed, but nothing significant discovered.

4. Jukes - Darwin Area

Geochemical reconnaissance sampling in Clark River Valley and in vicinity of old Crotty Smelters immediately east of Mt. Jukes. High ~~land~~ lead values (less than 600 ppm) discovered in one stream draining Mt. Jukes.

CENTRAL AREA

1. Jane - Franklin River Area

Geological reconnaissance completed over the 450 square miles in the north-central portion of the E.L. area. Plotted on 1" to 2000' photomosaics during helicopter survey, and compiled on 1" to 1 mile maps only brief ground examination made but aeromagnetic anomalies located at junction of Mary and Franklin Groups (i.e. between chlorite grade quartzites and garnet grade pelitic schists.

EASTERN AREA

1. Boyes River

Geochemical reconnaissance completed, and moderately high nickel values located.

2. Holley River and

3. Gordon-Serpentine River Areas

No work done this summer.

4. Gordon Road - Weld River Area

Geology of Cambrian rocks along road section completed, and a few streams in adjacent area traversed.

Geochemical samples collected from streams crossing road, and mild coincident copper, zinc and nickel located in one stream draining north from Mt. Wedge. Minor gabbros known to occur in Cambrian sediments in this area.

Cherts in Cambrian sequence along Gordon Road sampled for phosphate, but all negative.

MISCELLANEOUS

An airborne scintillometer survey for uranium was carried out by helicopter over the following areas:

(1) Sorell - Darwin - Ordovician conglomerates, Upper Cambrian breccia, and Cambrian ryholite and granite.

(2) Mt. Osmund Syncline - Ordovician conglomerate.

(3) D'AGUILLAR and King Billy Range - Ordovician cong glomerate.

(4) Bathurst Harbour - Younger Precambrian conglomerates.

(5) Lewis River - Elliot Bay - Cambrian granite.

(6) Urquhart River - Copper Creek - Cambrian sediments.

(7) Noddy Creek - Timbertops - Cambrian sediments, intermediate volcanics, ultrabasics, and diorite.

(8) Double Cove Belt - Cambrian sediments.

A planned survey of the Reed's Peak - Adamsfield - Tim Shea area was abandoned because of poor weather. The only significant result of the survey was the locating of an anomalous area (3-4 times background) at the north-east corner of the Low Rocky Point Granite and a less intense anomaly in D'Aguillar Range north-east of Mt. Lee.

RECOMMENDATIONS FOR FUTURE WORK ON E.L. 13/65

Reduction of Exploration Licence area by deletion of central and southern portions. Retention of Boyes, Weld, Holley, Gordon areas, and North Central, North-west, and west coast to Elliot Bay as separate blocks.

Reasons for retention and rejection.

WEST COAST AREA

1. Double Cove Belt

Open up area of geochemical anomalies co-existent with magnetic anomaly immediatly S.W. of Double Cove. Soil sampling, ground magnetics, E.M. and S.P., and detailed geology, followed by drilling of anomalies.

Redrill hole at Deep Creek, anomaly 129, to investigate extent of pyrite mineralisation.

2. Hibbs Belt

Assessment of asbestos to determine if worthwhile to continue and establish reserves.

Geochemical stream (and soil) results generally discouraging in northern portion of area, but completion of cover between headwaters of Madden River and Hibbs Bay ultimately desirable (i.e. drainage area of Hibbs River).

Also ultimatley desirable to more closely examined anomaly 8183 Y by ground magnetic and E.M. surveys.

Open up area of high intensity magnetics at Hibbs Plateau by bulldozing, then ground geological, geophysical and geochemical(?) surveys. Note access problems.

Follow up high zinc and nickel values at Hibbs Bay may be eventually desirable to bulldoze area of ultrabasics.

3. Mainwaring Belt

Completion of ground geophysical survey and soil sampling over aeromagnetic anomalies along lower reaches of Lewis River.

Open up area near headwaters of Cypress and South Cypress Creeks by bulldozing, initially concentrating on area of aero E.M. anomaly apparently coincident with zone of dynamic metamorphism in tuffaceous rocks. Ground E.M. survey and soil sampling along same grid.

4. Jukes - Darwin Area

Continuation of geochemical sampling to give complete reconnaissance cover.

Compilation of all available data from old reports, including geology, geophysics, drilling etc.

CENTRAL AREA

1. Jane-Franklin River Area

Ground geological investigation of main aeromagnetic anomalies along Franklin River and geochemical stream sediment sampling.

EASTERN AREA

1. Boyes River

Complete ground geophysical survey over ultrabasics, and collect soil samples along same lines.

Detailed (one inch to 400 feet) geological mapping of area may be required if sampling results are sufficiently encouraging.

2. Holley River

Ground geological and geochemical survey of area required, but permission to enter area may be difficult to obtain.

3. Gordon-Serpentine River Area

Ground geological and geochemical survey of area of garnet and mixed schists covered by mild aeromagnetic anomaly.

4. Gordon Road - Weld River Area

Follow up anomalous stream sediment results by collecting further samples upstream from road, and to geological traverse at same time.

Weld River remains to be sampled and traversed, and aeromagnetic anomalies apparently unrelated to dolerite or ultrabasics remain to be checked.

MISCELLANEOUS

Ground scintillometer survey of north-east corner of Low Rocky Point granite.

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THE DOUBLE COVE BELT

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THE DOUBLE COVE BELT

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SUMMARY

The Double Cove Belt is an area of Cambrian rocks on the Cape Sorell Peninsula of the west coast of Tasmania, and has a number of aeromagnetic anomalies along both its eastern and western margins.

During the 1967-68 field season the entire belt was geologically mapped at a scale of one inch to two thousand feet, and covered by systematic stream sediment sampling. Two of the magnetic anomalies along the eastern margin were examined in detail. One is caused by a narrow gabbroic dyke, and the other by a small hematite-magnetite body which has been partly penetrated by a drill hole, and is strongly pyritic at depth.

The most significant result of the geological and geochemical work is the discovery of an area of highly anomalous copper, zinc and nickel values draining an area of andesite and gabbro which is covered by a well defined aeromagnetic anomaly. This area, less than two miles from the coast of Macquarie Harbour is an outstanding target, and should be thoroughly investigated by detailed ground work as early as possible.

INTRODUCTION

Location

The Double Cove Belt is an area about 30 square miles on the Cape Sorell Peninsula, in the Macquarie Harbour 1:63,360 sheet district. It is a bush and scrub covered belt between two extensive buttongrass areas, and extends from the south coast of Macquarie Harbour to the west coast proper. It is up to three and a half miles wide and seven miles long, and contains Cambrian sediments with minor volcanics, and is faulted along both its NW and SE margins.

Topography

The area rises to 500 feet above sea level, and includes remnants of the Henty Surface, a Pleistocene outwash surface. The watershed is only two and a half miles south of the coast of Macquarie Harbour. The northern streams drain steeply into Macquarie Harbour, while the southern streams have very swampy upper reaches but become more deeply incised on approaching the coast. Both sets of streams flow NE - SW following the general strike of the sediments.

Vegetation

Where the streams are more deeply incised the area is clothed with thick myrtle and sassafras forest, with thick horizontal scrub along the sides of the streams. The more poorly drained, swampy areas are covered by thick bauera and ti-tree scrub with scattered eucalypts.

Climate

The area is in the zone of strong westerly influence, and receives an annual rainfall of between 50 and 60 inches.

Previous Work

The area was visited by Loftus Hills (1914) during a geological reconnaissance of the country between Cape Sorell and Point Hibbs. It was included in the special Prospectors Licence granted to Lyell-E.Z. Explorations (L.E.E.) in 1956, and later in Exploration Licence 3/59 granted in 1959. This was allowed to expire in 1962.

During the period of L.E.E.'s tenure the area was covered by airborne magnetic and electromagnetic surveys in 1958. A geological traverse was made along the west coast portion of the belt, and ground investigations were carried out over L.E.E. aeromagnetic 10/8 (Deep Creek iron body - B.H.P. anomaly 129) and an insignificant aeromagnetic anomaly, 9/4, just north of Birthday Bay.

Six shallow drill holes (maximum depth 122 feet) were drilled at Pelias Cove, just east of Double Cove, where a 6 to 10 feet thick hermatatic crust covered greywacke over a length of 40 feet along the shoreline. No. E.M. response was obtained over this zone and the drill holes failed to intersect significant mineralisation.

B.H.P. Field Work

The Deep Creek iron body was visited by R. Whitehead in January 1965, shortly after the granting of E.L. 1/64 in August 1964, and a number of trial geochemical stream sediment samples were collected from Deep Creek.

In October 1965 a party under the supervision of L. Hollingworth constructed a bulldozed track over buttongrass country along the NW side of the belt, and then cut across into the central portion of the belt.

No further work was done in the area until April 1967, when the Deep Creek iron body was re-located during a geological - geochemical sampling traverse along Deep Creek. An attempt to open the area up by bulldozing was made in late April 1967, but was abandoned at the end of the month when the field season was terminated.

Much of the 1967-1968 field season work was focussed on the area. Geological traverses were made along the coastal sections and along the track across the west central portion of the belt. Geological and geochemical sampling traverses were also conducted along the majority of the streams draining the area.

Anomalies 128 and 129 were opened up by bulldozing, and detailed geological mapping and ground magnetics, E.M. and S.P. traverses were carried out over the bulldozed tracks.

Diamond drilling was commenced at Anomaly 129 (Deep Creek) in early April 1968.

THE GEOLOGY OF THE DOUBLE COVE BELT (SEE FIG.3A)

INTRODUCTION

The Double Cove Belt is an area of Cambrian and minor Precambrian rocks, faulted to the east and west against Precambrian rocks, and includes a number of lithologies not previously encountered in E.L. 13/65.

STRATIGRAPHY

The rocks of the Double Cove Belt and immediately flanking areas are divided into three groups.

1. Modder Group (Precambrian) - schist-quartzite association to the east and west.
2. Birthday Group (?Uppermost Precambrian and Lower Cambrian) - characterized by the common occurrence of limestone and dolomite, and occupying the southern end of the Double Cove Belt.
3. Correlatives of the Dundas Group (Middle and Upper Cambrian) - an argillite-greywacke association, occupying the northern and greatest area of the belt.

Modder Group

Rocks of the Modder Group belong to the greenschist metamorphic facies and are the oldest in the area. They outcrop in two belts east and west of the Cambrian rocks.

The rocks west of the Liberty Fault consist dominantly of quartzite with graphitic schist and quartz schist, and minor conglomerate. The quartzite is white to grey, massive, and occurs in bands up to four feet thick, and is interbedded with finely foliated schist in bands up to 50 feet thick. A band of quartz pebble conglomerate is associated with these rocks just west of Liberty Creek.

The rocks east of the Spence Fault are dominantly graphitic schist and subpelitic quartz-chlorite schist with minor quartz schist and quartzite. Thin beds of limestone, three inches to three feet thick, are interbedded with these rocks on the west coast, and are strongly boudinaged and cut by numerous quartz veins.

The rocks in both belts are isoclinally folded about axes striking north to NNE. The majority of the folds plunge 30° northwards. The finer grained rocks have a well developed axial plane cleavage and mica crinkle lineation.

Birthday Group

Rocks of the Birthday Group are characterized by the common occurrence of calcareous horizons, and are divided into three groups:

1. An ?Upper Precambrian quartzite-schist association about 3,500 feet thick.
2. A Lower ?Cambrian limestone-phyllite association about 4,000 feet thick.
3. A Lower Cambrian argillite-limestone-quartzite association about 5,000 feet thick.

The contacts between the three divisions are all faulted, and the inferred sequence is determined from the differences in metamorphic rank and deformation. The same fold style is common to all members. The contact with the older Modder Group is also faulted, but the contact with the younger Dundas Group, although not observed, is probably gradational.

1. The oldest member of the group occurs at the southern end of the belt where it is faulted against Modder Group schist to the east, and the middle member to the north. It is well exposed along the west coast from half a mile north of the mouth of Birthday Creek to two and a half miles south, and is folded into an anticline which is slightly overturned to the west and plunges south-west at 15° to 25°. A generalised section includes the following rock types:

At top

Black and white, locally red quartzite with minor maroon, green and grey banded argillite and dolomite bands............1,500 ft.
Quartzite and slate...................................100 ft.
Dolomite and schist...................................1,000ft.
Massive quartzite and quartz schist with minor
red and grey slates...................................1,000 ft.

At the extreme southern end of the belt the quartzite and dolomite on the east limb of the anticline is intruded by a small syenite-biotite granite body, and cut by thin quartz-hematite veins and syenite dykes.

2. The middle member of the Birthday Group is exposed along the west coast from the mouth of Waller Stream to half a mile south of the mouth of Big Creek, and also in Deep Creek and at the mouth of Lagoon Creek. It is characterized by a thick horizon of grey and black crystalline limestone, which is locally silicified and segregated into banded calcite veins, and forms a well developed kaarst topography.

The highest rank rocks of the group are the phyllite and schist just north of Big Creek, which are recrystallized, have a well developed tectonic fabric, and have been deformed by two phases of folding. These are intruded by a small diorite body just south of Waller Stream, and by a sill of biotite porphyry just north of Big Creek.

The section along the west coast is folded into three structures plunging north-east, but many of the minor structures plunge south-west. A generalised sequence includes the following rocks:

At top

Schist, phyllite and graphitic argillite.............	500	feet
Limestone..	1,800	"
Schist and phyllite..................................	900	"
Biotite porphyry.....................................	200	"
Limestone and phyllite...............................	300	"

In Deep Creek rocks of the middle member strike NNE, dip vertically and are faulted on all sides. The Deep Creek pyritic, hematite-magnetite body is located at the eastern boundary of this faulted block.

The following rocks are exposed in Deep Creek:

At top (east)

Green-grey quartzose argillite) Well bedded, light maroon sandstone in three to) twelve inch bands) Maroon argillite and fine green sandstone) Grey-brown sandstone) Grey argillite)	200	feet
Maroon argillite.....................................	700	"
Maroon sandstone and grey siltstone..................	500	"
Grey limestone.......................................	200	"
Graphitic phyllite...................................	200	"
Grey-black limestone.................................	1,500	"

Graphitic phyllite..300 feet
Grey-brown argillite......................................500 "

The thick limestone member also occurs in faulted wedges at the mouths of Lagoon and Big Creeks, and is strongly contorted at both localities.

3. The upper member of the Birthday Group is exposed in Big Creek between the Spence and Big Creek Faults, and is the least indurated member of the group. Its lower boundary is faulted, but its upper boundary is inferred to be gradational into rocks correlated with the Dundas Group.

The member consists dominantly of massive, green-grey quartzose argillite with thin bands of conglomerate, impure limestone and quartzite. In Deep Creek these rocks are closely folded into a series of structures plunging gently north-east.

The following section was measured in Big Creek:

At top

Light grey phyllite and argillite	thickness unknown
Green quartzite	)
Green-grey argillite, locally grey-black, pyritic	)
Maroon, gritty quartzite	)........500 ft.
Green grey argillite	)
Quartzite and laminated argillite	)
Black limestone with thin graphitic partings	)
Green-grey argillite	1,000 "
Maroon, white and purple conglomerate of sub angular to sub rounded pebbles	50 "
Green-grey argillite	thickness unknown

Dundas Group

Rocks correlated with the Dundas Group of the Zeehan and Queenstown areas are the most widespread in the Double Cove Belt. They occupy the entire coastal portion of the belt at Macquarie Harbour, but are exposed on the west coast only adjacent to the mouth of Albina Creek.

The group is approximately 16,000 feet thick, but no single section is complete as the area is cut by a number of strong, north-east trending faults. It is composed dominantly o of greywacke and argillite with a thick horizon of igneous rocks, the Lucas Creek Volcanics.

These rocks generally become younger to the east. The top of the group is unknown, and the lowest observed contact is faulted against limestone on the west coast just north of the mouth of Albina Creek.

The following composite section has been compiled:

At top	
Greywacke with conglomerate bands	200 feet
Laminated grey and grey-blue argillite	1,000 "
Grey-black and black, locally pyritic, graphitic argillite with a thin band of limestone and a thin band of chert	2,000 "
Greywacke with thin argillite and conglomerate bands	1,500 "
Argillite	200 "
Lucas Creek Volcanics	
Andesite	50 "
Argillite	200 "
Gabbro	400 "
Andesite	470 "
Gabbro	300 "
Andesite	650 "
Argillite	200 "
Andesite	380 "
Massive greywacke with thin argillite and conglomerate bands	1,500 "
Grey and grey-black laminated argillite, locally graphitic and strongly pyritic	4,800 "
Limestone	50 "
Finely bedded greywacke and laminated grey-brown and green-brown argillite	2,100 "
Laminated green-grey phyllite	400 "

The greywacke is usually well bedded and is occasionally laminated and has flow convolutions. It often has graded bedding. The conglomerate bands are up to six feet thick, poorly sorted, and contain sub-rounded to angular pebbles of Cambrian greywacke and Precambrian quartzite one to six inches across in a gritty quartz matrix. East of Double Cove the finer beds in the greywacke have a well developed axial plane cleavage.

The Lucas Creek Volcanics are exposed along the coastline of Macquarie Harbour from the mouth of Lucas Creek for half a mile to the west. The andesite members are massive, prominently jointed, medium green to grey, and locally porphyritic. The gabbro is medium grained, mottled green and black, and partly serpentinised. Interbedded with the igneous rocks are bands of maroon, green and grey-brown argillite which are churned up close to their contacts with the andesite.

STRUCTURE

The Double Cove Belt is bounded by two north-east striking faults, the Liberty Fault to the west and the Spence Fault to the east, and is an apparent graben between two Precambrian blocks. The Spence Fault is exposed in Big Creek as a thin graphitic zone dipping steeply north-west.

The oldest rocks are confined to the southern end of the belt, and occur in gently plunging folds with steeply dipping limbs. They are locally overturned to the west, and have been deformed by two periods of folding. The fold style is similar to that in the flanking Precambrian rocks.

The Middle and Upper Cambrian rocks occur in steeply dipping, north-east striking belts, and are cut obliquely by large strike faults. Along the coast immediately east of Double Cove these rocks are highly contorted into similar and kink style mesoscopic folds with variable, but usually steep plunge. The asymetry of these minor folds indicates the presence of a vertical to steeply south plunging syncline with an axis passing through Pelias Cove.

MINERAL OCCURRENCES

Pyrite, as both minute cubes and thin, cryptoe crystalline bands is common in the dark, graphitic argillite members of the Dundas Group. It is most likely to be syngenetic.

A pyritic, hematite-magnetite body, assaying from 64.8% Fe to 69.2% Fe, occurs on the eastern side of the

Spence Fault at Deep Creek. It is described in detail in the report on Anomaly 129.

Thin veins of specular hematite up to three inches thick and pyrite cubes up to an inch across occur in dolomitic rocks close to the small syenite-biotite granite body at the eastern end of the belt.

Cobbles of a copper stained, hematitic gossan were found on the beach at Pelias Cove, but their origin is uncertain.

A few tons of chalcopyrite, bornite and copper carbonates were mined at Birthday Bay at the turn of the century, but the occurrence appears to have been only a surface feature. The workings are no longer visible.

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THE GEOLOGY OF ANOMALY 128

Introduction

Anomaly 128 is located midway along the eastern margin of the Double Cove Belt, four miles south-west of the coast of Macquarie Harbour.

North-west dipping Cambrian sediments to the west have been faulted against north-west dipping low grade metamorphics to the east. A dyke extends along the inferred faulted contact between the Cambrian and Precambrian rocks, and is the obvious cause of the magnetic anomaly.

Cambrian Sediments (?Dundas Group)

The Cambrian sediments are predominantly siltstones, shales (locally pyritic) and argillites ranging in colour from pale grey to black and brown. These rocks strike between N30° E and N 45° E and dip 30° to 50° north-west.

Precambrian Metamorphics (Modder Group)

The Precambrian rocks are dominantly low grade chloritic and graphitic pelitic schists ranging in colour from light to dark grey. Minor quartzite bands are interbedded with the pelitic schists. These rocks strike from N 20° E to N 60°E and dip north-west at 60° to 90°.

Igneous

A narrow dyke up to 100 feet wide and 2,400 feet long strikes N 20° E and extends along the contact between the Cambrian and Precambrian rocks. In the north it is a highly weathered gabbro, while to the south it outcrops as a very dark, medium grained, slightly serpentinized pyroxenite, and also as a coarse grained, dark green gabbro.

The serpentinized pyroxenite was found to be weakly to strongly magnetic.

Relationship of Geology to Geophysical Anomaly

The igneous intrusion coincides with a high ground magnetic anomaly. As there is no obvious evidence of mineralisation the magnetic high is assumed to be due to the high magnetite content of the dyke.

Samples of the dyke rock were assayed, and the results are outlined below:

Sample No.	Rock Type	Results in Parts per Million 1,000-10,000	100-1,000
B 6175	Serpentinite	Ni Mn Ti	Rb Cs P Zn Co Cr
B 6176	Gabbro with magnetite	Mn Ti	Rb Cs P Co Ni Cr
B 6177	Gabbro with magnetite	Ni Mn Ti	Rb Cs P Zn Co Cr
B6178	Gabbro	Ni Mn Ti	Rb Cs Li P Cu Co Cr V Sr
B 6179	Serpentinized pyrox.	Mn Ti	Rb Cs P Co Ni Cr
B 6180	Serpentinized pyrox.	Mn Ti	Rb Cs B P Co Ni Cr

Recommendations

It is recommended that no further work should be carried out in the area.

084028

027

THE GEOLOGY OF ANOMALY 129 - DEEP CREEK (SEE FIG.4B)

Introduction

The Deep Creek aeromagnetic anomaly is situated at the south-west corner of the Double Cove Belt, and is caused by a vertically dipping body of pyritic magnetite and hematite.

The iron body strikes north-south and lies along the faulted contact between Precambrian schistose quartzites and schists to the east, and Cambrian shales and slates to the west.

Precambrian (Modder Group)

The Precambrian rocks consist mainly of schistose quartzites and quartzites. Minor phyllites outcrop in Deep Creek and about 400 feet to the north, and also to the east of Helipad8.

The quartzose rocks are dominantly of fine sand grade. They are mainly light blue-grey to very pale brown, and weather to give a fine white sand. They usually occur in massive beds, but finer beds are present. The average strike is N 30° E and the dip vertical.

The phyllites are light buff to pale green-brown, and appear to consist of very fine muscovite and quartz with minor chlorite. In Deep Creek they are strongly sheared in the direction N15° E. The average strike is N 30° E and the dip vertical.

A dark green, quartz-chlorite schist outcrops near the helipad, but the exposure is too poor to enable dip and strike measurements to be taken.

Minor graphite beds outcrop along the track between the helipad and Deep Creek.

Cambrian (Birthday Group)

The Cambrian rocks consist mainly of green and purple shales and slates, but fine sandstone beds outcrop in the creek and 400 feet to the north.

In the north-west of the area pale green and purple chloritic shales and slates are exposed. They strike N 40°E and dip 60° south-east and have two strong cleavages, one parallel to the bedding and the other striking N 20°W. Minor purple sandstone beds are present, and more massive sandstone outcrops between the shales and the iron body.

A light grey siltstone in the creek downstream from the cascades strikes N 5° E and dips 50° E, and has three strong cleavages which strike N 45° W, N 20° E and N 70° E, and dip 55° SW, 80° NW and 85° N respectively.

Immediately adjacent to the iron body this siltstone contains pyrite aggregates up to 0.3 inches.

Iron Body

The iron body is located at the east side of the faulted contact between Cambrian and Precambrian rocks. The fault strikes N 15° E and appears to be vertical or dip steeply east.

The iron body has a maximum width of 400 feet but averages about 150 feet, and a maximum length along strike of approximately 1,600 feet. At its maximum thickness the iron is present as both hematite and magnetite, but to the south the outcropping rock has been oxidised entirely to a blue-grey hematite. Pyrite is disseminated throughout the central and northern portions of the body. It occurs as single cubes and aggregates, and in places these have been oxidised to limonite, forming boxworks of hematite.

Using a factor of eight cubic feet per ton, a maximum tonnage of 4.4 million tons of iron ore is estimated from the top of the iron body to stream level.

Drilling

A diamond hole, designed to penetrate the thickest part of the iron body was drilled on a bearing of 305° and a depression of 50° from a point 80 feet north of Helipad 8. It penetrated to a depth of 331 feet before being abandoned because of drilling

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difficulties. The following rocks were intersected in the hole:

Grey schistose quartzite and light and dark grey finely foliated quartz schist with thin graphitic partings. Dip in core 15° to 70°, average 45°-50°	0 to 304 ft.
Gritty, mottled green-grey and white quartzite	304 to 304.5 ft.
Grey schistose quartzite	304.5 to 309 Ft.
Gritty, mottled green-grey and white quartzite with minute pyrite crystals. Dip in core 20° to 40°	309 to 315.5 ft. (1)
Mottled red and green clay and grey-brown argillite	315.5 to 317 ft.
Massive sulphide/oxide of 30% hematite and 70% pyrite	317 to 320 ft. (2)
Grey schistose quartzite. Dip in core 40°	320 to 331 ft.

The drill hole information indicates that the eastern contact of the iron body dips west at 70° and trangresses the schistosity of the rocks to the east.

Recommendations

The present drill hole information is inconclusive, but the remarkable increase in pyrite content (70% at 250 feet below the surface outcrop as against 5% at the surface) is interesting.

It is recommended that another hole be drilled in the same line of section, but about 50 feet closer to the iron body, also at a depression of 50° and taken to a depth of approximately 900 feet.

	Cu	Pb	Co	Ni	Cr	Mn	Mo	Gn	
(1) Sample A8874	60	3	15	10	8	1500	2	3	ppm
(2) Sample A8875	60	100	50	20	40	1000	2	3	"

GEOCHEMICAL SURVEY OF THE DOUBLE COVE BELT (SEE FIG.5A-B-C)

Geochemical Fieldwork

A total of 46 man days were spent in the area of which 27 were spent mapping and sampling in the northern portion and 19 in the southern portion.

In the northern area geochemical samples were collected from all 14 streams flowing into Macquarie Harbour, and from 4 creeks crossing the track. At the same time geological traverses were made along four of these streams which drained the aeromagnetic anomalies.

In the southern area, sampling and geological traverses were carried out along the six streams draining the area.

Geological traverses were also made along the coastlines at the north-east and south-west ends of the belt.

Reconnaissance stream sediment samples were collected from a total of 180 sites at quarter mile intervals from all the streams traversed. Each sample was marked in the field by the attachment of a red tape, bearing the appropriate sample numbers, to a nearby tree. Duplicate samples were collected from most localities of which only the - 80 mesh fraction of one sample was forwarded for Cu, An and Ni analyses.

Sample locations were marked on the 1" to 2,000 feet aerial photographs, and later transferred to field sheets of the same scale. The final compilation of results is shown on 1" to 1 mile maps. The sample numbers, location and results are tabulated below.

Results of Analyses

The division into background, threshold and anomalous groupings were made purely from visual inspection of the assay results. This method was preferred to the original groupings as calculated statistically and used by M.H. McIntyre (1966-1967 field season report). It gave a more realistic picture of the relative distribution of values, at the same time emphasizing the anomalous areas.

The following divisions have been used:

Copper (Total Range 0 - 110 ppm)

Background	0 - 20 ppm
Threshold	21 - 50 ppm
3rd Order Anomaly	51 - 70 ppm
2nd Order Anomaly	71 - 90 ppm
1st Order Anomaly	over 90 ppm

Zinc (Total Range 0 - 275 ppm)

Background	0 - 30 ppm
Threshold	31 - 80 ppm
3rd Order Anomaly	81 -100 ppm
2nd Order Anomaly	101 -200 ppm
1st Order Anomaly	over 200 ppm

Nickel (Total Range 0 - 340 ppm)

Background	0 - 30 ppm
Threshold	31 - 70 ppm
3rd Order Anomaly	71 -120 ppm
2nd Order Anomaly	121 -160 ppm
1st Order Anomaly	over 160 ppm

Discussion of Results

The most significant feature of the results is the anomalous values for Cu, Zn and Ni in the stream entering the western bay of Double Cove, Macquarie Harbour, and the threshold and lower order anomalous results from the streams to the west. These are associated with a belt of andesitic lavas and minor gabbro interbedded with Cambrian greywackes. Gossanous boulders were located on a beach immediately east of Double Cove and may have been derived from this area. An aeromagnetic anomaly (123) also lies over the centre of this area.

A tributary of the northern stream in the Birthday Bay area also shows anomalous values for Cu, Zn and Ni and is probably associated with a nearby aeromagnetic anomaly (125).

Recommendations

Further investigation is required to locate and

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determine the cause of the highly anomalous area to the west of Double Cove.

To cover the centre of the aeromagnetic anomaly and the area drained by the anomalous creeks an initial total of 10 miles of tracks are proposedat approximately 500 feet spacing (see map).

A total of 110 soil samples at 250 feet intervals, with supporting geophysical work, should be sufficient to locate the area of interest. More detailed follow up sampling and geophysical work may then be employed using hand cut lines and/or supplementary bulldozed tracks. This is dependent on the nature of the bush.

It is also proposed that the aeromagnetic anomaly (125) two miles to the south-west of the above area should be investigated. This would require two and a half miles of track and an initial 50 soil samples at 250 feet intervals, and geophysics with any necessary follow up work.

There are three possible access routes into the area (see map). One track is already in existence and being in fairly good condition it would take less than a day to complete repairs on it.

Two alternative access routes would be from the coast of Macquarie Harbour. While that from Double Cove may be over rougher terrain, it offers the advantage of sheltered waters which would facilitate the landing of equipment, stores etc.

Three potential camp sites are also shown, all within very close proximity of fresh water.

Recommendations

1. The discovery of the anomalous copper, zinc and nickel values in the stream sediments of Lucas Creek, immediately west and south-west of Double Cove, is of outstanding importance. The area coincides closely with the Cambrian Lucas Creek Volcanics, and is covered by aeromagnetic anomaly 123 with a peak of 4,926 gammas.

A similar area of andesite and gabbro (Briggs Gully Volcanics) at the northern end of the Hibbs Belt was also covered by stream sediment sampling, but the assay values (copper 2-35 ppm, zinc 4-100 ppm, and nickel 11-128 ppm) bear little comparison with those of the Lucas Creek area (copper 42-110 ppm, zinc 58-238 ppm and nickel 58-250 ppm). This comparison greatly enchances the optimism directed towards the Lucas Creek area.

The greatest concentration of high, coincident copper, zinc and nickel values is along the south-east corner of Anomaly 123, and this area should be considered of prime importance in future work, and given top priority.

It is therefore most strongly recommended that a program of line clearing, soil sampling and detailed geological and geophysical investigation be implemented as soon as field work commences for the 1968-69 summer. The program detailed by G.R. Fenton in the section on Geochemistry, although it may have to be slightly modified as work progresses, offers the most effective method of locating a drilling target, and no effort or expense should be spared in doing this.

In conclusion it must be forcefully reiterated that the Lucas Creek area is a target which cannot be neglected.

2. The Deep Creek iron body should be conclusively tested by a further diamond drill hole. This should be on the same line of section, bearing and depression as the original hole, but 50 feet closer to the iron body.

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Appendix A 084035

DOUBLE COVE BELT - RECONNAISSANCE SAMPLES

Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
1584	Deep Creek	16	10	12
1585	" "	13	19	6
1586	" "	6	15	6
1587	" "	6	19	6
1588	" "	2	5	2
1589	" "	6	18	4
1591	" "	6	13	6
1592	" "	6	17	6
1593	" "	6	20	8
1594	" "	7	33	6
1595	" "	2	9	-
2471	Big Creek	26	26	19
2472	" "	6	23	11
2473	" "	108	38	16
2474	" "	42	33	24
2475	" "	16	19	11
2476	" "	6	26	11
2477	" "	1	15	4
2478	" "	10	16	6
2479	" "	8	24	8
2480	" "	8	10	6
2481	" "	10	48	32
2482	" "	3	20	12

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Sample No.	Location	Results (in PPM) Copper	Zinc	Nickel
8601	Liberty Creek	16	38	25
8603	" "	42	85	50
8605	" "	18	58	38
8607	" "	22	58	43
8609	" "	14	37	25
8611	" "	20	51	30
8613	" "	30	79	43
8615	" "	24	70	38
8617	" "	18	44	30
8619	" "	24	76	43
8621	" "	4	19	11
8623	" "	8	22	19
8625	" "	26	70	50
8627	Between Schofield and Spence Creeks	3	9	5
8629	" " "	3	7	5
8631	" " "	1	5	5
8633	" " "	3	7	5
8635	" " "	1	6	5
8637	" " "	1	7	5
8639	" " "	1	9	5
8641	" " "	1	7	5
8643	" " "	-	4	5
8645	Lucas Creek	64	160	135
8647	" "	42	93	85
8649	" "	66	88	128
8651	Between Schofield & Spencer Creeks	1	4	2
8653	" " " "	1	5	2
8655	" " " "	1	2	2
8657	" " " "	1	8	2
8659	" " " "	3	11	2
8661	" " " "	3	7	2
8663	" " " "	1	12	2
8665	Between Liberty and Lucas Creeks	40	85	67
8667	" " " "	54	110	83
8669	" " " "	100	91	67
8671	Between Schofield and Spence Creeks	14	62	19
8673	" " " "	10	11	8
8675	" " " "	38	96	67

036

Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
8677	Between Liberty and Lucas Creeks	26	69	44
8679	" " " " "	40	93	70
8681	" " " " "	16	37	27
8683	" " " " "	20	24	22
8685	" " " " "	28	37	35
8687	" " " " "	51	91	86
8689	" " " " "	49	88	61
8691	" " " " "	76	135	98
8693	" " " " "	40	96	61
8695	" " " " "	44	100	78
8697	" " " " "	24	83	52
8699	" " " " "	38	93	61
8701	" " " " "	64	100	78
8703	Between Schofield and Spence Creeks	10	14	8
8705	" " " "	8	14	11
8707	" " " "	8	11	11
8709	" " " "	14	19	16
8711	" " " "	12	17	11
8713	" " " "	8	17	11
8715	Between Schofield and Spence Creeks	4	9	6
8717	" " " "	4	7	4
8719	" " " "	8	19	11
8721	Lucas Creek	85	150	105
8723	" "	110	190	86
8725	" "	47	65	58
8727	" "	51	74	64
8729	" "	42	72	58
8731	" "	68	93	90
8733	" "	61	91	83
8735	" "	56	76	70
8737	" "	49	69	No result
8739	Schofield Creek	10	10	6
8741	" "	1	7	2
8742	" "	1	5	2
8743	" "	1	5	2
8745	" "	3	7	4
8747	" "	3	6	4

Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
8749	Schofield Creek	1	4	2
8751	" "	3	4	2
8753	" "	3	7	4
8755	" "	3	7	4
8757	Between Waller Stream & Big Creek	4	34	8
8759	" " " " "	3	24	-
8761	" " " " "	8	165	35
8763	" " " " "	6	57	11
8765	" " " " "	6	54	16
8767	" " " " "	6	65	16
8769	" " " " "	8	74	19
8771	" " " " "	3	44	4
8773	" " " " "	4	72	16
8775	" " " " "	6	93	22
8777	Waller Stream	8	55	8
8779	" "	8	40	6
8781	" "	8	38	8
8783	" "	12	49	11
8785	" "	10	54	6
8787	" "	24	70	24
8789	" "	10	62	8
8791	" "	10	44	6
8793	" "	6	42	2
8795	" "	8	37	2
8797	" "	12	44	8
8799	" "	8	47	6
8801	Lučas Creek	73	180	140
8803	" "	88	210	154
8805	" "	100	180	90
8807	" "	64	190	132
8809	" "	71	188	132
8811	" "	59	165	116
8813	" "	56	188	116
8815	" "	68	238	120
8817	" "	71	224	154
8819	" "	85	202	140
8821	" "	73	216	150
8823	" "	88	275	120
8825	Between Liberty & Lucas Creeks	47	85	169
8827	" " " "	47	100	250

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Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
8829	Between Liberty and Lucas Creeks	68	91	120
8831	" " " "	44	100	340
8835	Waller Stream	8	40	4
8837	" "	6	30	2
8839	" "	6	34	4
8841	" "	8	40	4
8843	" "	10	42	8
8845	" "	32	70	44
8847	Albina Creek	30	67	50
8851	Between Lucas and Schofield Crks.	3	17	19
8853	" " " "	3	7	5
8855	" " " "	1	5	11
8857	" " " "	1	7	19
8859	" " " "	3	7	25
8861	" " " "	1	5	-
8863	" " " "	3	7	5
8865	" " " "	1	3	5
8867	Spence Creek	22	43	11
8869	" "	20	45	5
8871	" "	12	40	11
8873	" "	10	30	11
8875	" "	8	28	11
8877	" "	8	28	11
8879	" "	14	47	19
8881	" "	3	4	19
8883	" "	6	9	11
8885	" "	14	48	25
8887	Albina Creek	64	140	86
8889	" "	51	96	64
8891	" "	40	74	47
8893	" "	14	30	14
8895	" "	38	70	50
8897	" "	38	65	40
8899	" "	76	135	83
8901	" "	10	31	4
8903	" "	4	24	2
8905	" "	4	33	2
8907	" "	3	18	2
8909	" "	4	18	2

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039

Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
8911	Albina Creek	4	23	2
8913	" "	3	19	-
8915	" "	44	88	52
8917	" "	16	29	4
8919	" "	34	69	40
8921	" "	40	67	52
8923	" "	28	49	32
8951	Head of Lagoon Creek	24	30	22
8953	" " "	8	30	14
8955	" " "	10	28	16
8957	" " "	32	58	50
8959	Albina Creek	34	44	200
8961	" "	3	6	2
8963	Head of Lagoon Creek	6	18	4

040

084041

THE HIBBS BELT

P.W. MCGREGOR.
E.D. BUMSTEAD

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INTRODUCTION

The Hibbs Belt is an area of approximately 100 square miles in extent. It is defined as the area bounded in the north by the coastline of Macquarie Harbour, and in the south by an east-west line drawn throuth the south-east corner of Endeavour Bay below Pt. Hibbs. The western boundary is taken at the Modder Fault between Macquarie Harbour and Hibbs Bay, and then along the coastline to the south. The eastern boundary is taken along the western edge of the Tertiary and Pleistocene gravels (see map).

Topography and Vegetation

The Hibbs Belt is an undulating area rising to 900 feet above sea level where extensive remnants of the Henty Surface are preserved.

The northern portion of the belt is strongly dissected, and the streams flow steeply over frequent waterfalls into Macquarie Harbour and Birch Inlet. The old surface is better preserved to the south, and the drainage is sluggish into the deeply incised valleys of the Modder, Hibbs and Spero Rivers.

The higher area are covered with thick bauera and ti-tree scrub and scattered eucalypts, and the more dissected areas carry a thick myrtle and sassafras forest with scattered celery-top pines.

Apart from the bulldozed tracks, movement is generally difficult through the area except along a few of the larger streams.

B.H.P. Field Work

Field work in the Hibbs Belt began in late October 1966, with the bulldozing of initial lines across the pronounced circular aeromagnetic anomaly at Timbertops and the pronounced belt of linear anomalies along the western margin of the belt at Hibbs Lagoon, Noddy Creek and the headwaters of the Modder River. The discovery of diorite and andesitic volcanics at Timbertops, and asbestos and a large e.m. anomaly at Noddy Creek led to these areas being further opened up for detailed examination.

During the 1966-67 field season reconnaissance magnetic and e.m. traverses were conducted along the majority of the tracks cleared by the bulldozers. Geological mapping at 1 inch to 400 feet was carried out along the same tracks, and mapping at 1 inch to 2,000 feet was carried out along the coastal section of the northern portion of the area. At the same time stream sediment samples were collected from the mouths of all the coastal streams.

As the values for these samples were higher than many previously collected from other portions of the Exploration Licence area, additional geological and sampling traverses were conducted along a number of the larger streams draining the area.

A geological and stream sampling traverse was also undertaken along the Spero River at the southern end of the belt, and along McCarthy Stream, a large north bank tributary of the Spero River.

At the end of the 1966-67 field season the geochemical results were only of mediocre interest, and the main potential of the area appeared to lie in the asbestos occurrences at Noddy Creek, and the E.M. anomaly along the western margin of the eastern belt of ultrabasic rocks at the same locality.

During the 1967-68 field season the main detailed work was concentrated on the asbestos and E.M. anomaly. Further bulldozing defined the limits of the main asbestos-bearing area to a zone 7000ft. long and a maximum of 100 feet across. Seventeen costeans have been cut across this zone. The grade of asbestos ore was measured along a horizontally laid tape as the ratio of asbestos fibre 1/16th inch and greater to the country rock. The estimated grade and tonnage are not outstanding, and are fully discussed in the report on the Noddy Creek area.

In an attempt to locate additional asbestos the ultrabasic rocks exposed during the previous season were reexamined, as was the occurrence at Asbestos Point. The area of aeromagnetic anomalies north-east of Noddy Creek was also cleared, but proved to be underlain by andesitic volcanics and gabbro.

The E.M. anomaly was closely defined by E.M. and S.P. traverses along lines 100 feet apart and with readings taken at 25 feet intervals. Soil samples were collected from the same area.

A single diamond hole was drilled into the peak of the anomaly, but was abandoned at 229 feet after penetrating beyond the zone of interest. The anomaly is caused by 11 feet of pyritic graphite lying along the western side of the ultrabasics.

Geological mapping and systematic stream sediment sampling were completed in the northern portion of the Hibbs Belt, mainly in an endeavour to discover whether the thick andesitic volcanics held promise of being mineralised. This does not appear to be the case.

Further mapping and sampling were carried out in the vicinity of Hibbs and Spero Bays at the southern end of the Hibbs Belt. The source of the main aeromagnetic anomaly extending south-east from Hibbs Lagoon could not be located because of the difficult terrain and vegetation, but relatively high nickel and zinc values in Evans Creek indicate that ultrabasics probably occur at the head of the catchment area.

To date 78 stream sediment samples, 203 soil samples, and 1,500 rock samples have been collected from the Hibbs Belt, but none contain outstanding values. Bulldozing has cleared 130,000 feet of tracks, of which 65,000 feet is largely for access alone. In addition six areas were cleared for helicopter landings. Geophysical readings have been taken along 40,000 feet of tracks.

The quality and grade of asbestos in the Hibbs Belt do not appear to be economic, and the remaining rocks, despite the common occurrence of ultrabasics, gabbro, diorite, and andesitic volcanics, do not, on the available evidence, appear to be mineralised.

To complete the evaluation of the Hibbs Belt the catchment area of the Hibbs River should be covered by geological mapping and systematic stream sediment sampling. The area of high intensity aeromagnetics two to three miles south-west of the head of Birch Inlet should be opened up by bulldozing to enable ground geophysical surveys to be carried out. However, a number of creeks flowing south into Timbertops Stream drain this area, and should be sampled prior to a decision being made to examine the area in detail.

A number of relatively high, but usually isolated stream sediment values, particularly for nickel, occur in the Hibbs Belt and may eventually require closer examination, but are at present of low priority.

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THE GEOLOGY OF THE HIBBS BELT (SEE FIG.3A, 3B)

Introduction

A geosynclinal sequence of up to 34,000 feet of Cambrian greywacke and argillite with andesitic volcanics and sills of ultrabasics has been intruded by small bodies of diorite and gabbro. The base of the Cambrian is faulted against Precambrian metamorphic rocks. Along the western side of the area the Cambrian is conformably overlain by Ordovician sandstone, but to the east the Cambrian is unconformably overlain and a considerable thickness is missing.

All age relationships observed in the Cambrian sequence indicate younger beds towards the east.

Cambrian

A generalised sequence through the Cambrian rocks in the northern portion of the belt is given below:

At top

Fine grained, green micaceous sandstone	70 feet
Laminated green-grey and maroon argillite with thin green sandstone bands; contains trilobites	610 "
Gritty green sandstone	20 "
Laminated green-grey argillite and fine sandstone	300 "
Red, green purple and green-grey argillite, with bands of angular intraformational mud pellet conglomerate. Locally conglomerate of rounded pebbles in muddy matrix	1250 "
*******faulted at base********	
Finely laminated grey argillite	+5000 "
Greywacke with conglomerate and thin argillite bands	700-1500 "
Finely laminated grey argillite	600-3000 "
Greywacke with conglomerate and argillite bands	800-1500 "
Finely laminated grey argillite	+1500 "
Briggs Gully Volcanics; andesitic lavas, tuffs and agglomerates, minor basalt, gabbroic and dioritic intrusives	2500-7000 "
Black argillite	300 "
Greywacke with thin argillite bands	1200 "
Laminated blue-grey and green-grey argillite with thin, irregular bands of gritty green sandstone	max1500 "
Graded bedded greywacke and conglomerate with thin argillite bands	1000 "

Ultrabasics; locally layered pyroxenite-harzburgite 200 feet and gabbro 800 feet, and sheared dark green and massive apple green serpentinite...... max 2500 ft.

Green-grey and black argillite with minor thin conglomerate and greywacke bands......................3500 "

*** faulted base ***

Sediments

The youngest rocks in the sequence are exposed in a faulted strip along the western margin of the belt. Just west of Helipad 2 they are conformably overlain by two feet of very fine to gritty, red and white conglomerate equivalent to the Owen Conglomerate, followed by 400 feet of Caroline Creek Sandstone. In Hills Creek three miles to the south 10 feet of quartz sandstone confor conformably overlies Cambrian argillite, and is followed by three feet of fine, red and white conglomerate, and then further quartz sandstone with thin bands of red and white conglomerate.

A trilobite fauna collected 220 feet below the top of the Cambrian contains Lotagnostus and is dated as Upper Cambrian.

Up to 12,500 feet of greywacke and argillite, slightly older than the fossiliferous argillite, occurs at the north-east end of the Hibbs Belt. They are faulted against volcanics to the west and are unconformably overlain by Caroline Creek Sandstone to the south.

The argillite is medium grey and well bedded in ½ inch to 1½ inch bands, and contains thin bands of greywacke, generally less than three inches thick but up to three feet thick and lensing out along strike. The argillite usually has a well developed cleavage.

The greywacke is light grey to yellow-brown, friable, and occurs in six inch to three feet bands. It often has a strong cleavage and is cut by thin quartz veins. Along the coastline of Macquarie Harbour it contains bands of conglomerate up to 10 feet thick, which consist of angular to sub-rounded quartz and quartzite pebbles and isolated argillite fragments up to 18 inches across in a gritty, angular matrix. Graded bedded cycles from conglomerate to argillite are common.

The argillite in the lower part of the Cambrian is typically blue-grey and green-grey with bands of graded bedded greywacke up to three feet thick.

Immediately east of the ultrabasic rocks is a zone of greywacke with common angular fragments of milky quartz and elongate greywacke and argillite pebbles and thin argillite bands. At Noddy Creek the greywacke contains a discontinuous, but very distinctive band of conglomerate up to 10 feet thick, composed largely of fragments of fuchsite (chrome mica) probably derived from the ultrabasics.

Adjacent to the ultrabasics the argillite is deformed around pods of greywacke and talc, and boudinaged quartz veins.

Noddy Creek Volcanics

The Noddy Creek Volcanics are exposed along the coast of Macquarie Harbour just east of Asbestos Point, and extend south to Noddy Creek and Timbertops. They are faulted against sediments to the east and west and are interbedded with them south-east of Timbertops. The volcanics are up to 7,000 feet thick east of Noddy Creek.

The volcanics consist dominantly of andesitic lavas with minor pyroclastics. Two types of lava are present. The most common are "normal" or leuco-andesites which have been recognised as distinct flows at Timbertops. They are generally pale green-grey, and range from very fine grained, aphyric and banded to porphyritic, medium grained varieties resembling microdiorite. They are locally richly vesicular, and are often extensively replaced by chlorite.

In thin section the leuco-andesites show abundant andesine phenocrysts in a groundmass of fine, feathery plagioclase and small chlorite flakes. Apart from the chlorite which is secondary, ferromagnesian minerals are absent. Talc is often abundant, particularly in the large shear zones at Timbertops.

The less common pyroxene andesites are generally dark reddish or purplish brown, and contain abundant pale feldspar laths, dark ferromagnesian phenocrysts and pale yellow or green, chlorite, quartz or epidote filled vesicles.

In thin section the pyroxene andesites show abundant large andesine and pyroxene crystals in a groundmass rich in haematite. The pyroxene is often replaced by chlorite. The groundmass may be entirely devitrified glass, very fine plagioclase, or a mixture of both.

The relationship between the two types of andesites is not clear, but the pyroxene andesites are sometimes associated with minor basalts.

Both tuff and agglomerate occur with the andesites between Noddy Creek and Timbertops. The tuff is a hard, pale green rock, and is sometimes banded. The agglomerate is generally a pale, mottled pink and green rock, with angular andesite fragments up to six inches across.

At Timbertops the andesites and tuffs are intruded by a number of bosses of hornblende diorite. At the northern end of the area and immediately west of Birch Inlet they are intruded by gabbro.

Ultrabasics

A single band of ultrabasic rocks up to 2,000 feet wide extends from south of Hibbs Lagoon to Fern Creek. It consists largely of highly sheared serpentine with minor pyroxenite and gabbro, and is faulted against Cambrian and Ordovician sediments to the west.

Just south of Fern Creek the ultrabasics widen to 3,000 feet and become divided into two belts by faulting. The western belt is up to 1,000 feet wide, and continues along the faulted western contact. It consists largely of sheared, medium to dark green serpentinite with very minor asbestos occurrences.

The eastern belt is 2,000 feet across at Fern Creek, and extends to Noddy Creek, north of which it is faulted out. The southern portion of the belt consists largely of pyroxenite and harburgite in ½ inch to two inch bands, and minor sheared serpentinite. The central portion is made up of 200 feet of banded pyroxenite and harzburgite to the west and 800 feet of medium grained gabbro in the east. To the north the ultrabasics become highly sheared and consist of both sheared, dark green serpentinite and massive, apple green serpentinite with common asbestos. A lamprophyre dyke cuts obliquely across the serpentinite at the northern end of the belt.

At Asbestos Point a body of ultrabasic rocks, 200 feet wide and 3,000 feet long is faulted against black phyllitic argillite to the west. It consists of sheared serpentinite with xenoliths of pyroxenite up to six feet across, and contains small pockets of asbestos fibre which have largely been worked out.

At Spero Bay at the southern end of the Hibbs Belt, a body of basic and ultrabasic rocks two miles long and one mile across intrudes Cambrian sediments. The southern third of the body consists of banded pyroxenite and harzburgite with sheared serpentinite, while the northern portion consists of gabbro.

The ultrabasics were probably originally layered sills with a lower portion of banded pyroxenite and harzburgite and an upper portion of gabbro. North of Hibbs Bay they have been faulted into their present position and strongly sheared. The Spero Bay body appears to be much less disturbed, and its present shape may reflect a north plunging anticlinal structure, with the stratigraphically lower pyroxenite-harzburgite to the south and the overlying gabbro to the north.

Ordovician

Ordovician rocks occur in the Timbertops syncline and in a vertical, faulted strip in the headwaters of the Modder River. They are divided into two formations, the Caroline Creek Sandstone and Gordon Limestone.

In the headwaters of the Modder River Caroline Creek Sandstone is 400 feet thick and rest conformably on Upper Cambrian argillite. It consists of laminated, white to cream quartz sandstone with a thin band of fine, red and white conglomerate at or near the base. In the Timbertops Syncline the formation rests unconformably on Briggs Gully Volcanics. It is 2,100 feet thick and includes three members, each 700 feet thick. The upper and lower members are white quartz sandstones, while the middle member is a medium grey, micaceous siltstone. The lower sandstone also occurs as an isolated outlier east of the syncline.

Gordon Limestone conformably owerlies the sandstone in both the Timbertops Syncline and headwaters of the Modder River. In the headwaters of the Modder River it is 770 feet thick, and includes the following members:

At top (faulted)

Fine grained, grey crystalline limestone..........	200	feet
Pupple shale...	10	"
White quartz sandstone.............................	60	"
Fine grained, grey crystalline limestone..........	500	"

Three miles to the south the lower limestone thins to 200 feet, and the sandstone member thickens to 650 feet and becomes a fine grained, maroon quartz grit with thin bands of red and white conglomerate.

Devonian

Lower and Middle Devonian rocks are exposed only at Point Hibbs, and are included in the Spero Bay Group (Banks, 1957). They are at least 2,000 feet thick, and are folded into a tight syncline which is faulted against Permian rocks to the west, and rests unconformably on Cambrian and Precambrian rocks to the east.

A siliceous conglomerate at the base is overlain by cross-bedded sandstone with thin siltstone members. These pass into 570 feet of richly coralline limestone, which is overlain by well sorted, cross-bedded sandstone with thin conglomerate and siltstone horizons.

Permian and Jurassic

Immediately west of the Devonian rocks are 1,600 feet of reworked Permian tillite and siltstone. These dip vertically to steeply west, and are faulted against Jurassic dolerite to the west.

THE HIBBS LAGOON AREA

SUMMARY

A narrow N.N.E. trending belt of Cambrian ultrabasic rocks lies between Cambrian sediments in the Hibbs Lagoon area in the southern part of the Hibbs Belt. The ultrabasic belt is comprised of pyroxenite, serpentinite and gabbro with inliers of pyritic hornfels and argillite. West of the Cambrian sediments are Ordovician, and further Cambrian and Precambrian sediments.

Two insignificant asbestos localities were noted in massive serpentinite. Pyrite is common in hornfels and rare in serpentinite at its eastern margin.

INTRODUCTION

Location

The Hibbs Lagoon Area lies about seven miles W.S.W. of Birch Inlet Camp, immediately north of Hibbs Lagoon. The area is shown on three 1 inch to 400 feet geological maps. (Figs. 6,7,8.)

Topography and Vegetation

Addeep north-south trending valley lies two hundred feet below the surrounding area. To the west the country is flat and covered with button grass and to the east is gently undulating with a thick cover of myrtle and eucalypt forest. The valley, in which the serpentinite occurs, has a variable flora with young eucalypts in the north passing southwards into myrtly forest. Manuka, (ti-tree), cutting grass and bauera occur throughout.

Field Work

In the second half of March and early April 1967, four and a half miles of bulldozed tracks were cleared and surveyed. Geological mapping and geophysical work using magnetic and e.m. methods was also carried out, and geochemical samples were taken from the streams crossing the tracks.

GEOLOGY

Introduction

A narrow N.N.E. trending ultrabasic belt consisting of pyroxenite, serpentinite and gabbro lies between Ordovician sandstone and conglomerates, Cambrian siltstone and Precambrian phyllite to the west and Cambrian siltstone, argillite, greywacke and minor volcanics to the east. Inliers of siltstone and pyritic hornfels occur in the ultrabasic belt.

Ultrabasics

The ultrabasic belt is 1,100 feet wide in the north and widens southwards to 2,500 feet over a strike length of 10,000 feet. The ultrabasics probably extend both north and south along strike, and the belt is thought to be continuous northwards to the Noddy Creek area. The rock types include pyroxenite, serpentinite and gabbro.

The pyroxenite occurs in the core of the ultrabasic belt and extends as a narrow ridge of low relief (5-30 feet high) following the trend of the ultrabasic belt and occuring just west of a north-south line along the centre of the belt. It is coarse grained, equigranular and dark green in colour, and forms massive, partly rounded outcrops, which weather to a buff colour. It is usually partly serpentinized, and the serpentinized material was probably olivine.

Gabbro is best represented in the south where two bands, one 400 feet wide, and another 350 feet wide are present. The western band forms the western contact of the ultrabasics with sediments and thins northwards to a width of 40 feet. The eastern band also thins northwards and tapers off before it reaches the northernmost E - W line. The gabbro is medium grained, equigranular and mottled green and white. This rock weathers fairly readily to a soft fawn mottled rock.

The serpentinite is the most widely developed rock in the ultrabasic belt, and is 1,000 feet wide in the north and 2,100 feet wide in the south, but this thickness includes the 350 feet wide eastern gabbro band. The serpentinite is dominantly highly sheared with minor partly sheared sub-conchoidal lumps.

Its colour varies from ochreous yellow-green and apple green to blue-green.

Insignificant asbestos and pyrite are found in the serpentinite and are described below.

Three inliers, two of pyritic hornfels and one of siltstone occur in the serpentinite. The siltstone is pale green-grey in colour and occurs as a lens 400 feet wide (see Fig. 7.)5/G 762465yN 338920yE). The pyritic hornfels is described below.

SEDIMENTS

Precambrian Phyllite

This occurs to the west of the area and is faulted against the Cambrian siltstone. The phyllite is dark grey in colour, fine grained, cleabed and contains common syngenetic pyrite.

Cambrian Siltstone and Greywacke

Siltstone

Two bands of siltstone occur west of the ultrabasic belt. The first is 450 feet thick and forms the western contact of the ultrabasic belt. This band of siltstone is faulted against Ordovician sandstone to the west. West of this sandstone a second band of Cambrian siltstone occurs. It is 250 feet wide, conformable with the Ordovician sandstone and faulted against Precambrian phyllite to the west. The siltstone is finely laminated, and medium grey in colour, with minor dark grey, green and pale blue laminations.

Greywacke

The greywacke is the dominant rock type east of the ultrabasic belt.

Minor siltstone, conglomerate and volcanic horizons are associated with it.

The greywacke is crudely sorted and poorly bedded, and contains angular, milky quartz fragments, rounded elongate pebbles of sandstone and fragments of siltstone. The regional strike is north-south and the dip vertical.

Ordovician Sandstone

The sandstone has a saccharoidal texture and is

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composed of white and pink quartz fragments in a siliceous matrix. It is conglomeratic in part and is correlated with the Caroline Creek Sandstone.

Volcanics

Minor volcanic horizons occur in the greywacke. These are much altered and have the appearance of chert in hand specimens. Two have been petrologically examined and identified as silicified porphyritic andesite and quartz feldspar porphyry respectively. The quartz feldspar porphyry abuts against serpentinite in the north of the area.

ECONOMIC GEOLOGY

Asbestos

Asbestos is poorly developed in this area and has been noted at two localities:

Fig. 7 760255yN 338450yE
Fig. 8 762530yN 338920yE

At both localities only a few veins of asbestos were present in massive dark green serpentinite. The maximum width of asbestos was a quarter of an inch, and all veins were seen to lens out rapidly.

Pyrite in Serpentinite

Pyrite occurs in silicified serpentinite as small radiating blebs at (Fig. 6) 763255yN 339300yE where serpentinite is in contact with quartz feldspar porphyry.

Pyritic Hornfels

Two lenses of medium grained, green pyritic hornfels occur as inliers in the ultrabasic belt. Pyrite is very common both as veins and disseminated cubes. Pyrite cubes up to three eights of an inch square occur as layers in the joint planes. Four analyses of this rock are shown below:

Sample No.	Fig.No.	Location	Results in PPM				
			Cu	Pb	Zn	Ni	Cr
B6064	Fig.7	762175yN 338920yE	150	6	25	100	400
B6065	Fig.7	762175yN 338920yE	120	15	60	60	200
B6066	Fig.8	760600yN 338600yE	60	50	120	120	200
B6067	Fig.8	760600yN 338600yE	70	5	100	100	100

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Geologist

TIMBERTOPS AREA - FERN CREEK AREA (SEE FIGS.9,10,11,12,13)

General

The oldest Cambrian rocks in the area are laminated siltstones and argillites, probably Middle Cambrian in age. These sediments are associated east of Timbertops with massive porphyritic rocks, probably belonging to the spilite suite, and interbedded cherts. Greywackes and greywacke conglomerates occur near the volcanics and are probably derived from them. The spilite suite rocks are probably related to the (?) pillow lavas along the west side of Birch Inlet. A small outcrop of altered basalt occurs with keratophyre on the south-eastern Timbertops crossroad.

A thick sequence of andesite flows centred at Timbertops is probably younger than the spilites, while bodies of hornblende diorite and microgranite apparently intrude the andesites and are thus the youngest rocks in the area. Very minor basalt and gabbro bodies are associated with the andesites.

No pyroxenites occur in the area, but the introduction of talc and chlorite along major sheer zones has produced rocks similar to those associated with the ultrabasic belt near Pad. 2. The introduction of talc may have occurred as a result of quartz-diorite intrusion.

A major zone of chloritisation and shearing runs approximately WNW through the area, and may be folded around the Tabberabberan syncline defined by Lower Ordovician rocks. Nearly all rocks in this zone are chloritised to varying degrees, and the lavas close to the quartz-diorite bodies are very rich in talc. Shearing and slight mineralisation occurs in the Cambrian rocks (andesites) against the contact with the Ordovician, and with talc schist along the western limb of the syncline.

The andesite complex is faulted against siltstones and greywackes to the NW and SW of Timbertops, and tapers to a thin wedge in sediments 2 miles SE of Pad 1. It appears to be wrapped around the syncline, but correlations in the SW area are not good enough to be certain.

Petrology

The rocks are described in order of apparent age, but it must be realised that there is very little evidence for the relative ages of the main types. Age relations have never been satisfactorily worked out for the Cambrian volcanics in other parts of Tasmania, and attempts at correlation seem pointless. While the earliest part of the sequence seems typically geosynclinal, the classical sequence for geosynclinal development i.e. spilite suite plus geocynclinal sediments, does not appear to have been followed. Ultrabasic intrusion, granite-granodiorite intrusion, andesites. Instead, the sequence appears to be: spilite suite and geosynclinal sediments, andesite suite, followed by dioritic bodies. Ultrabasics, if present must be post andesite and be deep-seated or further north.

The following descriptions are generally macroscopic, and an attempt is made to divide the rocks into groups easily recognised in the field. The most typical forms are described first, with brief mention of varieties.

Sedimentary Rocks

Laminated Siltstones and Argillites

The grey, laminated siltstones typical of the (?) Middle Cambrian rocks in the area have been described previously from Macquarie Harbour. The siltstones of the Timbertops area are generally very hard, induration increasing gradually from Birch Inlet to Timbertops.

South-west of Timbertops grey siltstones are fossiliferous, but contain no useful well-preserved fossils. Very hard, dark, banded siltstones, rich in pyrite, and black, sandy, pyritic siltstones also occur in the south-west area.

The laminated argillites are generally soft, pale yellow, grey or greenish. They are particularly subject to deformation, and bedding may be obliterated by cleavage as at the NE end of the track two miles SE of

Timbertops. West of the Timbertops Fault on the road to Pad 2. argillites are folded into vertically plunging structures.

Greywackes and Conglomerates

Graded greywacke and conglomerate occurs NW of the Timbertops Fault on the track two miles south-east of Timbertops and in the creek half a mile to the NW of that track. A fine greywacke from Timbertops yellow road contained large amounts of chlorite, serpentine and talc.

The greywackes NW of Timbertops Fault are dark grey and sandy, probably with chlorite cement, and resemble those interbedded with laminated siltstones in the creek, one mile E of Pad 1. Very hard conglomerates NW of the fault are light coloured and contain fragments of quartz, siltstones and chert.

The greywackes just NE of the Cambrian-Ordovician contacts on the track two miles south-east of Timbertops are yellow or reddish, soft and friable, and generally coarse-grained. Greywackes in the stream NW of this track are medium grained, greenish-grey with red (?) chert fragments. Cherty conglomerates also occur in this area. Massive grey or yellowish-white, opaque chert is closely associated with the keratophyres on the short track, one mile south-east of Timbertops, and on the cross-road immediately south-east of Pad 1. It generally occurs as boulders in the deep clay derived from the keratophyres, but has been found as interbedded outcrops. The chert is generally more massive than is usual in the Cambrian, most of the fractures being healed with crystalline quartz. The association with keratophyres is probably significant, and the chert may be a chemical deposit derived from silica emanating from lavas on the sea floor.

Igneous Rocks

Spilite Suite

Basalt (Spilite)

Altered Cambrian basalts are common in Camp Creek and on the west shore of Birch Inlet, several miles north of Camp. Pillow lavas may occur on the west shore of Birch Inlet.

A single small outcrop of (?) spilite occurs in the Timbertops area on the Cross-road south-east of Pad 1.

The spilite is very dark greenish-black, with abundant crystals of secondary epidote. The lavas in Birch Inlet have amygdales filled with calcite and pink (?) albite, while those at Noddy Creek have numerous patches of white calcite and (?) zeolite.

Keratophyre

A rock with idiomorphic feldspar phenocrysts and irregular masses of a ferromagnesian mineral (possibly epidote) set in a very fine, dark greenish-grey groundmass outcrops along the whole length of the short track one mile south-east of Timbertops. This rock is considered to be a lava belonging to the spilite suite, and resembles some members of the suite found at Noddy Creek.

A weathered, reddish rock with pale phenocrysts and vesicles is associated with the spilite on the cross-road south-east of Pad 1, and is probably related to the keratophyre described above. Similar specimens have been collected south-east of Pad 3, Noddy Creek.

Andesite Suite

Rocks belonging to this group include typical porphyritic andesite, highly and vesicular lavas as well as rocks which should technically be described as micro-diorites and diorites. However, these latter two are obviously minor variants within thick lava flows, and in view of this, and the problems connected with the origin of diorite magmas, they should be classed as part of the intermediate extrusive suite.

Typically the andesite is a light greenish-grey rock, weathering to almost white, with a groundmass too fine for individual grains to be visible, and scattered phenocrysts of plagioclase, or, less commonly, coloured silicates. Phenocrysts are several mm across and generally about 15mm apart. The rock is commonly hard and outcrops massively in some areas.

In the northern part of the area there are a number of outcrops of aphyric, banded andesite resembling very hard argillite, with thin irregular veins. These bands may mark the edges of flows which consist largely of vesicular, chloritised lava. Flow texture in minute plagioclase crystals is seen in thin section.

All gradations exist between the normal porphyritic andesite and varieties extremely rich in vesicles and phenocrysts. Rocks rich in amygdales 2-3 mm across and lined with quartz, calcite or zeolite commonly have a coarse-grained groundmass, often rich in feathery plagioclase crystals.

Non-porphyritic, fine-grained granular rocks with the composition of andesite often occur within bodies of normal andesite and grade into porphyritic and vesicular an andesite. On texture alone these rocks would be called microdiorites, see above.

Several isolated specimens of (?) basalt were collected from near the cross-roads at 33E, and possible gabbros were found at the south-west end of the area. These rocks appear to be related to the andesites rather than spilites, but their identification is doubtful.

Sheared Rocks

The major shear zone running through the Timbertops area affects a number of rock types, and in some cases, alteration is so great that the original affinities of the rocks involved can only be guessed.

Much of the material in the shear zones belonged originally to the andesite suite, the rather coarse-grained porphyritic and vesicular varieties being particularly susceptible to shearing and metamorphism, but the fine-grained material often being relatively unaffected. Typical rocks in the shear zone are medium-grained chlorite-talc-schists, dull green, soft and slippery. Weathering is generally deep, and feldspars which escaped alteration have been replaced by clay. Against the southern edges of the two quartz-diorite bodies alteration is extreme, and large lenses and pods of talc make up as much as 60% of the rocks. These rocks are apparently derived from andesite, bands of which are preserved in the shear zone.

East of the cross-roads at 33E a body of massive hornblende-diorite has been partly altered to chlorite-talc-schist in the shear zone, and much of the sheared material to the east of this appears to be derived from the diorite rather than andesite.

Chloritised and talcose andesite is again dominant near the cliffs east of Pad 1.

Near the Timbertops Fault (at 7W) highly vesicular, chloritised andesite grades into a coarse "chlorite-porphyry" containing radiating pseudomorphs of chlorite after (?) enstatite. The origin of this rock, which also occurs against the ultrabasics at Pad 2, is problematical, but it is certainly closely associated with the lava.

Talc-schist derived from sheared andesite commonly occurs just below the contact with Ordovician rocks, particularly along the SW limb of the syncline. In the SW part of the Timbertops area sheared "spotted lava" - a fairly fine-grained rock with abundant white plagioclase phenocrysts wrapped by a schistose chloritic matrix - is common, and grades into talc schist in some cases.

Intrusive Rocks

Diorites and more acid rocks form rounded bodies (?) intruding the andesites of Timbertops. The most acid material is porphyritic microgranite, which occurs to the SW of a diorite body in the nose of the syncline, and may be part of the diorite body. The microgranite contains 50% orthoclase and very little ferromagnesia - chlorite replacing (?) biotite.

The diorites vary from rather basic varieties containing augite, to tonalite and quartz-diorite containing 20% quartz. Ferromagnesians are unusually low, reaching a maximum of about 25% in the hornblende diorite at 34E. This rock is fairly distinct in appearance, being rather coarse-grained with very thin crystals of brown hornblende up to half an inch long. Further east, material belonging to the same body is even-grained and granular.

The quartz-diorite forming three lobes which outcrop very strongly as three small hills to the north and east of Timbertops is even-grained, medium and deficient in ferromagnesians (not more than 10% biotite and amphibole), hence it is pale coloured and appears acid rather than intermediate. However, the plagioclase is andesine, and there is no alkali feldspar.

Age Relations

As stated above, there is little evidence for the proposed sequence either in the Timbertops area or elsewhere in Tasmania.

The spilites are restricted areally, but seem to be fairly closely associated with geosynclinal siltstones and greywackes, and in some cases the greywackes may be derived from spilitic volcanic material. However, the keratophyres can only be shown to be interbedded with cherts, not with the normal sediments - if (at least) there is no repeated alteration of rock types.

The andesites show very little relationship with the sediments, although the evidence that they are extrusive is indisputable. At least four flows are suggested, possibly more on the evidence of chilled horizons.

Shearing occurred after the extrusion of the andesites, and was accompanied by the introduction of large quantities of chlorite and talc. It is tempting to suggest that the large quantities of magnesium required for this alteration could only be supplied by an ultrabasic intrusion. The association of ultrabasic and intermediate volcanics is seen in the Noddy Creek area to the north. Also the occurrence of vesicular lavas altered to talc schist near Pad 2, and the peculiar "chlorite-porphyry" in the same area suggest that the ultrabasic intrusions may favour the volcanic belts - for reasons which may be structural or petrological.

Magnesium for metasomatism of the sheared belt may be derived from the ultrabasics either in the Noddy Creek Belt or somewhere beneath the Timbertops shear zone. In either case the evidence points to the ultrabasics being post-andesite suite.

Another probability is that the alteration of the andesite is a contact effect with the quartz-diorites.

Certainly talc is most concentrated near these bodies, but it is difficult to see how a magma so low in mafic material could produce magnesium metasomatism.

The whole question of the diorite bodies is difficult. Since the hornblende diorite east of 33E is apparently sheared and chloritised, at least this intrusion should be pre-shearing, but field relations are not al all clear in the area around Pad.1. The quartz-diorites are quite remarkable for their lack of alteration, but this might be due simply to the lack of coloured silicates available to be chloritised. Only further exposure will show whether the chloritised rocks wrap around the quartz-diorites, but if so, this would then place the diorites pre-shearing, and hence possibly pre-ultrabasics.

All these events are presumed to have occurred before the deposition of the Lower Ordovician sandstones, and the Cambrian complex has probably been folded with the sandstones during the Devonian.

NODDY CREEK AREA

Summary

Cambrian sedimentary and igneous rocks in the Noddy Creek area, in the northern part of the Hibbs Belt, are faulted against Precambrian rocks along their western margin. The Cambrian sedimentary rocks are dominantly finely laminated siltstones with minor bands of quartzitic siltstone, greywacke and conglomerate, and are cut by two belts of ultrabasic rocks. A considerable amount of shearing has occurred along the contacts of the ultrabasic rocks. East of the eastern ultrabasic belt is an area of basic to intermediate volcanics. East of the volcanics is a further area of Cambrian greywacke, argillite and minor conglomerate.

Asbestos occurs in both ultrabasic belts but is more common and better developed in the eastern belt. It occurs in two zones, over at least 7,000 feet, following the strike of the ultrabasics. Minor fibrous magnetite, stichtite, chromite and pentlandite occurs in the serpentinite, and traces of galena, sphalerite and pyrite have been found in the gabbro of the eastern ultrabasic belt which has a prominent e.m. anomaly along its western margin. Traces of chalcopyrite and pyrite were located in the volcanics.

Introduction

Location:

The Noddy Creek Area lies about six miles northwest of Birch Inlet camp and is shown on four 1" = 400' geological maps, (Figs. 14,15,16 and 17).

Topography:

The Noddy Creek Area lies about 700 feet above sea level and is gently undulating with a number of deeply incised streams.

Vegetation:

Myrtle and sassafras forest with patches of horizontal scrub generally covers the Cambrian sediments, while scattered eucalypts with a dense undergrowth of bauera, manuka (ti-tree) and cutting grass cover the ultrabasics.

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Field Work

Field mapping was done intermittently at Noddy Creek from February to April 1967 as new bulldozed tracks opened the area. Three bulldozed costeans across an e.m. anomaly were channel sampled at ten foot intervals and assayed. Any mineralized rocks were also assayed. Geochemical stream sediments were collected from most of the creeks draining the area.

From January to March 1968 field mapping continued as new tracks were cleared. The tracks in the vicinity of the e.m. anomaly were mapped in detail and surveyed by theodolite, and the economic potential of the area was assessed by geochemical soil sampling and detailed geophysical work using magnetic, e.m. and s.p. methods. The three costeans across the e.m. anomaly were re-sampled at one foot intervals. The above work resulted in the drilling of a diamond drill hole (Noddy Creek DDH 1) through the peak of the e.m. anomaly. The fibre in eight asbestos costeans was measured and the asbestos percentage calculated. Asbestos exploration is at present continuing northwards and southwards from Noddy Creek, but the best possibilities appear to be to the north. The following bulldozing has been completed at Noddy Creek:

Year	Date	Line Miles	Costeans
1967	Feb. to April	12	3
1968	Jan. to April	6	14
	Totals=	18	17

THE ULTRABASIC BELT

Introduction

A belt of ultrabasic rocks extends in a NNE direction through the Noddy Creek area, and consists of pyroxenite, gabbro, serpentinite and minor granodiorite. The ultrabasics are flanked by Cambrian siltstone to the west and by Cambrian greywacke, siltstone and andesitic volcanics to the east.

Ultrabasics

The ultrabasic belt is up to 1,000 feet across and extends for at least 8,000 feet NNE of Helipad 3, and for at least 4,000 feet SSW of Helipad 3. The rock types present include banded pyroxenite, gabbro, serpentinite and minor granodiorite. Serpentinite is dominant to the north and gabbro to the south.

The pyroxenite is best developed between 1,000 feet and

2,000 feet SSW of Helipad 3. It is coarse grained, equigranular and dark green in colour, and forms massive partly rounded out-crops which weather to a buff colour. It is usually partly serpentinized and often well banded. The bands are from one to six inches thick, and consist of alternating coarse grained and fine grained partly serpentinized pyroxenite. Bronzite crystals are clearly defined in the unaltered pyroxenite, but are largely masked in the serpentinized bands.

Eight hundred feet south west of Helipad 3 the banding strikes N 20° W and is vertical, and sixteen hundred feet SSW of Helipad 3 it strikes N 30° E and dips 70° SE.

The gabbro is best developed in the area SSW of Helipad 3 where it is up to 1,000 feet across. It extends northwards as a thin band about a hundred feet wide along the eastern margin of the ultrabasic belt. Two bands of gabbro, each 100 feet wide are interbedded with the pyroxenite 500 feet west of Helipad 3, and extend to the SSE parallel to the banding in the pyroxenite.

The gabbro is medium to coarse grained, equigranular and mottled green and white, and has small concentrations of coarse grained pyroxene. It is cut by thin, reticulating, milky quartz veins, and patches of quartz one inch across. It forms massive rounded outcrops which weather to pale green and white.

Small blebs of sphalerite, galena and pyrite occur in the gabbro at Helipad 3 and are described below.

Three small areas of granodoirite, one at least 100 feet wide, occur between 2,000 feet and 3,000 feet SSW of Helipad 3 within the gabbro. The granodiorite is fine to medium grained, equigranular, and light green grey in colour. It occurs as irregular jointed boulders which weather to a buff colour, and differ from the gabbro by being finer grained and containing abundant quartz.

Serpentinite is well developed northwards from Helipad 3 for at least 8,000 feet. It occurs as both a highly sheared, flakey to conchoidal, medium blue green variety and a more massive granular apple green variety. The highly sheared serpentinite contains irregular boulders up to ten feet across of only partly sheared serpentinite. The dominant direction of shearing is N 20° E parallel to the elongation of the ultrabasic belt.

Asbestos, magnetite, pentlandite, stichtite and chromite occur in the serpentinite and are described below.

Shearing has occurred along both margins of the ultrabasic belt. In Costean 1 600 feet west of Helipad 3, banded dark blue green silicified serpentinite is separated from crushed black graphitic shale by three feet of black fault gouge. Eighteen feet west of the gouge zone is a block of gabbro 35 feet across with thin bands of graphitic shale and scattered small pyrite cubes. West of the gabbro is dark to light grey laminated siltstone. The gabbro appears to be isolated block which was torn off the main ultrabasic belt when movement occurred along its margin.

The western contact is again exposed in Costean 3, 800 feet north of Helipad 3. At the contact highly sheared, flakey serpentinite is separated from grey siltstone by seven feet of ochreous clay derived from decomposed crushed serpentinite.

Along the eastern contact of the ultrabasics is a zone one hundred to two hundred feet wide of highly sheared material consisting of rusty quartzose serpentinite, talc, chlorite, pyrite, schist, graphite, siltstone and greywacke. Nineteen hundred feet SSW of Helipad 3, a lens of brick red siltstone 800 feet long and two hundred feet across occurs west of the highly sheared zone. A baked contact, represented by a fine grained, dull medium green hornfelsic rock, occurs east of the gabbro along the eastern contact of the ultrabasics.

SEDIMENTS

Siltstone

The siltstone is dominantly medium grey in colour but ranges from pale grey to black; minor green, blue grey and yellow-brown varieties also occur. The siltstone is finely laminated, and contains thin greywacke bands and discontinuous horizons of pyritic graphitic shales. The regional strike is N 20° E and the dips are essentially vertical. The siltstones are about 3,400 feet thick on the western side of the ultrabasic belt.

They are also exposed 2,200 feet SSE of Helipad 3, between greywacke on the west and volcanics on the east. The western contact is conformable, but the eastern contact is faulted and associated with numerous quartz veins. These siltstones are about 500 feet thick and are locally folded into small minor structures.

Greywacke

The greywacke varies from coarse to medium grained and contains numerous thin bands of conglomerate. It is composed of angular, milky quartz fragments, rounded elongate pebbles of sandstone, and fragments of siltstone varying from tiny flakes to large lumps up to six inches across. Thin bands of siltstone occur in the greywacke. The regional strike is N 20° E and the dips are essentially vertical.

2,000 feet south of Helipad 3, 1,100 feet of greywacke occurs between the ultrabasic belt to the west, and siltstone to the east. The western contact is faulted and the eastern one conformable.

300 feet east of Helipad 3, the greywacke is 700 feet wide, but thins considerably to the north and is only 100 feet wide 2,000 feet NE of Helipad 3. At this locality the greywacke is faulted against gabbro to the east. East of the gabbro is a baked contact rock and then further greywacke which is faulted against volcanics to the east.

VOLCANICS

Volcanic rocks occur east of the ultrabasics in a belt extending from Timbertops to just east of Asbestos Point. SE of Helipad 3 they are faulted against greywacke and siltstone to the west, but to the northeast the volcanics are conformable with greywacke. Immediately east of Helipad 3, the volcanics are about 6,000 feet wide and their eastern contact is also faulted against greywacke and argillite.

Lavas

The lavas are mainly of andesitic composition with minor basaltic varieties.

Two distinct types are dominant. The first and most common is a porphyritic rock with feldspar and chloritized ferromagnesian phenocrysts in a dominantly purple groundmass. Many of the porphyritic rocks are mottled red, purple and green, and are possibly keratophyres. The second type is fine grained and ranges in colour from dark green-black to pale grey-green. These two types occur together throughout the volcanics, with the pophyritic variety dominating in the east.

The volcanics have undergone alteration resulting in the introduction of chlorite, calcite, epidote and minor pyrite and chalcopyrite mineralization.

Pyroclastics

Both tuffs and agglomerates are present in the volcanics. Two distinct varieties of tuff occur. The dominant variety is a hard, pale green rock which contains common visible quartz and is not bedded. It occurs as a large mass 3,000 feet north-east of Helipad 3. The second variety, which is rare, occurs as thin bands with agglomerate. This tuff is bedded, weathers to a yellow colour and contains chlorite.

The agglomerate occurs throughout the volcanic belt and is best developed southwards from 6,000 feet SSE of Helipad 3. The agglomerate is generally a pale, mottled pink and green rock, the texture being determined by the size of the angular fragments, which range from an eighth of an inch up to six inches across.

ECONOMIC GEOLOGY

1. Asbestos

Asbestos is well developed in the eastern ultrabasic belt and runs parallel to its elongation for about 7,000 feet from 5,000 feet north of Helipad 3 to 2,000 feet south of Helipad 3. Limes have recently been cleared across the ultrabasic belt at 6,000, 7,000, 8,000 and 10,000 feet north of Helipad 3, and 3,000, 4,000, 5,000 and 7,000 feet to the south, but have revealed no asbestos.

North of Helipad 3 two zones of asbestos have been exposed (i.e. the eastern zone and the western zone). South of Helipad 3 only the western zone is present and is currently being investigated.

Eight costeans have been cut across the asbestos, seven across the western zone and one across the eastern zone. Results of the examination of these costeans is summarized as follows:

<u>WESTERN ZONE</u>

Costean No.	Thickness of Zone	Thickness of Asbestos	% of Asbestos	Max. fibre length of Asbestos	Ave. fibre length of Asbestos
Asb 50 N_W	97'	0.2'	0.2	1/4"	1/8"
Asb 40 N_W	12'	0.7'	5.8	3/4"	3/16"
Asb 30 N_W	93'	3.61'	3.9	3/4"	1/4"
Asb 20 N_W	12'	0.3'	2.5	3/8"	3/16"
Asb 10N_W	5.7'	0.17'	3.0	1/2"	3/16"
Asb 10 E_W	21'	1.23'	5.85	1/2"	5/16"
Asb 20 S_W	16'	0.53'	3.3	1/16"	1/16"
Average	36.7'	0.96	2.6	7/16"	3/16"

<u>EASTERN ZONE</u>

Asb 40 N_E	71'	1.32'	1.9	1/2"	1/8"

No costean could be cut on the o line (i.e. immediately west of Helipad 3) due to the swampy mature of the ground. Asbestos is known to occur here.

The western zone of asbestos is known to occur over a length of 6,600 feet and if the asbestos continues to a depth of 300 feet in the same quantity as that exposed at the surface. The following tonnage is estimated to occur:

Volume = 6600 x 300 x 0.96 (from table)
= 1,900,000 cubic feet
Assume tonnage factor of 15 cu ft/ton
= 127,000 tons of asbestos

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The grade is 2.6% therefore tonnage of the western zone = 4,890,000 tons of ore.

Only one costean has been cut across the eastern zone which is known to extend for at least 3,800 feet. By halving the asbestos thickness in the costean which is considered slightly higher than average and calculating as above, 69,000 tons of asbestos occurs in the eastern zone. The grade is 1.9% therefore 3,630,000 tons of ore is present in the eastern zone. Therefore total asbestos reserves would be:

Tons of asbestos	=	196,000 tons
Average grade	=	2.3%
Tons of ore	=	8,520,000 tons

Providing that the asbestos grade and tonnage is comparable to the surface in depth the above estimates are considered conservative, since the bulldozer tends to destroy the asbestos fibre and remove high grade boulders from the costean, leaving behind highly sheared serpentinite in which the cross fibre asbestos has been destroyed by shearing. A good example of this is at Asb 20 N_W where the asbestos has been measured in the costean and along the track beside the costean.

	Thickness of zone	Thickness of asbestos	% of asbestos	Max. fibre length of asbestos	Ave. fibre length of asbestos
Costean	12'	0.3'	2.5	3/8"	3/16"
Track	30'	0.8'	2.56	3/8"	3/16"

As can be seen the amount of asbestos in the costean is only 40% of that occurring on the track.

The cross fibre asbestos occurs in massive or slightly sheared blue green serpentinite. Any more than slight shearing destroys the cross fibre asbestos leaving the flattened slip fibre asbestos in the shear planes.

The main development of asbestos occurs northwards from Costean Asb 20 N_W. Hear the serpentinite has been slightly sheared, but the asbestos is still of high quality, and silky fibre occurs up to one and a half inches wide. In Costean 20 N_W asbestos veins occur in massive hard serpentinite. The quality is excellent but is no better than the asbestos occurring in the slightly sheared serpentinite.

2. E.M. ANOMALY

In 1967 an e.m. anomaly was discovered along the western margin of the ultrabasic belt. This anomaly stretched from 2,000 feet south of Helipad 3 to 1,000 feet north of Helipad 3. It was also detected in a track crossing the contact at 3,000 feet north of Helipad 3. The peak occurred on the 0 line 600 feet west of Helipad 3.

Three costeans were cut across the contact at 0, 2,000 S and 1,000 N, and were respectively numbered costeans 1, 2 and 3. These costeans were channel sampled at ten feet intervals and the samples sent for spectrographic analyses. Results are shown below:

Costean 1

60W – 40W	40W – 30W	30W – 10W	10W – 0	0 – 20E	20E
Laminated Siltstone	Baked Sediment	Gabbro Block	Baked Sediment	Graphitic Pyritic Shale	Silicified Serpentinite Contact

Cu	100	120	50	80	100	100	100	70	
Pb	15	12	10	7	6	7	50	30	
Zn	80	120	40	50	70	40	70	100	
Ni	200	250	300	120	300	70	100	400	
Cr	300	300	400	400	600	250	300	300	
Co	70	100	60	50	80	40	60	100	

All the above values are shown in parts per million (ppm).

Costean 2.

0 – 10E	10E – 20E	20E – 30E
Laminated Siltstone ē Fe Staining	Graphite Shale ē Pyrite	Crushed Serpentinite ē Sulphides.

Morenosite ($NiSO_4.7H_2O$) deposited at contact.

ppm Cu	100	70	30
ppm Pb	8	40	5

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ppm Zn	80	60	70
ppm Ni	100	150	600
ppm Cr	250	300	500
ppm Co	20	30	120

Costean 3

10W 0 10E 20E 30E 40E1

Laminated siltstones with graphitic bands containing minor pyrite.

ppm Cu	100	70	70	100	80
ppm Pb	50	50	15	12	40
ppm Zn	30	20	50	60	30
ppm Ni	50	150	200	250	150
ppm Cr	200	300	250	250	300
ppm Co	3	3	15	30	60

In 1968 the three costeans were re-sampled at one foot intervals and the samples sent for semi quantitative analyses. The results are still awaited. This action was promted by the discovery of morenosite ($NiSo_4.7H_2O$) in Costean 2. It occurred as a thin coating at the sheared contact of serpentinite and pyritic graphitic shale. Dana states that morenosite is caused by the oxidation of NiS e.g. pentlandite. However, the $NiSo_4$ may have been deposited by a process whereby the pyrite in the shale was oxidized to $FeSO_4$, and this was carried in acid waters through the serpentinite, where nickel was collected and deposited as a fine coating of $NiSO_4$.

Detailed geophysical traverses were run across the e.m. anomaly at 200 feet intervals between 1,000 feet north of Helipad 3 and 400 feet south of Helipad 3. Two peaks were found to exist; one on the 0 line, and the other at 700 feet north. The latter was the highest and a diamond drill hole (Noddy Creek DDH 1) was sunk to intersect this anomaly at approximately 150 feet below the surface. It was abandoned at 299 feet without obvious economic mineralization being detected. A brief log is shown as follows:

Noddy Creek DDH 1

Serpentinized pyroxenite	0 to 153 feet
Cavity	153 to 156 "
Grey quartz	156 to 160 "
Siliceous serpentinite	160 to 167 "
Graphite	167 to 180 "
Laminated siltstone	180 to 278 "
Crushed green serpentinite	278 to 292 "
Laminated siltstone	292 to 299 "

The graphite and laminated siltstone contained numerous veins of pyrite up to an eighth of an inch wide. Pyrite was also present in cleavage planes of the siltstone as radiating blebs up to a quarter of an inch in diameter. The graphite and pyrite is in sufficient quantity to account for the e.m. anomaly and led to the abandoning of the hole. No further holes will be drilled through the e.m. anomaly unless assays of the drill core reveal economic mineralization not visible to the eye.

3. OTHER MINERALIZATION

Pentlandite $(Fe\ Ni)_9S_8$) occurs at two localities in dark olive green slightly sheared serpentinite. At the first locality 2,000 feet north of Helipad 3 the pentlandite occurs as round blebs up to an eighth of an inch across disseminated regularly throughout the serpentinite. Three samples of this pentlandite bearing rock were sent for semi quantitative analyses and contained 1,200 ppm Ni, 1,000 ppm Ni, and 400 ppm Ni respectively. The second locality is on strike with the first and 1,000 feet north of Helipad 3. The pentlandite occurs as rare tiny specks.

Galena and sphalerite occur as small blebs in the gabbro at Helipad 3. The galena also occurs as small patches up to half an inch across and occasionally as veins up to one tenth of an inch wide. Four samples of galena and sphalerite in gabbro were sent for semi quantitative analyses and contained 1,200 ppm Pb and 400 ppm Zn; 100 - 1,000 ppm Pb and 1,000 - 10,000 ppm Zn; 1,000 - 10,000 ppm Pb and 1,000 - 10,000 ppm Zn; and 100 - 1,000 ppm Pb and 100 - 1,000 ppm Zn respectively. This averages out at about 0.1% Pb and 0.1% Zn.

Minor chalcopyrite has been found in the volcanics at two localities. The first is 1,600 feet east of Helipad 3 and is associated with quartz veins in agglomerate. Three samples were sent for semi quantitative analyses and contained 100 - 1,000 ppm Cu, 100 - 1000 ppm Cu and 10 - 100 ppm Cu respectively. The second locality is 3,700 feet south-east of Helipad 3 and occurs in altered basalt with abundant calcite. It contains 1,000 - 10,000 ppm Cu i.e. 0.1% to 1% Cu.

Fibrous magnetite is common throughout the entire ultrabasic belt and has probably been weathered to form the thin limonitic crust. It is of no economic significance.

Stichtite ($MgCO_3$ $5Mg(OH)_2$ $2Cr(OH)_3$ $2H_2O$) is common and in sheared serpentinite as disseminated blebs from Helipad 3 northwards, and as massive sheets 4,000 feet south of Helipad 3.

GEOCHEMICAL SOIL SURVEY, NODDY CREEK AREA (SEE FIG.18A,B,C,D)

A geochemical soil survey was carried out along bulldozed tracks in the Noddy Creek area in order to examine more closely and to determine the cause of four electromagnetic anomalies which were considered to be (Taylor and Pollard, 1967) possibly significant in terms of sulphide mineralization.

The samples were usually collected at 100 feet intervals except in the immediate vicinity of the e.m. anomalies where the sampling interval was reduced to 50 feet. The soil cover in the Noddy Creek area is usually thin (less than 5 feet) but a complete soil profile is present particularly in areas underlain by siltstone. The ultrabasics tend to be nearer the surface and a complete soil profile is often absent in these areas. Most of the samples were taken from the B or C horizon and were corrected with a hand operated 2 inch diameter auger from depths between 6 and 24 inches.

The e.m. anomalies are roughly parallel to the regional strike and in the northern costean in the Pad 3 area graphite smears were noticed along bedding planes in the siltstone. The graphite probably has some quantitative effect on the e.m. anomalies.

THE GEOLOGY OF THE MAINWARING BELT

by

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MELBOURNE 1968

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THE MAINWARING BELT (SEE FIG.19)

Introduction

Location

The Mainwaring Belt is an area of Cambrian rocks 80 square miles in extent, on the southern portion of the west coast of Tasmania. The northern boundary is taken at an east-west line drawn through the south-east corner of Endeavour Bay, near Pt. Hibbs, and the western boundary is taken along the coastline to just south of Sassafras Creek, near Low Rocky Point. See map. The eastern boundary is taken at the western limit of the Tertiary and Pleistocene gravels, the Owen Conglomerate, and the Lewis River Volcanics, and joins the western boundary at Sassafras Creek.

The belt includes the lower reaches of the Wanderer and Mainwaring Rivers, the Urquhart River, and Cypress, South Cypress, Abo and Copper Creeks, and these provide the only relatively easy access into the area.

Topography

The area is an average of 300 to 600 feet above sea level, and is part of the Henty Surface which slopes gently westward. It is covered by trellised drainage pattern. The main streams flow west across the strike of the underlying rocks, while the tributaries flow north and south along the strike. Both sets of streams are deeply incised for most of their length.

Vegetation

Where the streams are deeply incised, the area is clothed with thick myrtle and sassafras forest with thick horizontal scrub along the sides of the streams. The more poorly drained areas are covered by thick bauera and ti-tree scrub with scattered eucalypts.

Climate

The area is in the zone of strong westerly influence, and receives an annual rainfall of between 60 and 70 inches.

Field Work, Results, and Recommendations

A brief reconnaissance of the coastal section of the Mainwaring Belt was first made during the 1965-66 field season, but did little more than establish the presence of Cambrian rocks.

During the latter part of the 1966-67 field season geological and stream sediment sampling traverses were carried out along the Wanderer. Urquhart and Mainwaring Rivers, and Cypress and Copper Creeks. Stream samples were also collected from South Cypress and Abo Creeks.

This work led to the discovery of an area of anomalous copper and zinc values between the Urquhart and Mainwaring Rivers.

During the 1967-68 field season further mapping and sampling were carried out in Copper Creek and Upper reaches of the Urquhart River. Samples were also collected from all the unexamined coastal streams between the Urquhart River and Copper Creek, and closely spaced bank and stream sediment samples were collected from Cypress and South Cypress Creeks, and the southern tributaries of the middle Urquhart River.

More detailed geological traverses were made along South Cypress Creek and the Mainwaring River, and the coastline between the Mainwaring River and Sassafras Creek was closely examined.

To date 219 reconnaissance stream sediment samples, 147 closely spaced stream sediment samples, and 291 closely spaced bank samples collected from the area have been assayed for copper, zinc and nickel. This sampling has continued to indicate that the drainage area between the Urquhart and Mainwaring Rivers carry anomalous concentrations of copper, zinc and nickel. The maximum values of the reconnaissance samples are 192 ppm Cu, 120 ppm Zn, and 136 ppm Ni. In the closely spaced samples the maximum values were 252 ppm Cu, 165 ppm Zn and 215 ppm Ni for the stream sediments, and 1875 ppm Cu, 250 ppm Zn and 810 ppm Ni for the bank sediments.

The area from which the high metal values are derived is underlain by thick andesitic and basaltic tuffs, locally agglomeratic and with minor interbedded sediments and small dioritic and gabbroic intrusions. These rocks contain common chlorite and epidote, and appear to have been hydrothermally altered, and are highly sheared,

A zone of highly sheared and hydrothermally altered rocks, on strike with those in the Mainwaring River is exposed on the coast between Abo and Sassafras Creeks. It seems highly probable that this zone continues north to the Urquhart River.

This zone of dynamic metamorphism and hydrothermal alteration is comparable, both tectonically and lithologically, with the copper mineralised schists at Mt. Lyell, and may be the source of the high copper values in the stream sediments.

A series of first class aero e.m. anomalies lies on the probable continuation of this zone north of Mainwaring River, and are obvious targets for closer investigation.

Indications of mineralisation in the area are:

Chalcopyrite in sheared, chloritic, epidote stained conglomerate at the mouth of Copper Creek.

Smears of native copper in sheared tuff in the middle Mainwaring River.

Chalcopyrite in greywacke near the mouth of Cypress Creek.

Copper staining in tuff in the middle Urquhart River.

Pyrite in tuff in South Cypress Creek.

Concentrations of 0.19% and 0.14% copper in bank sediment samples from Cypress Creek.

The area of the e.m. anomalies appears from aerial examination to be poorly drained, and covered by peat and thick scrub. The most practical means of opening it up would be to bring bulldozers in from the east across the area of Owen Conglomerate and commence line clearing once the Cambrian rocks are reached.

For easy access once initial work has begun, landing areas should be cleared for a helicopter, and a camp established similar to that operated at Noddy Creek during the 1967-68 field season. Land transport of heavy items such as fuel could be brought by Nodwell from the head of Birch Inlet. This journey would probably take a full day. However, it may be advantageous to consider utilising a larger helicopter such as a Hiller 1100, which can carry approximately 1,000lbs, and could undertake a return flight to Birch Inlet in just under one hour.

In conclusion it is strongly recommended that the area of first class e.m. anomalies, coincident with a zone of alteration and shearing causing high metal values in the stream sediments between the Urquhart and Mainwaring Rivers, be opened up for soil sampling and ground e.m. and s.p. traverses. Initial access to the area should be commenced as early as possible in the forthcoming field season, to enable full advantage to be taken of the drier summer period and long daylight hours.

THE GEOLOGY OF THE MAINWARING BELT (FIG.19)

Introduction

Lower and Middle Cambrian rocks consisting of rhyolitic volcanics intruded by granite, argillite and basaltic to andesitic tuffs intruded by gabbro and diorite, and geosynclinal greywacke and argillite correspond to the Lewis River Volcanics, and Mainwaring and Dundas Groups.

These rocks have a dominant north-south strike, and those of the Mainwaring Group have been strongly sheared and hydrothermally altered.

Shearing occurred after the emplacement of the granite bodies and prior to the deposition of the Owen Conglomerate. It is therefore most likely to have occurred during the Uppermost Cambrian.

Folding occurred during the late Devonian (Tabberabberan) Orogeny, and implanted a strong axial plane cleavage on the finer grained rocks of the Dundas Group.

A similar tectonic history has been inferred for the Mt. Lyell area, where rocks within and adjacent to large zones of sheared tuffaceous rocks are hydrothermally altered and strongly mineralised with copper

Stratigraphy

Lewis River Volcanics and associated intrusives

The Lewis River Volcanics occur in the area south and west of the Mt. Osmund Syncline. They are well exposed in the head of the Mainwaring River and Copper Creek, along the Hudson and Lewis Rivers, and on the northern coastline of Elliott Bay. In the remainder of the area they form a very subdued topography with abundant quartz float.

The volcanics are at least 10,000 feet thick, and are pale pink and green-grey fine grained rocks with abundant feldspar and glassy quartz phenocrysts. The original flow banding is locally visible, but is usually obliterated by a very strong shearing striking northeast.

They have a rhyolitic and dacitic composition, and were probably ignimbrites.

A number of bands of dark green, chloritic tuff up to 100 feet thick are interbedded with the igneous rocks, but connot be traced far.

The volcanics are conformably overlain by argillites of the Mainwaring Group at Copper Creek. North of Copper Creek a zone of intensely sheared, chloritic tuff separates the volcanics and argillite.

The Owen Conglomerate of the Mt. Osmund Syncline unconformably overlies the volcanics which occur as fragments only in the lowermost portion of the conglomerate.

At Low Rocky Point and the northeast corner of Elliott Bay the volcanics are intruded by small bodies of biotite granite. The Low Rocky Point Granite has a fine grained, white coloured western portion, and a coarse grained, pink coloured eastern portion. Both granite bodies have schistose margins.

The volcanics are also intruded by schistose quartz-feldspar porphyry along their eastern margin, and just south of the Lewis River. To the east the porphyry is faulted against Precambrian rocks.

The granite has been dated as Uppermost Cambrian, and been partly deformed by the same shearing as the volcanics.

Mainwaring Group

Rocks of the Mainwaring Group occur west of the Lewis River Volcanics. They are exposed at the entrance to the gorge of the lower Wanderer River, in the middle and upper reaches of the Urquhart River, in the Mainwaring River, and Cypress, South Cypress, Abo and Copper Creeks. They are also excellently exposed along the coast between Abo and Sassafras Creeks.

The lower portion of the Mainwaring Group consists of black and green-grey argillite which is strongly phyllitic in the south, and grades into a greywacke-argillite sequence north of the Urquhart River. At Copper Creek the argillite contains a band of greywacke conglomerate.

In the upper Urquhart River the argillite is cut by chloritised, mottled green-grey diorite and gabbro bodies, and contains a number of andesite ?sills.

The argillite is 4,000 feet thick at Copper Creek 2,000 feet thick in the Mainwaring River where its top is faulted out, and approximately 10,000 feet thick in the upper Urquhart River.

The upper portion of the Mainwaring Group consists dominantly of thick basaltic to andesitic tuffs. These are commonly green-grey rocks, and often schistose, and vary from very finely laminated, fine grained tuff to a mottled breccia of basalt fragments in a schistose, chloritic matrix.

The tuffs also contain bands of highly sheared, phyllitic, purple, green, maroon and buff conglomerate in which the pebbles are often completely flattened. The pebbles are dominantly derived from Cambrian rocks.

At a number of places in the Mainwaring River and at Diorite Point the tuffs are cut by small, sill-like bodies of mottled green, chloritic gabbro and diorite.

The tuffs vary in thickness from 4,000 feet near the mouth of Copper Creek, to 12,500 feet in the Mainwaring River and 5,000 feet in the Urquhart River. They rest conformably on the underlying argillite, and are conformably overlain by rocks correlated with the Dundas Group.

Dundas Group

Rocks correlated with Dundas Group extend along the west coast north from the mouth of Abo Creek, and are well exposed in the lower Mainwaring, Urquhart and

Wanderer Rivers, and Cypress and South Cypress Creeks.

They are up to 17,000 feet thick at the Wanderer River, and consist of thick sequences of greywacke interbedded with thick sequences of argillite. The greywackes are medium grey to brown, and commonly gritty, and are both massive and graded bedded with very thin argillite bands. They are commonly cut by thin quartz veins and often have a strong cleavage. The argillites are green-grey to black, finely laminated, and have a strong axial plane cleavage.

Structure

The rocks of the Mainwaring Belt have a dominant north-south strike and are vertical or dip steeply west. They are cut by small northeast and north-west striking faults, and a number of large north-south striking, vertical shear zones.

The shear zones are largely developed within and at the base of the Mainwaring Group, and can best be described as zones of intense dynamic metamorphism. The rocks within these zones are extremely sheared and partly hydrothermally altered, and contain abundant chlorite and epidote. They strongly resemble the Lyell and Rosebery Schists, which lie adjacent to large, metasomatic ore bodies.

A large syncline is exposed in Dundas Group rocks along the west coast. The continuation of the syncline north of the Urquhart River is uncertain, but it may cross the Wanderer River about two miles upstream.

GEOCHEMICAL FIELD WORK (SEE FIG.20A,B,C)

Introduction

A total of 66 man days were spent in the area during the 1967-68 field season, of which 40 were spent mapping and sampling at a reconnaissance level, and 26 were spent in detailed sampling.

The majority of the work was carried out between the Mainwaring River and Urquhart River as the previous season's work had indicated anomalous areas of Cu, Zn, and Ni in Cypress and South Cypress Creeks, in the Upper Urquhart and in some tributaries of the Mainwaring River. To completely surround the anomalous area, reconnaissance samples were taken from 65 sites in all the coastal streams, and the upper reaches of the Urquhart River (which was also geologically mapped). In an attempt to locate the probable source of these anomalous values, detailed samples were taken from 145 sites in Cypress and South Cypress Creeks and the two southern tributaries in the Upper Urquhart River (see maps).

The two branches of Copper Creek were also re-sampled and re-mapped because of the discovery of two anomalous localities during the previous season's work.

Reconnaissance samples were collected at the usual quarter mile interval, taking two samples from each site and forwarding the -80 mesh fraction of one for Cu, Zn and Ni assay - except in the coastal streams, where only one sample was collected from each site. In the Upper Urquhart River the sample interval was reduced to 500 feet.

The detailed sampling was done at between 75 and 100 feet intervals, taking two stream sediment samples, and a sample from both banks, at each site. The -80 mesh fraction of both bank samples and one stream sediment sample was forwarded for Cu, Zn and Ni analysis. See report - Geochemical methods used in S.W. Tasmania. McIntyre - Bumstead 1966-68.

Only those samples taken from the Upper Urquhart River and Copper Creek were marked in the field by the use of red tape. Sample locations were marked on the 1" to 2,000 feet aerial photographs and later transferred to field sheets on the same scale. The final compilation of results is shown on 1" to 1 mile maps.

The season's sample numbers, their location and assay results are tabulated below, together with the previous season's results, to give a complete record of the area.

Results of Analyses

The reconnaissance results were combined with the previous season's results, and visual inspection of the whole led to the following divisions of the assay results into background, threshold and anomalous. (For the sake of consistency with previous work the subdivisions of 1st, 2nd and 3rd order anomalies have been retained).

Copper (Total Range 0 - 252 ppm)	Range
Background	0 - 10 ppm
Threshold	11 - 30 ppm
3rd Order Anomaly	31 - 45 ppm
2nd Order Anomaly	46 -60 ppm
1st Order Anomaly	over 60 ppm

Zinc (Total Range 0 - 165 ppm)	Range
Background	0 - 10 ppm
Threshold	11 - 35 ppm
3rd Order Anomaly	36 - 60 ppm
2nd Order Anomaly	61 - 85 ppm
1st Order Anomaly	over 85 ppm

Nickel (Total Range 0-215 ppm)	Range
Background	0 - 20 ppm
Threshold	21 - 45 ppm
3rd Order Anomaly	46 - 75 ppm
2nd Order Anomaly	76 -105 ppm
1st Order Anomaly	over 105 ppm

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These results were plotted as worm maps on a scale of 1" to 1 mile.

The detailed sample results were plotted as graphs of assay value against distance up stream. A clear picture of the relative distribution of each element along the stream is obtained by plotting its value in the stream sediment samples and both bank samples on the same graph.

Discussion of Results

The main area of interest within the Mainwaring Belt is an area of ten square miles enclosed by the Urquhart and Mainwaring Rivers. Most streams draining this area show highly anomalous values for Cu, Zn and Ni (see map).

The results obtained from the detailed sampling of anomalous streams also confirm that they are highly anomalous. Inspection of the graphs of the results from Cypress Creek and South Cypress Creek (particularly the stream sample copper results) shows that these results increase in value up stream. This would appear to indicate that the major source of these copper results lies some distance up stream. No definite information was obtained from the bank samples. However, high values in the stream samples can usually be correlated with a high bank value some few hundred feet upstream.

It is interesting to note that in many cases where anomalous results occur in stream samples, there is, some distance upstream (or in the immediate vicinity), a boundary between two magnetic units - usually B and C (see aeromagnetic map). In many cases 1st and 2nd class electromagnetic anomalies lie along these boundaries (see electromagnetic map).

Recommendations

Bearing the above in mind (and also the conclusion that "the peripheral regions of the Band C zones (which coincide with the contacts between tuffs and argillite)) are regarded as potential zones of mineralization" Aeromagnetic Report on S.W. Tasmania, see page 5) the area has been subdivided into the following seven zones in order of priority.

Zone 1.

This is a zone of approximately ten square miles and is considered to be the primary target zone.

The zone is:

i) drained by two highly anomalous creeks (Cypress Creek and South Cypress Creek).

ii) contains the peripheral regions of B and C zones.

iii) contains 8 first class electromagnetic anomalies.

iv) contains a moderately anomalous aeromagnetic area.

An initial 26 miles of bulldozed grid lines at 1,000 feet spacing is proposed for this zone to cover all the significant features therein.

A total of 275 soil samples at 500 feet intervals (or 550 at 250 feet intervals) should be sufficient, with supporting geophysical work, to locate more specifically the areas of interest. More detailed follow up sampling and geophysics may then be employed using hand cut lines and/or supplementary bulldozed tracks. This is dependent on the nature of the bush.

Zone 2.

This is a zone of approximately one square mile, less than one mile north of Zone 1 and would be the next area to be investigated.

The zone contains the area drained by the two anomalous tributaries of the Upper Urquhart River.

Seven miles of tracks are proposed for this zone with an initial total of 75 soil samples at 500 feet intervals (150 at 250 feet intervals), and geophysics with any necessary follow up work.

Zone 3.

This zone lies just to the north east of Zone 2 and is about one square mile in area.

Contained in this area are:

i) the possible source of the anomalous values in the Upper Urquhart River.

ii) anomaly 105 (see aeromagnetic map) which was recommended for further investigation in the aeromagnetic report.

Four miles of track are proposed with an initial total of 45 soil samples at 500′ intervals (90 at 250′ feet intervals), and geophysics with any necessary follow up work.

Zone 4.

This is a zone one mile long and half a mile wide linking Zones 1 and 2, and lies along a peripheral region of a A, B and C magnetic unit. This region may be the source of the anomalous zinc reading in the creeks to the west.

Three miles of track are proposed, with an initial 30 soil samples at 500 feet intervals (60 at 250 feet intervals), and geophysics with any necessary follow up work.

Zone 5.

This is a zone of one square mile area adjacent to the southern end of Zone 1, and is the possible source of the anomalous coastal stream and several tributaries of the Mainwaring River. Within this area are also:

i) two 2nd class electromagnetic anomalies.

ii) a boundary between magnetic units B and C.

iii) a moderately anomalous aeromagnetic area.

Five miles of track are proposed, with an initial 55 soil samples at 500 feet intervals (110 at 250 feet intervals), and geophysics with any necessary follow up work.

Zone 6

This is a zone of one square mile in area to the east of Zone 5, and contains the area drained by an anomalous Mainwaring tributary. It also contains an aeromagnetically anomalous area.

Five miles of tracks are proposed, with an initial 55 soil samples at 500 feet intervals (110 at 250 feet intervals), and geophysics with any necessary follow up work.

Zone 6A

This is a small zone less than a quarter of a mile in area and is basically a southern extension of Zone 6 to cover Anomaly 108.

Approximately one mile of track is proposed, with an initial 10 soil samples at 500 feet intervals (20 at 250 feet intervals), and geophysics with any necessary follow up work.

Summary

Fifty miles of track 545 soil samples at 500 feet intervals.

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MAINWARING BELT

RECONNAISSANCE STREAM SEDIMENT SAMPLES

Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
923	Wanderer River	5	9	5
924	" "	2	5	3
925	" "	11	37	22
926	" "	3	10	7
927	" "	1	5	2
928	" "	24	90	38
929	" "	2	5	3
930	" "	9	48	20
931	" "	2	5	2
932	" "	2	9	7
933	" "	5	9	22
934	" "	1	5	8
935	" "	11	48	72
936	" "	-	2	2
937	" "	1	3	2
938	" "	7	23	18
939	" "	7	29	16
940	" "	6	19	16
941	" "	-	2	-
942	" "	10	20	20
943	" "	2	14	20
944	" "	3	12	18
945	" "	4	7	16
946	Urquhart River	22	45	36
947	" "	8	22	14
948	" "	21	47	36
949	" "	28	72	40
950	" "	14	44	22
1145	" "	23	51	36
1146	" "	23	101	59
1147	" "	24	47	38
1148	" "	21	35	16
1149	" "	23	40	40
1150	" "	20	35	44
1151	" "	29	53	62

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Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
1152	Urquhart River	18	22	10
1153	" "	19	39	42
1154	" "	31	80	62
1155	" "	50	83	62
1156	" "	34	53	54
1157	" "	52	78	64
1158	" "	36	44	52
1159	" "	32	50	18
1160	" "	29	38	54
1161	" "	3	8	16
1162	" "	3	7	5
1163	Cypress Creek	37	57	50
1164	" "	27	57	48
1165	" "	190	94	69
1166	" "	27	94	62
1167	" "	46	83	57
1170	South Cypress Creek	58	102	76
1171	" " "	60	101	44
1172	" " "	7	8	7
1173	" " "	32	63	38
1174	" " "	32	70	42
1175	" " "	29	15	22
1185	Mainwaring River	12	14	12
1186	" "	8	12	14
1187	" "	55	54	50
1188	" "	36	44	32
1189	" "	12	16	12
1190	" "	34	56	69
1191	" "	6	7	67
1192	" "	5	7	72
1193	" "	1	6	5
2065	Upper Mainwaring River	1	2	-
2066	" " "	1	1	-
2067	" " "	2	4	-
2068	" " "	10	10	10
2069	" " "	2	4	2

Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
2070	Upper Mainwaring River	2	2	-
071	" " "	1	3	-
2072	" " "	4	4	< 4
073	" " "	10	10	<10
2074	" " "	6	4	-
2084	Abo Creek	2	22	-
2085	" "	26	44	27
086	" "	20	30	<10
2087	" "	5	4	-
088	" "	16	18	12
2089	" "	17	30	20
090	" "	13	12	13
2091	" "	15	23	20
2092	" "	24	28	16
2093	" "	7	8	7
2094	" "	15	24	30
095	" "	7	8	7
2096	" "	8	9	14
097	" "	26	29	58
2098	" "	8	8	6
2247	Mainwaring River	43	70	121
2248	" "	40	98	103
2249	" "	40	98	61
2250	" "	24	20	12
251	" "	43	44	25
2252	" "	50	20	12
253	" "	33	72	40
2254	" "	14	5	4
255	" "	2	2	<4
2256	" "	6	8	-
2257	" "	3	5	4
2258	" "	7	15	23
2259	" "	4	7	4
260	" "	14	40	20
2261	" "	17	68	33
262	" "	50	54	33
225	Coastal Streams	30	51	87
0226	" "	16	30	67

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Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
8227	Coastal Streams	34	105	86
8228	" "	36	80	78
8229	" "	44	120	52
8230	" "	47	83	47
8231	" "	44	105	59
8232	" "	49	115	61
8233	" "	47	96	61
8234	" "	28	72	40
8235	" "	24	47	24
8236	" "	26	60	27
8237	" "	18	74	32
8238	" "	28	62	58
8239	" "	8	72	27
8240	" "	6	63	19
8241	" "	10	26	6
8242	" "	14	24	8
8243	" "	10	27	8
8244	" "	10	25	11
8245	" "	8	23	8
8246	" "	8	17	4
8247	" "	20	40	24
8248	" "	24	58	38
8249	" "	22	58	38
8250	" "	24	48	40
8251	" "	14	32	19
8252	" "	14	44	24
8253	" "	32	67	52
8254	" "	30	58	47
8255	" "	49	48	27
8256	" "	51	44	32
8257	" "	22	88	64
8258	" "	22	83	61
8259	" "	51	63	55
8260	" "	24	44	38
8261	" "	192	93	105
8262	" "	36	65	50
8263	Upper Urquhart River	47	58	101
8265	" " "	38	45	98
8267	" " "	49	58	120
8269	" " "	24	33	61
8271	" " "	38	60	116

Sample No.	Location	Results (in ppm) Copper	Zinc	Nickel
8273	Upper Urquhart River	34	43	128
8275	" " "	30	40	70
8277	" " "	26	38	72
8279	" " "	42	65	136
8281	" " "	22	30	55
8283	" " "	20	30	64
8285	" " "	16	24	55
8287	" " "	16	21	44
8289	" " "	18	23	44
8291	" " "	12	20	32
8293	" " "	8	13	19
8295	" " "	8	14	22
8297	" " "	12	17	24
8299	" " "	26	29	55
8301	" " "	8	14	22
8303	" " "	38	58	120
8305	" " "	14	20	40
8307	" " "	18	27	70
8309	" " "	66	76	116
8311	" " "	47	58	83
8313	" " "	51	70	90
8317	Copper Creek - eastern main tributary	6	21	2
8319	" " " " "	3	14	-
8321	" " " " "	1	16	-
8323	" " " " "	1	18	-
8325	" " " " "	1	11	-
8327	" " " " "	3	24	4
8329	" " " " "	1	16	-
8331	" " " " "	3	15	2
8333	" " " " "	1	14	-
8335	" " " " "	3	22	2
8337	" " " " "	3	25	2
8339	" " " " "	3	18	2
8341	Copper Creek	8	35	4
8343	" "	6	31	4
8345	" "	8	44	8
8347	" "	6	28	4
8349	" "	44	22	2
8451	" "	3	14	-
8453	" "	6	16	2
8455	" "	4	21	2

Sample No.	Location	Results (in ppm)		
		Copper	Zinc	Nickel
8..57	Copper Creek	3	21	2
8..59	" "	4	19	2
8..61	" "	3	18	-

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DETAILED SAMPLING

Location	Stream sed't. sample number	Bank sample number	Results (in ppm) Stream sediment Cu	Zn	Ni	Bank samples Cu	Zn	Ni
South Cypress Creek	8013	5432	61	155	83	24	49	19
						24	38	19
" " "	8015	5434	42	88	58	6	29	8
" " "		5435				34	65	38
" " "	8017	5436	54	140	78	12	40	16
" " "	5437					20	44	16
" " "		5438				24	36	14
" " "		5439				16	38	22
" " "	8021	5440	51	93	64	44	65	24
" " "		5441				16	37	16
" " "	9023	5442	54	85	61	4	31	14
" " "		5443				26	42	22
" " "	8025	5444	64	130	72	8	33	11
" " "		5445				47	65	27
" " "	8027	5446	49	140	78	3	27	6
" " "		5447				24	45	24
" " "	8029	5448	54	93	70	10	38	16
" " "		5449				12	40	19
" " "	8031	5450	49	85	70	20	42	24
" " "		5451				8	36	14
" "	8033	5452	10	20	14	12	40	19
" " "		5453				12	38	16
" "	8035	5454	16	24	19	12	43	16
" "		5455				8	34	14
" " "	8037	5456	12	22	16	8	39	19
" " "		5457				4	44	11
" " "	8039	5458	16	22	16	10	22	4
" " "		5459				6	24	4
" " "	8041	5460	54	83	61	51	140	112
" "		5461				16	27	22
" " "	8043	5462	71	135	90	3	27	6
" " "		5463				42	130	154
" "	8045	5464	59	130	61	3	30	6
" " "		5465				6	42	8
" "	8047	5466	64	91	78	44	60	6
" " "		5467				18	42	6
" "	8049	5468	56	93	83	117	130	50
" " "		5469				18	22	22
" "	8051	5470	56	85	72	38	38	22
" " "		5471				12	58	44

Location	Stream sed't sample number	Bank sample number	Stream Sediment Cu	Stream Sediment Zn	Stream Sediment Ni	Bank Samples Cu	Bank Samples Zn	Bank Samples Ni
South Cypress Creek	8053	5472	82	150	86	18	28	8
" " "		5473				12	34	14
" " "	8055	5474	36	85	50	61	58	52
" " "		5475				38	49	40
" " "	8057	5476	51	85	70	61	49	22
" " "		5477				80	220	67
" " "	8059	5478	76	140	105	100	67	44
" " "		5479				28	60	16
" " "	8061	*5480	76	91	78	*Not collected		
" " "		5481				66	62	35
" " "	8063	5482	73	130	99	94	62	40
" " "		5483				161	91	40
" " "	8065	5484	88	130	98	180	44	52
" " "		5485				103	30	16
" " "	8067	5486	85	125	90	61	40	44
" " "		5487				54	37	35
" " "	8069	5488	68	91	78	76	63	64
" " "		5489				64	47	35
" " "	8071	5490	91	135	94	73	70	64
" " "		5491				136	40	35
" " "	8073	5492	97	145	105	42	26	24
" " "		5493				97	60	61
" " "	8075	5494	85	125	101	59	42	58
" " "		5495				73	49	55
" " "		5496				103	57	83
" " "		5497				91	65	72
" " "	8079	5498	106	93	83	66	58	72
" " "		5499				82	65	72
" " "	8081	5500	80	85	72	85	48	67
" " "		5501				56	39	35
" " "	8083	5502	85	91	90	610	57	105
" " "		5503				88	65	64
" " "	8085	5504	51	74	78	244	52	47
" " "		5505				30	30	24
" " "	8087	5506	36	91	58	186	44	44
" " "		5507				82	54	67
" " "	8089	5508	61	100	64	32	63	105
" " "		5509				144	250	35
" " "	8091	5510	56	130	64	4	15	8
" " "		5511				340	96	78

Location	Stream sed't. sample No.	Bank sample No.	Results (in ppm) Stream sediment Cu	Zn	Ni	Bank samples Cu	Zn	Ni
South Cypress Creek	8093	5512	76	155	86	24	160	32
" " "		5513				80	47	22
" " "	8095	5514	56	96	61	4	14	4
" " "		5515				73	72	35
" " "	8097	5516	61	135	70	10	9	6
" " "		5517				64	72	55
" " "	8099	5518	40	81	58	6	27	19
" " "		5519				22	30	19
" " "	8001	5520	56	135	70	38	37	24
" " "		5521				24	35	22
" " "	8103	5522	68	135	72	18	29	16
" " "		5523				80	48	35
" " "		5524				61	63	24
" " "		5525				16	35	24
" " "		5526				24	47	35
" " "		5527				61	48	61
" " "								
Cypress Creek		5121				18	25	40
" "	8119	5122	66	91	98	30	37	38
" "		5123				44	58	87
" "	8121	5124	73	100	109	56	54	90
" "	8122	5125	91	100	120	54	54	94
" "	8123	5126	88	130	120	47	51	83
" "		5127*				* Sample lost		
" "	8125	5128	91	100	109	47	49	78
" "		5129				56	25	35
" "	8127	5130	64	74	58	54	49	90
" "		5131				51	47	72
" "	8129	5132	76	88	109	61	51	87
" "		5133				76	39	38
" "	8131	5134	88	96	112	64	63	105
" "		5135				103	65	61
" "	8133	5136	106	150	128	61	55	98
" "		5137				68	88	83
" "	8135	5138	136	155	120	56	58	98
" "		5139				61	58	109
" "	8137	5140	91	125	112	54	51	86
" "		5141				71	65	101
" "	8139	5142	110	140	120	47	74	70
" "		5143				85	57	64

103

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Location	Stream sed't. sample No.	Bank sample No.	Results (in ppm) Stream sediment Cu	Zn	Ni	Bank samples Cu	Zn	Ni
Cypress Creek	8141	5144	103	125	116	66	57	90
" "	5145	5145				51	60	86
" "	8143	5146	97	130	109	66	39	101
" "		5147				73	67	112
" "	8145	5148	100	130	112	88	65	98
" "		5149				66	52	101
" "	8147	5150	97	145	116	47	37	64
" "		5151				61	55	101
" "	8149	5152	114	145	112	59	52	86
" "		5153				66	58	112
" "	8151	5154	106	135	120	64	58	105
" "		5155				82	51	90
" "	8153	5156	106	125	116	64	58	98
" "		5157				68	51	98
" "	8155	5158	148	165	136	51	44	67
" "		5159				76	60	101
" "	8157	5160	100	120	109	71	40	29
" "		5161				124	79	132
" "	8159	5162	136	155	136	73	63	112
" "		5163				61	55	98
" "	8161	5164	117	140	120	65	52	90
" "		5165				85	51	94
" "	8163	5166	94	115	105	56	48	94
" "		5167				59	48	47
" "	8165	5168	114	120	112	22	23	14
" "		5169				51	42	86
" "	8167	5170	161	145	116	59	54	98
" "		5171				88	60	98
" "	8169	5172	140	155	132	64	54	90
" "		5173				71	58	116
" "	8171	5174	144	150	128	56	54	98
" "		5175				66	54	105
" "	8173	5176	148	145	125	82	58	72
" "		5177				80	63	87
" "	8175	5178	140	140	120	73	69	101
" "		5179				114	55	78
" "	8177	5180	110	125	109	85	54	70
" "		5181				61	55	86
" "	8179	5182	110	115	109	82	58	94
" "		5183				54	51	83
" "	8181	5184	152	155	128	64	62	109
" "		5185				64	60	86

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Location	Stream sed't. sample No.	Bank sample No.	Results (in ppm) Stream Sediment Cu	Zn	Ni	Bank Samples Cu	Zn	Ni
C.press Creek	8183	5186	156	155	136	49	44	64
" "		5187				88	62	86
" "	8185	5188	132	142	128	96	58	72
" "		5189				85	76	105
" "	8187	5190	166	155	120	32	25	32
" "		5191				32	70	101
" "	8189	5192	204	155	128	34	25	24
" "		5193				73	67	101
" "	8191	5194	230	155	128	56	58	87
" "		5195				171	58	58
" "	8193	5196	161	135	120	51	44	72
" "		5197				71	67	124
" "	8195	5198	171	140	132	59	47	72
" "		5199				1875	150	112
" "	8197	5200	144	120	112	66	67	116
" "		5201				224	83	116
" "	8199	5202	192	155	116	59	58	86
" "		5203				960	83	78
" "	8201	5204	28	70	50	100	58	83
" "		5205				1440	91	83
" "	8203	5206	217	155	132	56	42	52
" "		5207				85	63	98
" "	8205	5208	144	115	105	100	32	47
" "		5209				120	60	67
" "	8207	5210	180	135	116	91	30	35
" "		5211				59	58	78
" "	8209	5212	152	130	112	73	74	94
" "		5213				64	62	86
" "	8211	5214	110	105	105	224	44	38
" "		5215				124	70	78
" "	8213	5216	117	110	101	238	93	78
" "		5217				171	100	112
" "	8215	5218	166	130	112	260	100	128
" "		5219				117	57	78
" "	8217	5220	103	64	72	114	63	72
" "		5221				144	55	94
" "	8219	5222	171	110	136	16	19	6
" "		5223				460	60	105
" "	8221	5224	14	30	55	124	57	83
" "		5225				61	63	86
" "	8223	5226	252	145	158	66	62	101

Location	Stream sed't sample No.	Bank sample No.	Results (in ppm) Stream sediment Cu	Zn	Ni	Bank samples Cu	Zn	Ni
Upper Urquhart River (eastern tributary)		5227				20	19	87
	8351	5228	94	100	87	24	34	50
" " "		5229				38	36	44
" " "	8353	5230	91	91	90	30	35	50
" " "		5231				120	48	72
" " "	8355	5232	85	100	90	32	47	70
" " "		5233				49	48	78
" " "	8357	5234	97	100	101	128	40	58
" " "		5235				38	39	58
" " "	8359	5236	97	88	87	40	35	61
" " "		5237				51	43	70
" " "	8361	5238	103	91	128	38	40	64
" " "		5239				44	37	44
" " "	8363	5240	97	85	120	136	70	168
" " "		5241				40	34	40
" " "	8365	5242	66	81	105	32	38	55
" " "		5243				211	40	70
" " "	8367	5244	54	76	99	156	65	98
" " "		5245				28	55	35
" " "	8369	5246	30	57	85	68	58	94
" " "		5247				32	42	58
" " "	8371	5248	51	96	120	24	33	55
" " "		5249				132	57	50
" " "	8373	5250	34	69	90	20	35	52
" " "		5251				20	33	32
" " "	8375	5252	38	65	99	61	47	32
" " "		5253				30	37	61
" " "	8377	5254	47	83	120	32	42	67
" " "		5255				28	35	58
" " "	8379	5256	38	79	105	56	44	47
" " "		5257				22	36	55
" " "	8381	5258	42	81	99	34	37	40
" " "		5259				28	43	61
" " "	8383	5260	61	96	112	17	47	72
" " "		5261				76	45	44
" " "	8385	5262	51	79	128	34	38	67
" " "		5263				71	34	52
" " "	8387	5264	34	54	90	49	47	78
" " "		5265				73	44	58
" " "	8389	5266	47	83	105	32	43	78

Location	Sample sed't. sample No.	Bank sample No.	Results (in ppm) Stream sediment Cu	Zn	Ni	Bank Samples Cu	Zn	Ni
pper Urquhart River (eastern tributary)		5267				36	38	61
	8391	5268	30	62	90	204	72	105
" " "		5269				28	34	58
" " "	8393	5270	26	54	79	54	43	55
" " "		5271				36	43	64
" " "	8395	5272	28	54	79	350	91	112
" " "		5273				56	32	35
" "	8397	5274	26	48	35	276	140	178
" " "		5275				47	36	40
" " "	8399		32	63	90			
Upper Urquhart River western „tributary		5276				61	37	32
	8401	5277	114	150	174	114	60	116
" " "		5278				73	44	35
" " "	8403	5279	91	88	141	128	65	98
" " "		5280				88	57	50
" " "	8405	5281	114	96	69	120	58	72
" " "		5282				71	58	86
" " "	8407	5283	110	140	80	71	69	144
" " "		5284				144	49	44
" " "	8409	5285	97	100	190	76	51	105
" " "		5286				64	42	83
" " "	8411	5287	88	88	169	66	31	44
" " "		5288				85	47	58
" " "	8413	5289	76	79	141	148	52	83
" " "		5625				61	76	101
" " "	8415	5626	76	83	160	61	69	98
" " "		5627				85	45	61
" " "	8417	5628	91	91	180	144	52	58
" " "		5629				100	42	44
" " "	8419	5630	73	85	169	140	81	109
" " "		5631				152	48	44
" " "	8421	5632	94	96	200	94	72	70
" " "		5633				91	44	61
" " "	8423	5634	97	100	215	132	85	98
" " "		5635				48	28	44
" " "	8425	5636	88	130	190	124	70	72
" " "		5637				80	67	78
" " "	8427	5638	73	88	160	161	65	70
" " "		5639				76	44	52
" " "	8429	5640	82	88	160	94	52	52
" " "								

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Location	Stream sed't Sample No.	Bank sample No.	Results (in ppm) Stream sediment Cu	Zn	Ni	Bank Sample Cu	Zn	Ni
Upper Urquhart River (western tributary)		5641				91	61	70
	8431	5642	68	81	141	97	76	67
" " "		5643				110	55	64
" " "	8433	5644	84	100	190	80	54	52
" " "		5645				76	93	178
" " "	8435	5646	59	72	135	103	51	50
" " "		5647				85	54	55
" " "	8437	5648	76	93	169	82	55	810
" " "		5649				142	250	408
" " "	8439	5650	88	96	190	66	42	55
" " "		5651				47	54	78
" " "	8441	5652	71	93	160	64	81	78

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SOUTH CYPRESS CREEK

ROCK SAMPLES

Sample No.	Location	Description	Results (in ppm) Cu	Zn	Ni
E 6188	200' up N. Tributary	Ferruginous "resinous" phyllite	80	50	300
E 6189	700' " " "	Quartz with black, manganiferous material	120	80	200
E 6190	800' " " "	Tuffaceous sediments with pyrite cubes.	400	100	200
P 6191	1400' " " "	Fresh chloritized greywacke	50	40	60
E 6192	1400' " " "	Fresh chloritized greywacke.	60	40	80
P 6193	1600' " " "	Green, tuffaceous sediments.	100	100	200
B 6194	1700' " " "	Green tuff.	50	60	200
E 6195	350' " " "	Green, limonitic tuff	120	150	600
P 6196	200' up S tributary	Green mottled tuff- ("stretched").	40	150	60
B 6197	200' " " "	Orange/pink weathered, bedded siltstone	200	100	100

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LEWIS RIVER GEOCHEMICAL

and

MAGNETIC SURVEY

See Fig. 21.

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Introduction

A combined geochemical soil sampling and ground magnetometer survey was carried out over an area ass associated with an aeromagnetic anomaly adjacent to the Cambrian granite/volcanic contact on the Lewis River some 2 miles north of Elliott Bay.

The aeromagnetic anomaly has the form of an arc with the concave side to the east. It has two peaks (A & B) north and one (C) south of the Lewis River which it intersects about 1½ miles above the mouth. The peaks A, B and C have values of 5749, 5603 and 5166 gammas respectively.

Geology

The area is underlain by the Cambrian Mt. Read Volcanics, an igneous suite including granite, quartz and feldspar porphyries and rhyolitic volcanics. The granite occurs as a roughly triangular boss, some 4 miles on each side, between the Lewis River and Elliott Bay and the geochemical work was carried out just north of the contact between the granite and the rhyolitic rocks.

Surveys

a. Methods

Two grids were laid out. On the north side of the river a base line of 4,000 feet bearing 10° magnetic was used with side lines on a bearing of 280° magnetic. On the south side a 2,000 feet base line bearing 170° magnetic with sidelines of 1,000 feet bearing 80°. In all a total of 30,400 feet was pegged of which 25,400 feet was sampled.

Soil samples and magnetometer readings were taken at intervals of 200 feet. Samples were taken with a 2 inch diameter anger from the interval of 6 to 12 inches below surface. Magnetometer readings were taken with a AEM pocket magnetometer.

b. Results

The magnetometer reading comfirmed the presence of the airborne anomaly. This was found to coincide with a NNE striking fault.

Soil samples collected close to or overlying outcrops of the Mt. Read Volcanics were light to dark brown, fine to coarse friable quartz sand with occasional organic material, while those collected away from the outcrops were dark, organic clayey, mud and peat. Areas close to the outcrops were usually covered with white quartz pebbles and cobbles and occasional boulders weathered from quartz veins in the volcanics.

Results obtained from soil samples show background values for copper and nickel. Isolated samples give higher values but these are not considered significant.

Zinc values show two background tenors probably related to soil type. No anomalous values are found. The results are tabulated below:

SOIL SAMPLES

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Sample No.	Location	Local Coordinates	Results (in ppm) Copper	Zinc	Nickel
300	North of Lewis River	0/0	3	29	4
30[illegible]	" " " "	2N/0	1	28	2
302	" " " "	4N/0	3	22	2
303	" " " "	6N/0	1	38	2
304	" " " "	8N/0	1	25	2
30[illegible]	" " " "	10N/0	1	20	2
30[illegible]	" " " "	12N/0	1	28	4
307	" " " "	14N/0	1	22	2
30[illegible]	" " " "	15N/0	3	38	4
309	" " " "	16N/0	3	26	2
31[illegible]	" " " "	18N/0	1	29	2
311	" " " "	20N/0	1	24	2
31[illegible]	" " " "	22N/0	1	24	2
313	" " " "	24N/0	1	24	4
31[illegible]	" " " "	25N/0	6	29	11
31[illegible]	" " " "	26N/0	1	25	2
316	" " " "	28N/0	1	23	2
31[illegible]	" " " "	30N/0	1	25	2
318	" " " "	32N/0	3	27	2
31[illegible]	" " " "	34N/0	1	24	2
320	" " " "	35N/0	3	24	2
32[illegible]	" " " "	36N/0	1	26	2
322	" " " "	38N/0	1	29	2
323	" " " "	40N/0	3	42	4
32[illegible]	" " " "	40N/20W	3	25	2
325	" " " "	40N/18W	3	25	2
32[illegible]	" " " "	40N/16W	1	22	2
327	" " " "	40N/14W	1	22	2
32[illegible]	" " " "	40N/12W	3	21	2
329	" " " "	40N/10W	3	27	2
33[illegible]	" " " "	40N/8W	1	28	2
33[illegible]	" " " "	40N/6W	3	29	2
33[illegible]	" " " "	40N/4W	1	24	2
33[illegible]	" " " "	40N/2W	1	40	2
334	" " " "	35N/20W	1	19	2
33[illegible]	" " " "	35N/18W	1	14	2
336	" " " "	35N/16W	1	10	2
33[illegible]	" " " "	35N/14W	-	6	2
338	" " " "	35N/12W	-	8	2
33[illegible]	" " " "	35N/10W	-	13	2
340	" " " "	35N/8W	1	11	2

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Sample No.	Location				Local Coordinates	Results (in ppm) Copper	Zinc	Nickel
5341	North	of	Lewis	River	35N/6W	-	11	2
5342	"	"	"	"	35N/4W	-	10	2
5343	"	"	"	"	35N/2W	-	9	2
5344	"	"	"	"	30N/2W	-	9	2
5345	"	"	"	"	30N/4W	-	9	2
5346	"	"	"	"	30N/6W	1	9	2
5347	"	"	"	"	30N/8W	1	11	2
5348	"	"	"	"	30N/10W	1	11	2
5349	"	"	"	"	30N/12W	1	14	2
5350	"	"	"	"	30N/14W	4	14	2
5351	"	"	"	"	30N/16W	3	12	2
5352	"	"	"	"	30N/18W	3	9	2
5353	"	"	"	"	30N/20W	-	10	2
5354	"	"	"	"	25N/20W	-	11	2
5355	"	"	"	"	25N/18W	1	15	2
5356	"	"	"	"	25N/16W	-	9	2
5357	"	"	"	"	25N/14W	-	8	2
5358	"	"	"	"	25N/12W	-	11	2
5359	"	"	"	"	25N/10W	1	11	2
5360	"	"	"	"	25N/8W	-	11	2
5361	"	"	"	"	25N/6W	-	9	2
5362	"	"	"	"	25N/4W	-	5	2
5363	"	"	"	"	25N/2W	1	7	2
5364	"	"	"	"	20N/2W	1	19	2
5365	"	"	"	"	20N/4W	1	16	2
5366	"	"	"	"	20N/6W	1	9	2
5367	"	"	"	"	20N/8W	14	9	2
5368	"	"	"	"	20N/10W	1	8	2
5369	"	"	"	"	20N/12W	1	37	2
5370	"	"	"	"	20N/14W	1	15	2
5371	"	"	"	"	20N/16W	1	17	2
5372	"	"	"	"	20N/18W	1	11	2
5373	"	"	"	"	20N/20W	4	14	2
5374	"	"	"	"	15N/20W	1	13	2
5375	"	"	"	"	15N/18N	1	12	2
5376	"	"	"	"	15N/16W	1	11	2
5377	"	"	"	"	15N/14W	1	11	2
5378	"	"	"	"	15N/12W	1	9	2
5379	"	"	"	"	15N/10W	1	11	2
5380	"	"	"	"	15N/8W	1	8	2

Sample No.	Location	Local Coordinates	Copper	Zinc	Nickel
			Results (in ppm)		
5381	North of Lewis River	15N/6W	-	9	2
5382	" " " "	15N/4W	1	11	2
5383	" " " "	15N/2W	-	11	-
5384	" " " "	42N/10W	1	11	2
5385	" " " "	44N/10W	4	11	2
5386	" " " "	46N/10W	3	9	2
5387	" " " "	48N/10W	1	9	2
5388	" " " "	50N/10W	1	13	6
5389	" " " "	52N/10W	1	17	2
5390	" " " "	54N/10W	1	10	2
5391	" " " "	56N/10W	1	11	2
5392	" " " "	58N/10W	3	9	2
5393	" " " "	60N/10W	1	25	2
5394	" " " "	62N/10W	1	19	2
5395	" " " "	64N/10W	1	11	2
5396	" " " "	66N/10W	1	14	2
5397	" " " "	68N/10W	18	22	14
5398	" " " "	70N/10W	1	17	2
5399	" " " "	72N/10W	1	11	2
5400	" " " "	74N/10W	1	16	2
5401	" " " "	76N/10W	1	27	2
5402	" " " "	70N/12W	1	23	2
5403	" " " "	70N/14W	1	30	2
5404	" " " "	70N/16W	1	22	2
5405	" " " "	64N/12W	1	23	2
5406	" " " " "	64N/14W	1	24	2
5407	" " " "	64N/16W	1	24	2
5408	" " " "	60N/12W	1	22	2
5409	" " " "	60N/14W	1	28	2
5410	" " " "	60N/16W	1	31	14
5411	South " " "	0/0	1	34	2
5412	" " " "	2S/0	1	35	4
5413	" " " "	4S/0	1	28	2
5414	" " " "	6S/0	1	23	2
5415	" " " "	8S/0	1	29	2
5416	" " " "	10S/0	1	30	4
5417	" " " "	12S/0	1	29	4
5418	" " " "	14S/0	1	21	2
5419	" " " "	16S/0	1	27	2
5420	" " " "	19S/0	1	21	2
5421	" " " "	20S/0	1	22	2
5422	" " " "	12S/2W	1	30	2

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Sample No.	Location	Local Coordinates	Results (in ppm) Copper	Zinc	Nickel
5423	South of Lewis River	12S/4W	1	122	2
5424	" " " "	12S/2E	1	54	8
5425	" " " "	12S/4E	1	26	2
5426	" " " "	12S/6E	1	22	2
5427	" " " "	6S/2W	1	32	4
5428	" " " "	6S/4W	1	31	4
5429	" " " "	6S/2E	1	31	4
5430	" " " "	6S/4E	1	25	2
5431	" " " "	6S/6E	1	22	2

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MOUNT JUKES - MOUNT DARWIN AREA

See Fig. 22A-D.
Fig. 23A-D

E. D. BUMSTEAD
G. R. FENTON (?) - geophys?

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INTRODUCTION

Tributaries of the King River draining the north east flank of Mount Jukes near the Old Crotty Smelters and the Clark River draining the southern parts of Mount Darwin were sampled on a reconnaissance scale during the 1968 season. The results show lead, zinc anomalies in the Mount Jukes area.

GEOCHEMICAL SURVEY

Methods:

The field sampling methods are described by McIntyre and Bumstead 1968. Sampling was confined to stream sediments and although two samples were taken at each sample site only one was sent for analysis.

Geochemical and Mineralogical Laboratories Pty. Ltd. analysed the samples and determined copper, nickel, lead and zinc on solutions resulting from digestion of the sample in hydrochloric perchloric acid mixture.

Background, threshold and anomalous zones were selected by inspection for each group of samples; the number of results is small and makes a statistical appraisal subject to gross error.

Results:

The geology of the area and the sample sites are shown in Fig.22A. The streams drain areas underlain by Cambrian rocks.

In the Crotty Smelters area two stretches of stream are in the threshold zone and as such are possibly anomalous for copper.

Figure 22C shows the distribution of zinc in stream sediments. The stream draining north into the King River is anomalous in the upper reaches for zinc.

The lead distribution is shown in figure 22D. and shows the same stream to be anomalous for this element. It further shows the upper part of the southerly stream to be anomalous.

The Clark River results are shown in figures 23A, 23B 23C, 23D. and show only threshold values for zinc. Copper and nickel were in the background zone. The Mount Jukes - Mount Darwin area has been inspected by Lyell E-Z exploration (1957,58) and by U.S. Metals (1965). An aeromagnetic anomaly was detected by Lyell E.Z. (1957) on the North flank of Mount Jukes. It is believed to be caused by a magnetite outcrop. Ground magnetics were used to follow up and prove the anomaly. Soil sampling appears to have been taken in the area but no results are available.

It is reported that pyrite mineralization was found in NE/SW cross fault in the Dundas formation. The major fault trend is NW/SE. Pyrite was sometimes found to be associated with magnetite. Three adits have been excavated and copper minerals and pyrite were present on the dumps.

Lyell E-Z Exploration carried out a preliminary Helicopter E.M. Survey (1957) in the Mount Darwin area which covered an area 5.5 miles long (N.S.). It includes the East Darwin, Findons, Prince Darwin and Tasman Darwin Prospects. The last three have been sampled in the past and the amount of near surface sulphide mineralization is a known quantity. The area contains the southerly extension of the Lyell Shear and the associated Dundas Rocks.

The aerial E.M. Survey was carried out over the area, and the presence of magnetic orebodies were suggested by the results. One of the anomalies covers the southern end of the Prince Darwin orebody which trends 160^{o}, is 700 ft. long, 120-200 ft. wide. It carries up to 20% hematite, 10% pyrite and 1% copper with some magnetite. An approximate tonnage of 4 million tons is reported.

The lack of copper stream anomalies in both areas is disturbing in view of the considerable amount of copper present in the environs. The absence of copper anomalies may be due to the following features of the environment:-

1. Steep slopes and rugged topography.
2. High Rainfall.
3. Low stream water pH.
4. Abundant humus and Humic acids.

The first feature combined with the high rainfall favour mechanical weathering and produce little fine grained material. Thus stream sediments also carry little clay size material and adsorption sites within the stream are few or absent.

The low pH of stream waters (4.5 - 6.0) precludes the occurrence of secondary carbonate minerals by their solution. It maintains the cupric ions in solution. This ion does not begin to precipitate until pH 6.5. The low pH is due to the high concentration of humic acids and other decomposition products in streams.

Humic acids are effective complexing agents for copper thus preventing its adsorption. Davidson (1962) states that 50% of copper carried by the Dnieper (Dnepr) River, U.S.S.R. is in the form of copper humates. The presence of excess organic material such as leaf litter also prevents rapid weathering of sulphides.

Although it cannot be shown in this case that the above mechanisms have in fact prevented anomalies forming, it is probable that they have played a part.

CONCLUSIONS AND RECOMMENDATIONS

The lead-zinc anomaly in the Crotty Smelters area should be followed up by geological ground survey of the creek prior to a soil survey. Other streams to the south should be sampled on a reconnaissance scale. The Clark river does not indicate the presence of lead.

The technique used in this area has been unsuccessful in detecting known copper deposits. It is unlikely that another form of attack would give better results. However some change in grain size may be successful and it is recommended that the duplicate samples from the Crotty Smelter area be submitted to Geochemical and Mineralogical laboratories for this work. Samples of water from this area should also be collected and submitted for copper determination. This should indicate if the streams are carrying copper and possibly in what form. The results of this work will be useful in other parts of Tasmania.

...

Melbourne:
EDB:gai
24-4-'69

REFERENCES:

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Econ. Geol. 57 265

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U.S.Metals Refining 65. Exploration Licence EL2/64 Jukes-Darwin Area Tasmania Comp. Report 518.

....

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084125

B O Y E S   R I V E R

GEOCHEMICAL SURVEY (1967 - 68)

E.D. BUMSTEAD.

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084126

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CONCLUSION	3

Fig. 24a Geological Map and Geochemical Sample position.
24b Geochemical Results - ppm copper.
24c Geochemical Results - ppm zinc.
24d Geochemical Results - ppm nickel.
24e Geochemical Results - ppm arsenic.

Table 1 Semi quantitative Analysis of Boyes River Ultrabasic Rocks.
2 Reconnaissance Samples Boyes River.

BOYES RIVER GEOCHEMICAL SURVEY (1967-68)

(SEE FIGS.24A B C. D,E)

Introduction

The Boyes River is a tributary of the Gordon River on the western side of the Stepped Hills.

Ultrabasic rocks occur in the Boyes River valley at the base of a thick (greater than 10,000 feet) sequence of Lower Ordovician fanglomerates and Upper Cambrian marine sediments. The ultrabasics rocks consist essentially of serpentinite containing minor amounts of magnetite and chromite and are believed to be genetically related to the ultrabasic rocks at Adamsfield some 8 miles southeast. They occasionally outcrop, and weather to a red-brown soil but are usually covered with coarse boulder talus shed from the Stepped Hills. The boundaries of the ultrabasics were not observed but are believed to be faulted.

Old pits and trenches indicate that the ultrabasic areas were briefly worked, probably for alluvial osmiridium during the late 1920's, but no production records are known.

A marked belt of aeromagnetic anomalies with a peak of 7450 gammas is associated with the ultrabasics and during November 1967, a geochemical stream sediment survey was carried out over the major southern anomalies. A number of ultrabasic specimens were taken for spectrographic analysis.

Results

The results of the geochemical survey carried out in the 1968 season are presented in fig. 24A,B,C,D,E. The analysis was carried out by Geochemical and Mineralogical Laboratories using a perchloric acid leach followed by determination of nickel, copper and zinc by atomic absorption spectrophotometry. Arsenic values were obtained by the Gutzeit method.

Nine rock samples have been analysed using a spectroscopic scan. This analysis was carried out by Australian Mineral Development Laboratories, and their A1 scheme of 1967 was used. Values confirm that the ultrabasic rocks carry average nickel and lithium values. (Table 1) The other element values are low as indicated by the average values also given in Table 1.

Discussion of Results

The stream results for copper show no anomalous values. The mean lies between 2 and 3 ppm and the top value is six, a value which could be due to analytical error.

Nickel values for the streams show two anomalous areas with values up to 240 ppm. Background values are around four ppm. The high values are found in stream draining ultrabasic rocks. However, it is only the western tributaries which return the high values.

High zinc values are found in the same stream stretches that showed high nickel values. Threshhold values for zinc are also found in other streams and possibly indicate a higher degree of dispersion.

Two stream stretches are anomalous for arsenic giving values up to 60 ppm. Background values are less than five ppm. The arsenic anomalies are found in the western tributaries, which also returned nickel and zinc values of interest, and stretches down stream.

The nickel and zinc values can be considered as indication of the ultrabasics. The analyses in Table 1 indicate that the ultrabasic rocks of the Boyes River area have an average nickel content. It is also noted that the chromium value are lower than average. However, other streams draining ultrabasic areas are not nickel anomalous and in as much as arsenic is indicative of mineralization, stream with both nickel and arsenic anomalous values must be considered of interest and require work to confirm mineralization as the cause of the anomaly. Other arsenic values do not appear to have other metals associated with them and the stream which show this type of pattern must be relegated to a low priority.

<u>Conclusion</u>

Nickel arsenic anomalies in the stream draining from the west to confluence at 423900yE 756600yN may indicate nickel mineralization. Further stream sampling to the west is required together with soil sampling west of 423900yE and north of 756000yN to 757000yN. Detailed geology and rock sampling in the same area will also add to our understanding of these anomalous values. If any further work is carried out in the Boyes River area, it is necessary to remember that the overburden in the area consists mainly of a transported boulder talus.

.....4.

Table 1. Semi-quantitative Analysis of Ultrabasic Rock of the Boyes River Area. (ppm)

Sample No.	Cr	Mn	Co	Ni	Cu	Zn	Ag	B	Li	Ba	Zr
B.R.1	600	1000	100	2000	3	20	0.2	5	-	3	-
B6154	120	50	50	700	10	50	0.2	5	3	10	50
6155	400	300	50	1000	8	40	0.2	3	3	40	50
6156	700	200	100	1500	20	40	0.1	3	3	10	50
6157	500	200	50	800	8	30	0.2	4	3	20	50
6158	400	150	40	800	6	40	0.2	10	3	10	50
6159	600	150	60	700	6	20	0.2	4	3	10	50
6160	2000	200	50	300	5	40	0.1	4	4	10	50
6161	200	200	40	1000	8	30	0.1	4	3	5	100
Mean Values	2000	1300	200	1200	80	50	0.3	40	2	-	-

From Vinogradov 1956a Table 4.

Table 2. Reconnaissance Samples

SAMPLE NUMBER	LOCATION	RESULTS (in ppm) Copper	Zinc	Nickel	Arsenic
2408	Boyes River	4	8	6	-
2409	" "	4	7	4	-
2410	" "	2	15	4	-
2411	" "	2	3	2	-
2412	" "	2	4	4	-
2413	" "	2	6	2	-
2414	" "	2	4	2	-
2415	" "	2	18	6	-
2416	" "	2	8	4	-
2417	" "	2	22	4	-
2418	" "	2	3	2	-
2419	" "	-	7	2	-
2420	" "	-	7	2	20
2421	" "	-	4	2	30
2422	" "	2	5	2	40
2423	" "	2	4	2	60
2424	" "	2	11	47	40
2425	" "	2	6	14	30
2426	" "	6	58	240	40
2427	" "	2	8	6	40
2428	" "	4	38	116	60
2429	" "	2	3	4	5
2430	" "	2	5	4	5
2431	" "	2	5	2	-

SAMPLE NUMBER	LOCATION		RESULTS (ppm) Copper	Zinc	Nickel	Arsenic
2432	"	"	2	8	2	-
2433	"	"	2	6	4	20
2434	"	"	-	4	4	5
2435	"	"	2	11	2	5
2436	"	"	2	10	4	-
2437	"	"	2	12	35	-
2438	"	"	2	19	11	-
2439	"	"	2	6	4	-
2440	"	"	2	5	2	-
2441	"	"	2	3	2	-
2442	"	"	2	6	2	-
2443	"	"	2	9	2	-
2444	"	"	2	19	2	-
2445	"	"	2	7	4	-
2446	"	"	2	8	2	-
2447	"	"	4	22	50	-
2448	"	"	2	18	2	-
2449	"	"	2	8	2	-
2450	"	"	2	9	4	-
2451	"	"	2	5	4	-
2452	"	"	2	5	6	-
2453	"	"	2	9	24	-
2454	"	"	2	45	40	-
2455	"	"	2	33	98	-
2456	"	"	2	31	72	-
2457	"	"	2	19	11	-

SAMPLE NUMBER	LOCATION		RESULTS (in ppm) Copper	Zinc	Nickel	Arsenic
2458	"	"	-	15	16	-
2459	"	"	2	19	19	-
2460	"	"	2	35	14	30
2461	"	"	2	7	6	-
2462	"	"	2	11	4	-
2463	"	"	6	65	290	-
2464	"	"	-	5	2	-
2465	"	"	-	11	4	-
2466	"	"	-	3	4	-
2467	"	"	-	14	24	-

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084134

S.W. TASMANIA E.L. 13/65

GORDON ROAD GEOCHEMICAL STREAM RECONNAISSANCE SURVEY

1967 - 1968

M. McINTYRE and E. D. BUMSTEAD
G. R. FENTON

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INTRODUCTION

A brief geochemical reconnaissance survey was carried out along a portion of the Gordon Road during November, 1967. The purpose of the survey was four fold; it was intended, to sediment sample streams draining areas underlain by Cambrian rocks, to test Cambrian sedimentary rocks for phosphate, to collect samples of Cambrian ultra - basic rocks to test for nickel, chromium and platinoid metals, and to sediment sample streams draining Precambrian pelitic garnet schists containing common pyrite and suspected chalcopyrite.

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GEOCHEMICAL SURVEY

Methods.

The method of sample collection is described by McIntyre and Bumstead (1968). Samples originating from this survey were analysed by Geochemical and Mineralogical Laboratories Pty. Ltd. of Sydney. The elements, nickel, copper and zinc, were determined by atomic absorption spectrophotometry after a hot 0.5 normal hydrochloric acid attack.

Rock samples were sent to Australian Mineral Development Laboratories for semi-quantitative spectrographic analysis. This is A.M.D.E.L.'s A1 scheme (1967). A.M.D.E.L. also determined the silica content of these rocks, using a colourmetric method. Phosphate determination was carried out in camp using the Shapiro test (1952).

Background, threshold and anomalous values (Table 1) of stream sediments results were calculated, assuming a normal distribution, from the mean and standard deviation of the result. However, the small number of samples does not allow reliable calculations to be made for nickel.

Results.

Phosphate tests were carried out on 43 samples of Cambrian sedimentary rock. All rocks tested returned negative results and it is considered that no further testing for phosphate is necessary along the Gordon Road.

Semi-quantitative Spectrographic analysis of six ultrabasic rock specimens (Table 2) indicated no anomalous concentrations of nickel, chromium or platinoid metals. Silica values (Table 4) are abnormally high for ultrabasic rock. This is probably due to quartz mineralisation after emplacement of the ultrabasic bodies. The nickel values are close to the average values for ultrabasic rocks (cf Hawkes and Webb 1962).

Although the rocks are reasonably fresh it is not possible to use the work of Nyuppenen (1966) which concerns the nickel-silica ratio, to evaluate the rocks nickel potential. This is due to the variable silica values which appear to be related to post emplacement quartz mineralisation. As the nickel values are average no further work is suggested for these rocks.

Spectrographic analysis of Precambrian pelitic schists (Table 3) indicate no anomalous concentration of base metals. Thus it is concluded that mineralisation is wholly pyritic. This is confirmed by the fact that results from hand picked specimens of the sulphide bearing rock show no statistically significant variation in base metal content when compared to results from similar but unmineralized rock samples.

Although two sample populations are suggested for nickel by the stream sediment results inspection of the areal distribution indicates that on geological grounds only one exists. The second population originates from the first by omitting samples with results above 30 ppm. The statistical parameter of the first population of samples indicates three streams above the chosen threshold value of ppm nickel. These streams drain Silurian argillites either side of the Cambrian ultrabasic body which does not appear to be reflected in stream values. The streams follow a possible fault line which could be the focus of mineralisation if present.

As the area is readily accessible a geological investigation of the streams combined with selective rock sampling aimed at revealing mineralisation should be carried out, and may reveal the cause of the anomaly. If the anomaly is shown to be due to mineralisation further stream sampling to the south will have to be carried out prior to a soil sampling program to isolate areas of prime interest.

<u>Summary</u>.

Geochemical sampling indicates that the Cambrian sediments do not contain economic phosphate or copper mineralisation. It also indicates that the ultrabasic rocks contain average amounts of nickel. The stream sampling indicates nickel anomaly which requires further work.

Stream sediment sample results are presented in Fig. 25B-D. Only one copper value is anomalous. This stream drains Silurian argillite on the N.E. flank of Mt. Wedge. Several other streams drain this area but do not indicate any mineralisation.

The same stretch of stream is anomalous for zinc.

TABLE 1

MEAN AND STANDARD DEVIATION

FOR

COPPER, ZINC AND NICKEL STREAM SEDIMENT VALUES

(ppm) rounded to nearest whole number

		NICKEL	COPPER	ZINC
Σx	484	203	215	479
$\bar{x}$	21	11	9	21
σ	26	6	10	16
n	23	19	23	23
Threshold	73	33	29	54

TABLE 2. SEMI- QUANTITATIVE SPECTROGRAPHIC ANALYSIS - RESULTS FOR ULTRABASIC ROCKS FROM THE GORDON ROAD (P.P.M.)

Sample No.	Cu	Pb	Zn	Co	Ni	Sn	Ag	Bi	Mn	Cr	V	Mo	Be	Li	Pb
B.9751	5	3	50	300	3,000	1	0.2	2	800	3,000	2	4	3	150	100
2	5	1	40	300	3,000	"	0.1	2	800	2,000	1	2	3	3	30
3	10	3	40	300	3,000	"	"	2	300	1,000	2	2	3	"	"
4	60	80	50	60	100	8	"	2	5,000	400	500	2	1	800	400
5	20	8	30	40	300	1	"	1	2,000	2,000	4	1	1	500	150
6	250	1	150	100	100	2	"	"	300	10	800	2	"	500	200

TABLE 3. **SEMI-QUANTITATIVE SPECTROCHEMICAL ANALYSIS**

RESULTS FOR ULTRABASIC ROCKS FROM THE GORDON ROAD (P.P.M.)

Sample No.	Cu	Pb	Zn	Co	Ni	Sn	Ag	Bi	Mn	Cr	V	Mo	Be	Li	Pb
B.9757	100	200	40	5	100	8	0.2	3	300	300	300	3	3	800	1,000
8	30	200	50	5	20	8	0.1	3	300	300	300	3	3	2,000	1,000
9	60	200	50	5	10	8	0.2	3	1,000	300	300	10	3	2,000	1,000
60	100	200	50	8	30	8	0.1	3	1,000	500	300	20	3	2,000	1,000
1	60	200	50	8	30	8	0.2	3	1,000	500	400	20	3	2,000	1,000
2	60	200	30	5	60	8	0.1	3	800	500	400	20	3	2,000	1,000
3	60	200	30	10	60	8	0.2	3	800	500	400	20	3	2,000	1,000

The following Elements were not detected:-

Au, Cd, Pt, Os, Ir, Rh, Ru, As, Sb, Ta, Nb, W, In, Pd, Te, Tl
Y, La, Ce.

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TABLE 4

SILICA RESULTS FOR ULTRABASIC ROCK ON THE GORDON ROAD (%)

Sample	Silica
B951	40.6
2	37.6
3	40.4
4	76.0
5	50.1
6	48.7

9-12

Figs 25a-d vocd

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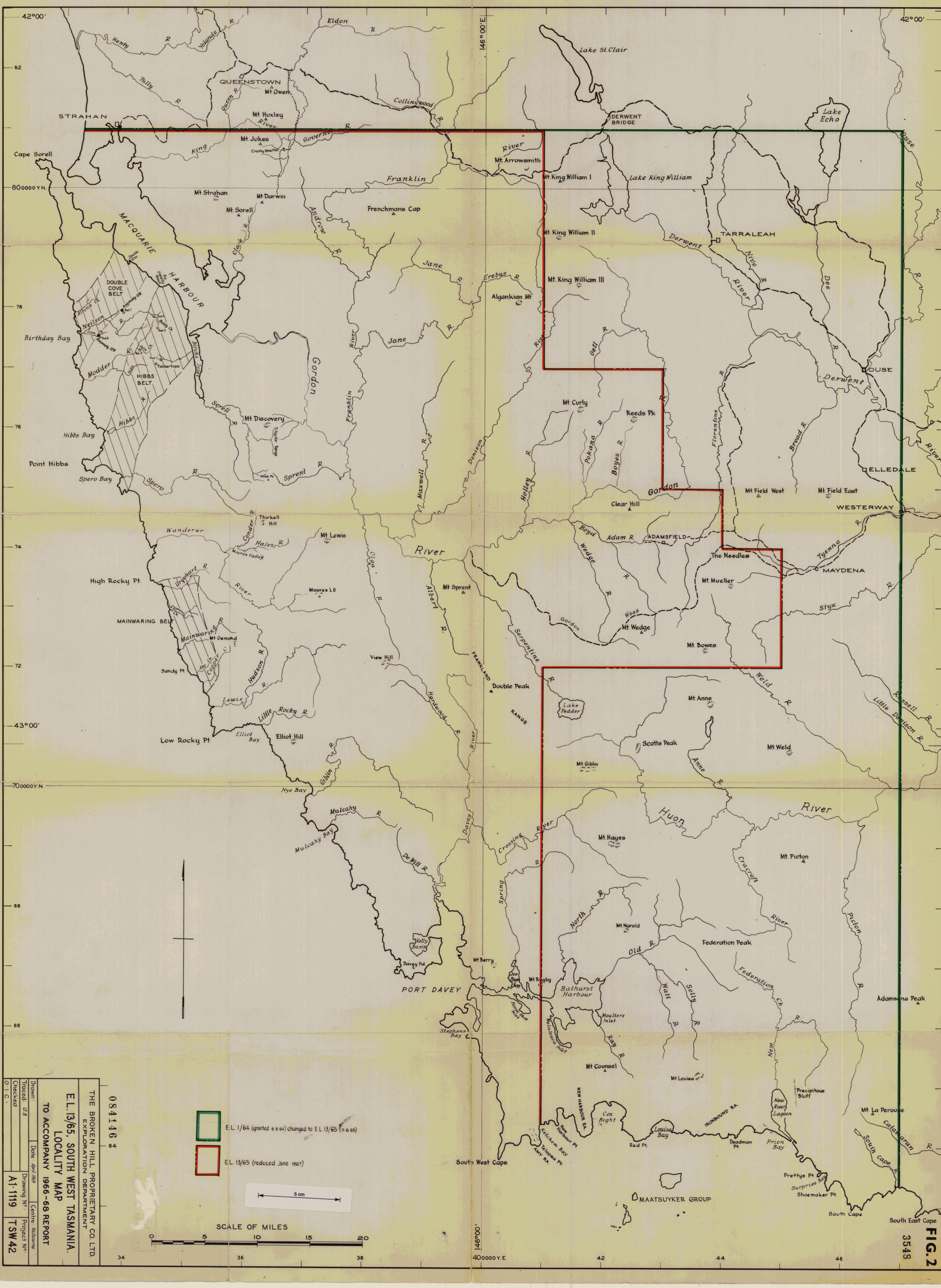
FIG. I.
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT
E.L. 13/65 SOUTH WEST TASMANIA
GEOLOGICAL MAP
Drawn S. Corbet
Traced A.S.Cz
Checked
O.I.C.
Date 28-10-69
Centre Melbourne
TSW-46
A1-1130
084145
5 cm
CAPE SORELL
MACQUARIE HARBOUR
POINT HIBBS
LOW ROCKY POINT
PORT DAVEY
SOUTH WEST CAPE
LAKE PEDDER
Maydena
Gordon
Wanderer R.
Urquhart R.
Cypress Ck.
Mainwaring R.
Copper Ck.
Spero R.
Hibbs R.
Modder R.
Nelson R.
Noddy Ck.
800 000 y.N
700000 y.N.
400 000 y.E
SCALE
5 4 3 2 1 0 5 10 15 MILES
QUATERNARY
Gravel, alluvium, dune sand, moraine
TERTIARY
Tms Macquarie Beds
JURASSIC
Jdl Dolerite
TRIASSIC
Ћ Sandstone and siltstone
PERMIAN
P Undifferentiated sediments
DEVONIAN
Ds Spero Bay Group
Dg Granite
D Undifferentiated sediments
Db Bell shale
Df Florence Quartzite
SILURIAN
S Undifferentiated sediments
ORDOVICIAN
Of Florentine Valley Mudstone
Og Gordon Limestone
Oc Caroline Creek Sandstone
Oo Owen Conglomerate
CAMBRIAN
€jb Jukes Breccia
€c Upper Cambrian Sandstones
Dundas Group
€d Undifferentiated
€ds Greywacke conglomerate
€da Argillite siltstone
Igneous rocks associated with Dundas Group
€qp Quartz porphyry
€fp Feldspar porphyry
€di Diorite
€g Gabbro
€s Pyroxenite serpentinite.
€rvr Mt. Read Volcanics
€vl Lucas Volcanics
€vb Noddy Creek Volcanics
Birthday Group
€ba Argillite, schist, phillite
€bl Limestone
Mainwaring Group
€m Undifferentiated green volcanics
€mt Tuff
€ma Phillite, schist
Lewis Volcanics
€lvr Rhyolite, ignimbrite (?)
€gr Granite
€efp Quartz-feldspar
PROTEROZOIC
Undifferentiated Proterozoic
Po Modder Group
Pv Varna Group
Solly Group
Plgs Graphitic schist
Plcs Chloritic schist
Plqt Quartzite
Younger Proterozoic
Bathurst Group
Pbc Conglomerate / breccia
Pbs Turbidites
Pba Argillite / phyllite
Jane Group
Pjd Dolomite
Clark Group
Pcd Dolomite
Pcp Phillite slate
Pcq Quartzite
Pcc Conglomerate
Pcs Sandstone, minor conglomerates
Older Proterozoic
Chlorite Grade Rocks
Arthur Group
Paqt Quartzite
Paqs Quartz (sericite) schist
Pags Graphite
Pacs Chloritic schist
Mary Group
Pmqt Quartzite
Pmqs Quartz schist
Pmp Phyllite
Fincham Group
Pfiqs Quartz schist
Pfip Phyllite
Garnet and Biotite Grade Rocks
Davey Group
Pdps Pelitic (graphitic) schist
Pdks Knotted (albite and garnet) schist.
Pdcs Chloritic schist
Franklin Group
Pfqt Quartzite
Pfs Schist
Pgp Governor River Phillite



084146

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EXPLORATION DEPARTMENT

E.L. 13/65, SOUTH WEST TASMANIA.
LOCALITY MAP
TO ACCOMPANY 1966-68 REPORT

Drawn: | Traced: | Checked: | O.I.C.: | Date April 1969 | Drawing No A1·1119 | Centre Melbourne | Project No TSW 42

FIG. 2

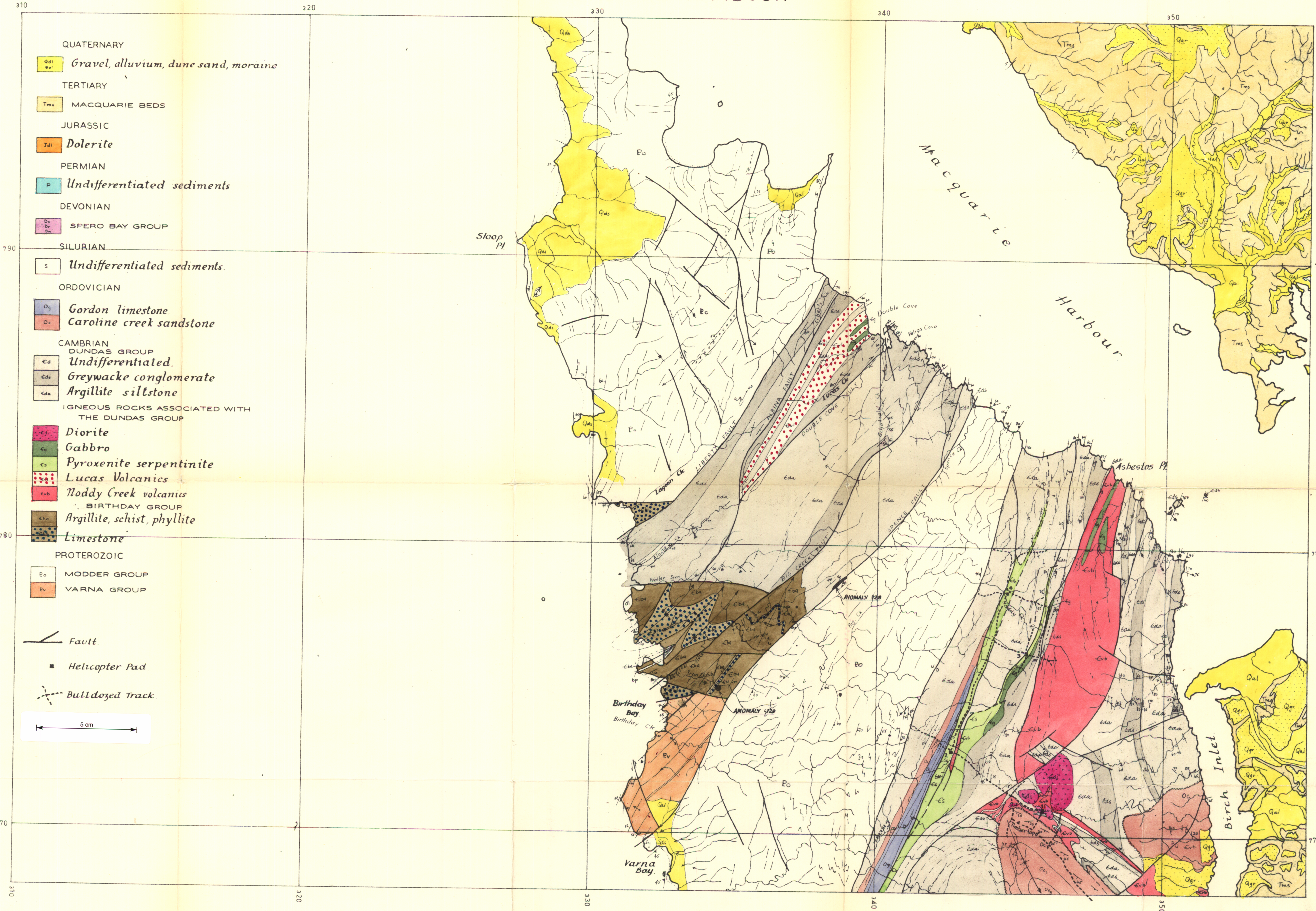
3548

69-555

69-555

FIG. 3A

MACQUARIE HARBOUR



084147

Fig. No: 3a
To accompany: 1967-8 Report No 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 13/65 SOUTH WEST TASMANIA
I MILE GEOLOGICAL MAP–MACQUARIE HARBOUR (DOUBLE COVE & HIBB BELTS)

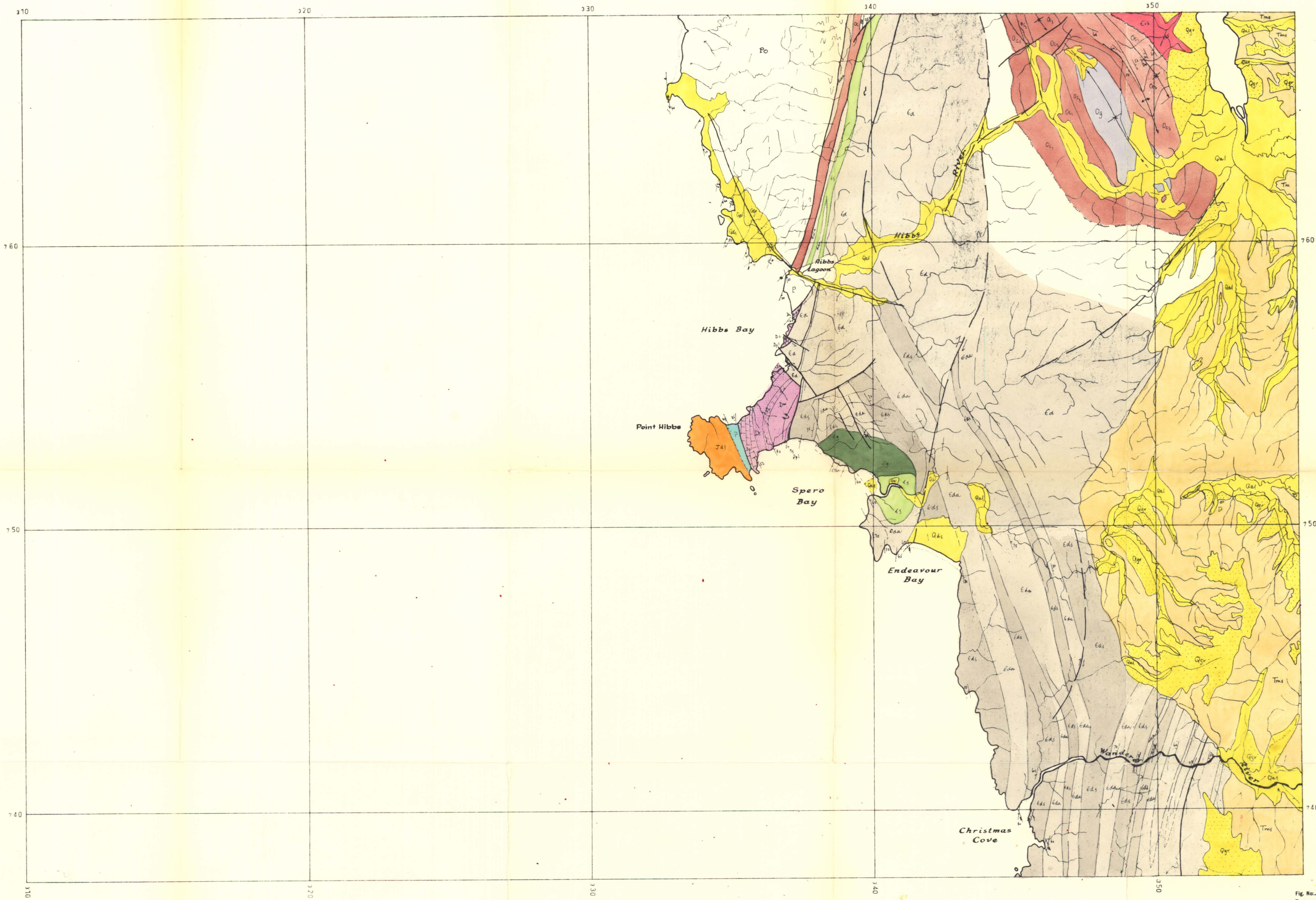
Drawn: M.H.	Date: 1968	Centre: Melbourne
Traced: K.H.	Drawing No:	Project No:
Checked:	A1-1131	TSW-47
O.I.C.:		

3549

69-555

FIG. 3B

POINT HIBBS



084148

Fig. No: 3b
To accompany: 1967-8 Report Nº 793
Dated: April 1969

LEGEND

REFER TO MACQUARIE HARBOUR SHEET

PLAN NO. A1-1131

5 cm

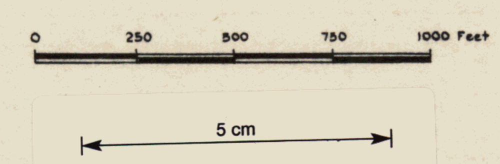
THE BROKEN HILL PROPRIETARY CO. LTD. EXPLORATION DEPARTMENT		
E.L. 13/65 SOUTH WEST TASMANIA I MILE GEOLOGICAL MAP – POINT HIBBS (DOUBLE COVE & HIBB BELTS)		
Drawn M.H.	Date 1968	Centre Melbourne
Traced K.H. / Checked / O.I.C.	Drawing No: A1-1132	Project No: TSW-48

3550

A1-1132

69-555

FIG. 4A



084149

Fig. No: 4a
To accompany: 1967-8 Report No 793
Dated: April 1969

SHEET DC 18

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EXPLORATION DEPARTMENT

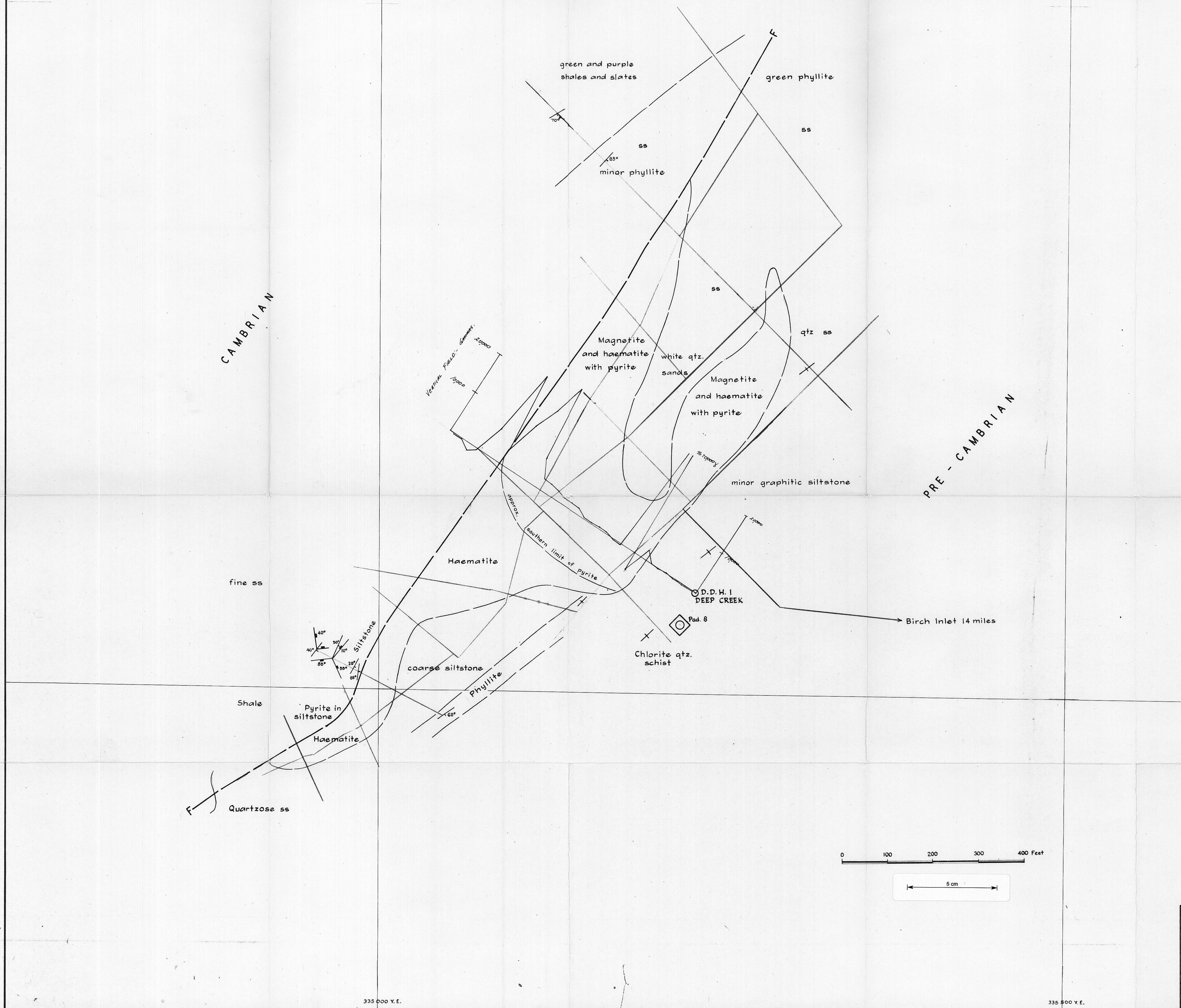
E.L. 13/65 SOUTH WEST TASMANIA
GEOLOGICAL MAP – ANOMALY 128
MIDDLE CREEK

Drawn:	Date: 6 - 3 - 68	Centre: Melbourne
Traced:	Drawing No:	Project No:
Checked:	A1-1133	TSW-49
O.I.C.:		

3551

69-555

FIG. 4B



084150

Fig. No: 4b
To accompany: 1967-8 Report No 793
Dated: April 1969

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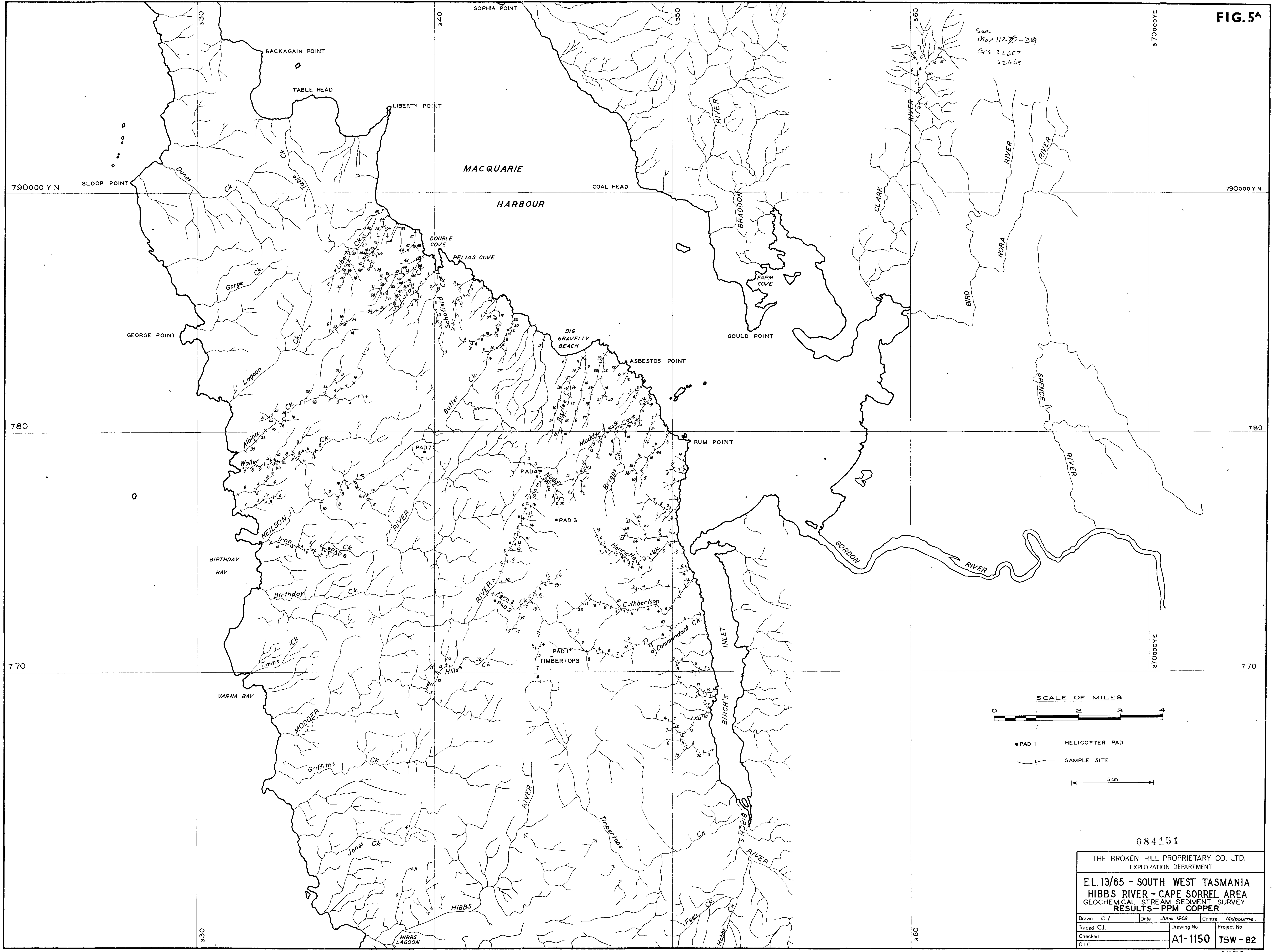
EXPLORATION DEPARTMENT

E.L. 13/65 SOUTH WEST TASMANIA
GEOLOGICAL MAP - ANOMALY 129
DEEP CREEK

Drawn: C. A.	Date: 6 - 3 - 68	Centre: Melbourne
Traced:	Drawing No: A1-1134	Project No: TSW-50
Checked:		
O.I.C.:		

3552



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EXPLORATION DEPARTMENT

E.L. 13/65 - SOUTH WEST TASMANIA
HIBBS RIVER - CAPE SORREL AREA
GEOCHEMICAL STREAM SEDIMENT SURVEY
RESULTS—PPM COPPER

Drawn C.I.	Date June 1969	Centre Melbourne	
Traced C.I.		Drawing No	Project No
Checked		A1-1150	TSW-82
OIC			

084152

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EXPLORATION DEPARTMENT

E.L. 13/65 - SOUTH WEST TASMANIA
HIBBS RIVER - CAPE SORREL AREA
GEOCHEMICAL STREAM SEDIMENT SURVEY
RESULTS - PPM ZINC

Drawn C.I.	Date June 1969	Centre Melbourne	
Traced C.I.		Drawing No	Project No.
Checked		A1-1151	TSW-83
O.I.C.			

3554

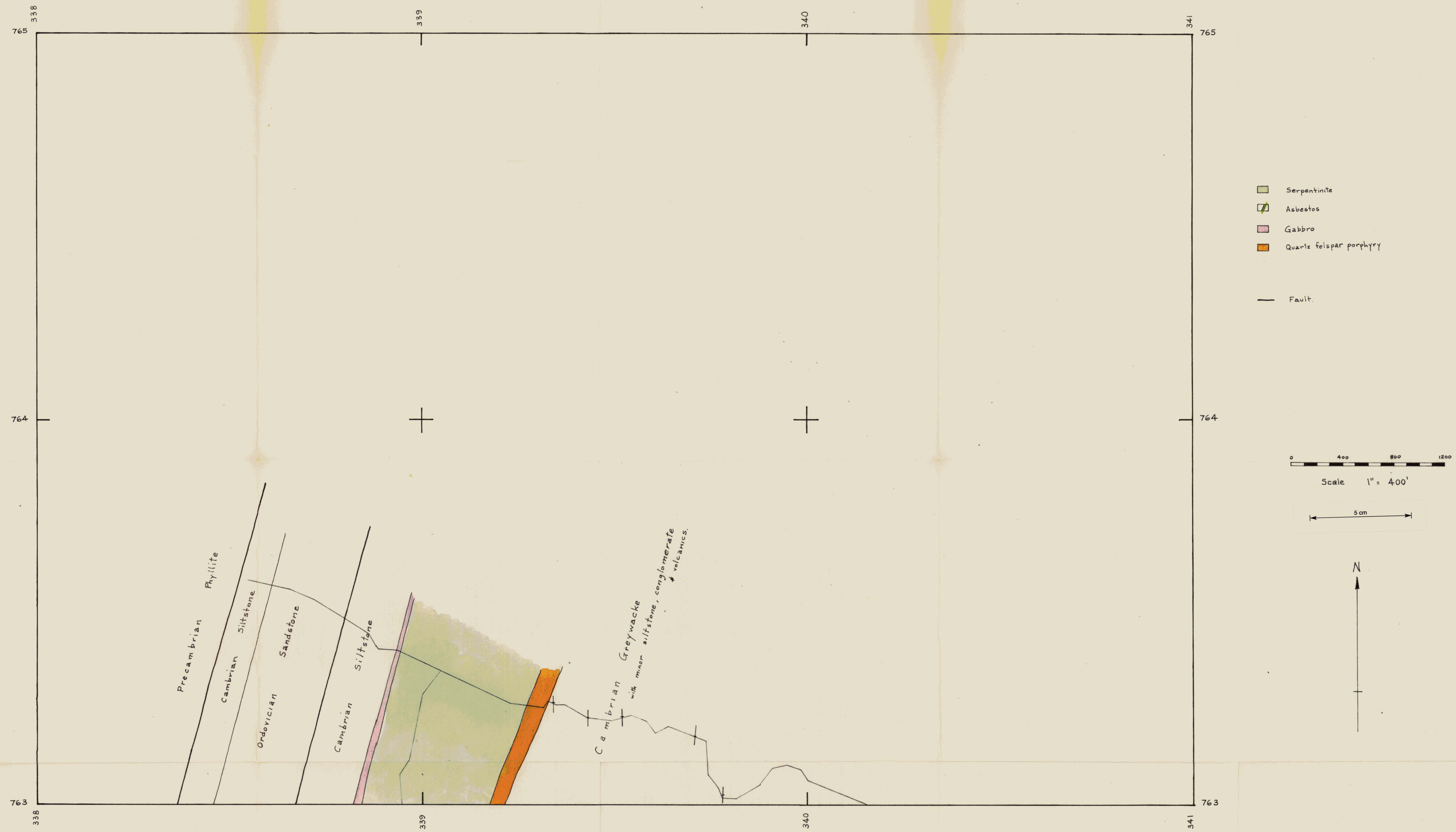
69-555


FIG. 5c
SOPHIA POINT
BACKAGAIN POINT
TABLE HEAD
LIBERTY POINT
SLOOP POINT
790000 Y N
MACQUARIE
HARBOUR
COAL HEAD
DOUBLE COVE
PELIAS COVE
GEORGE POINT
BIG GRAVELLY BEACH
ASBESTOS POINT
GOULD POINT
FARM COVE
RUM POINT
BIRTHDAY BAY
VARNA BAY
HIBBS LAGOON
Dunes Ck.
Table Ck.
Gorge Ck.
Lagoon Ck.
Liberty Ck.
Lucas Ck.
Schofield Ck.
Buller Ck.
Bowes Ck.
Muddy Cove Ck.
Albina Ck.
Waller Ck.
NEILSON RIVER
Iron Ck.
Muddy Ck.
Briggs Ck.
Henrietta Ck.
Birthday Ck.
RIVER
Fern Ck.
Cuthbertson Ck.
Commandant Ck.
Timms Ck.
Hills Ck.
MODDER
Griffiths Ck
Jones Ck
HIBBS RIVER
Timbertops
BIRCH'S INLET
BIRCH'S RIVER
Feen Ck.
Hobbs Ck.
PAD 1
PAD 2
PAD 3
PAD 4
PAD 7
PAD 8
TIMBERTOPS
BRADDON RIVER
CLARK RIVER
BIRD RIVER
NORA RIVER
SPENCE RIVER
GORDON RIVER
see maps 1126-29
330
340
350
360
370000 YE
780
770
SCALE OF MILES
0 1 2 3 4
• PAD 1 HELICOPTER PAD
SAMPLE SITE
5 cm
084153
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT
E.L. 13/65 - SOUTH WEST TASMANIA
HIBBS RIVER - CAPE SORREL AREA
GEOCHEMICAL STREAM SEDIMENT SURVEY
RESULTS-PPM NICKEL
Drawn C.I. Date June 1969 Centre Melbourne
Traced C.I.
Checked
OIC
Drawing No A1-1152
Project No TSW-84

3555

69-555

FIG. 6



084154

Fig. No: 6
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

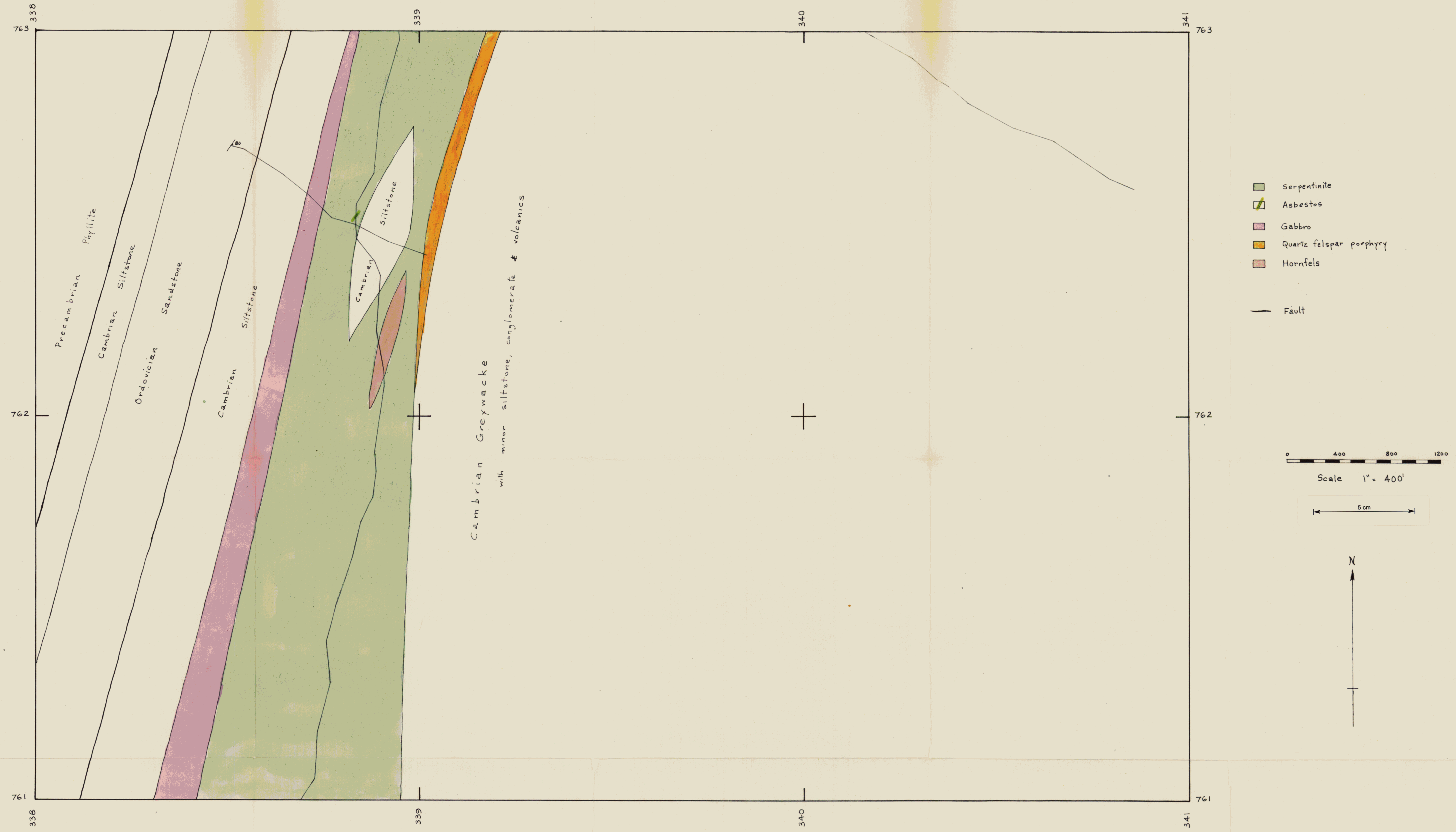
E.L.13/65 - SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
HIBBS LAGOON AREA
SHEET HB40

Drawn: P. McG	Date: 10-4-68	Centre: Melbourne
Traced:	Drawing No: A1-1135	Project No: TSW-51
Checked:		
O.I.C.:		

3556

69-555

FIG. 7



084155

Fig. No: 7
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

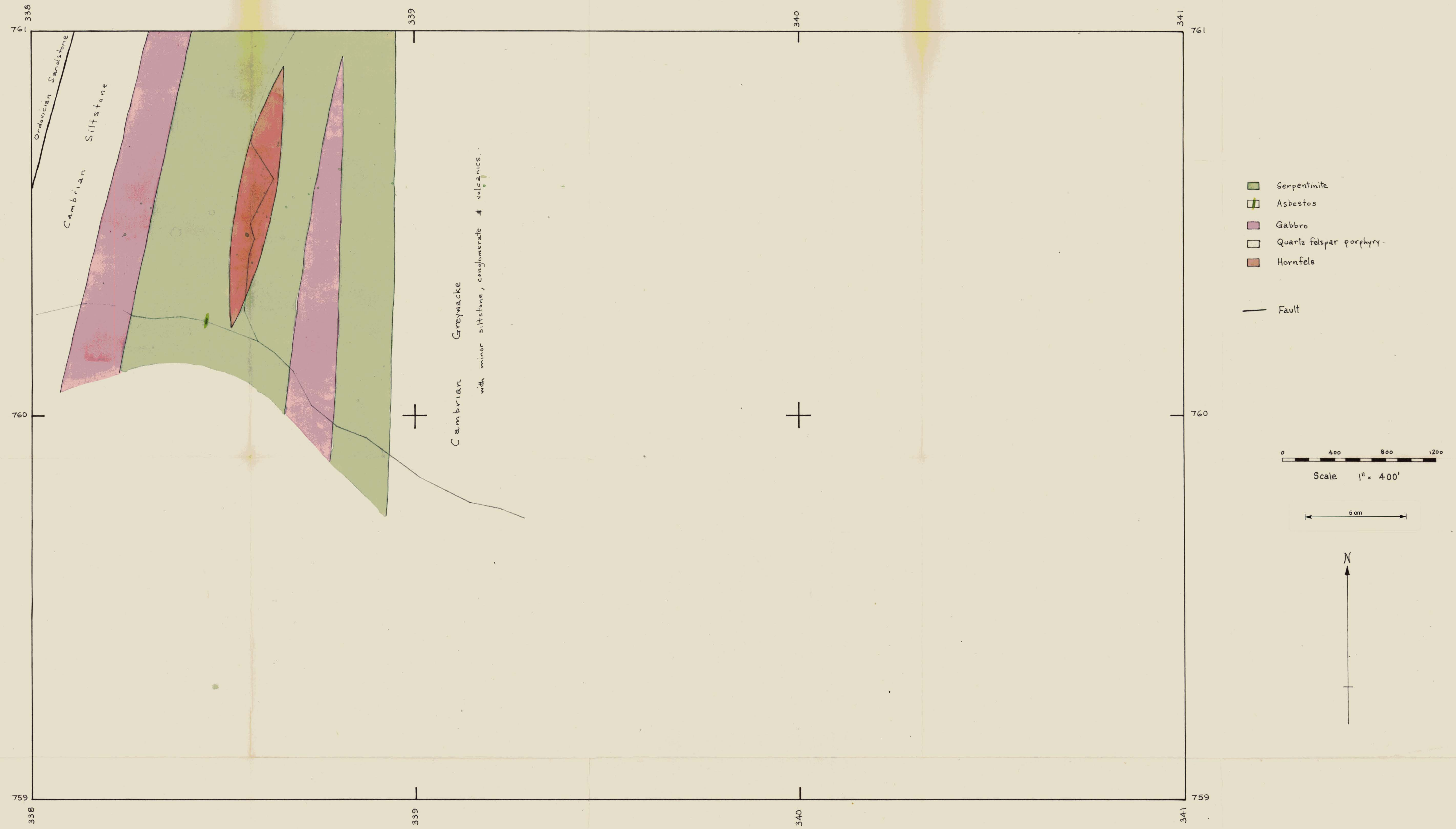
E.L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
HIBBS LAGOON AREA
SHEET HB45

Drawn: P. McG.	Date: 11-4-68	Centre: Melbourne
Traced:	Drawing No: A1-1136	Project No: TSW-52
Checked:		
O.I.C.:		

3557

69-555

FIG. 8



084156

Fig. No: 8
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD. EXPLORATION DEPARTMENT		
E.L. 13/65 ~ SOUTH WEST TASMANIA DETAIL GEOLOGICAL MAP HIBBS LAGOON AREA SHEET HB 50		
Drawn: P. McG.	Date: 11 - 4 - 68	Centre: Melbourne
Traced: Checked: O.I.C.:	Drawing No: A1- 1137	Project No: TSW -53

3558

69-555

FIG. 9

084157

Fig. No: 9
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

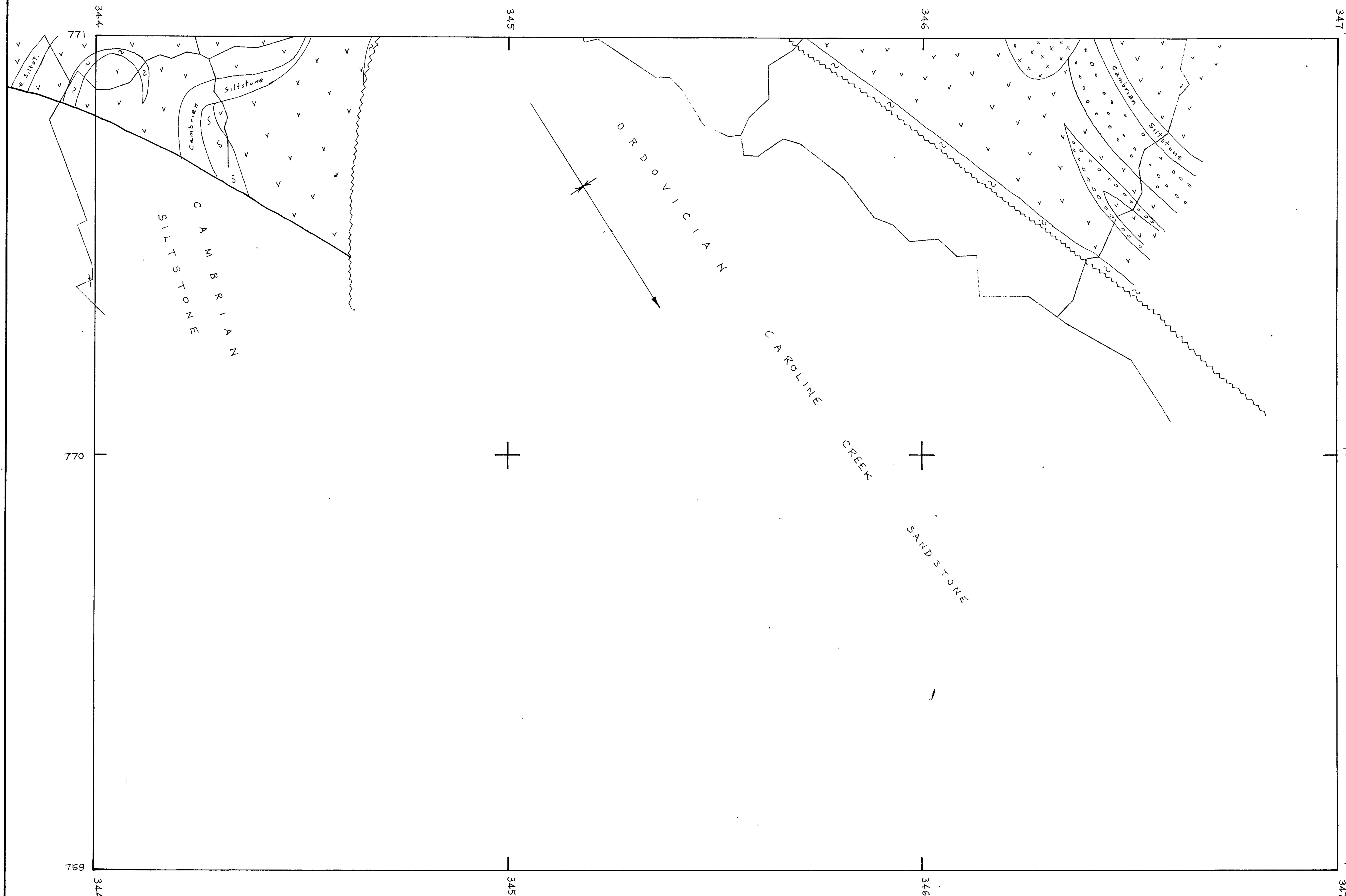
E.L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
TIMBERTOPS AREA
SHEET HB 22

Drawn: P. McG.	Date: 3-5-68	Centre: Melbourne
Traced:	Drawing No: A1-1138	Project No: TSW-54
Checked:		
O.I.C.:		

3559

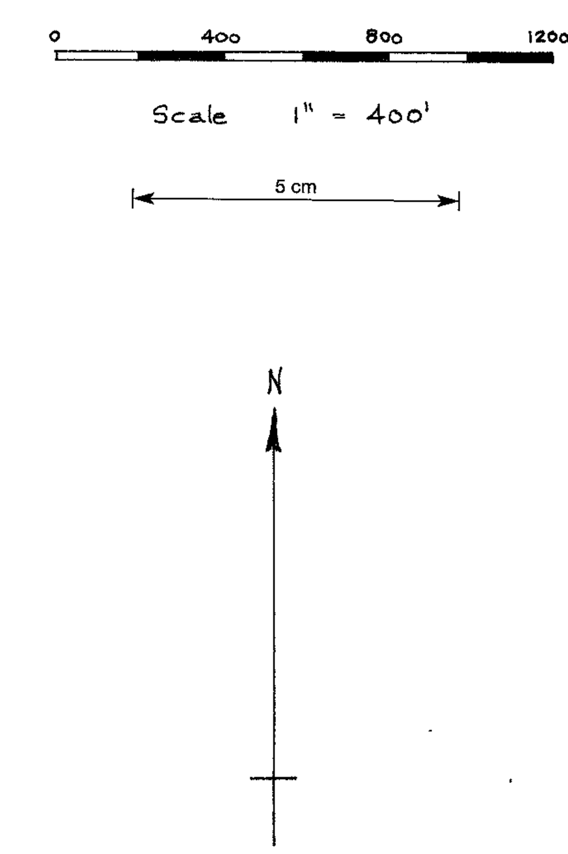
69-555

FIG 10.



GEOLOGICAL KEY

- Hornblende Diorite
- Green Chloritic Diorite
- Andesite
- Conglomerate
- Fault



084158

Fig. No: 10
To accompany 1967-8 Report No 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
TIMBERTOPS AREA
SHEET HB 27

Drawn P.McG.	Date 3-5-68	Centre Melbourne
Traced	Drawing No	Project No.
Checked	A1-1139	TSW-55
OIC.		

3500

69-555

FIG. 11

GEOLOGICAL KEY

- Serpentinite & Pyroxenite
- Talc, sheared serpentinite, quartz greywacke with graphite
- Fault

0 400 800 1200

Scale 1" = 400'

5 cm

N

084159

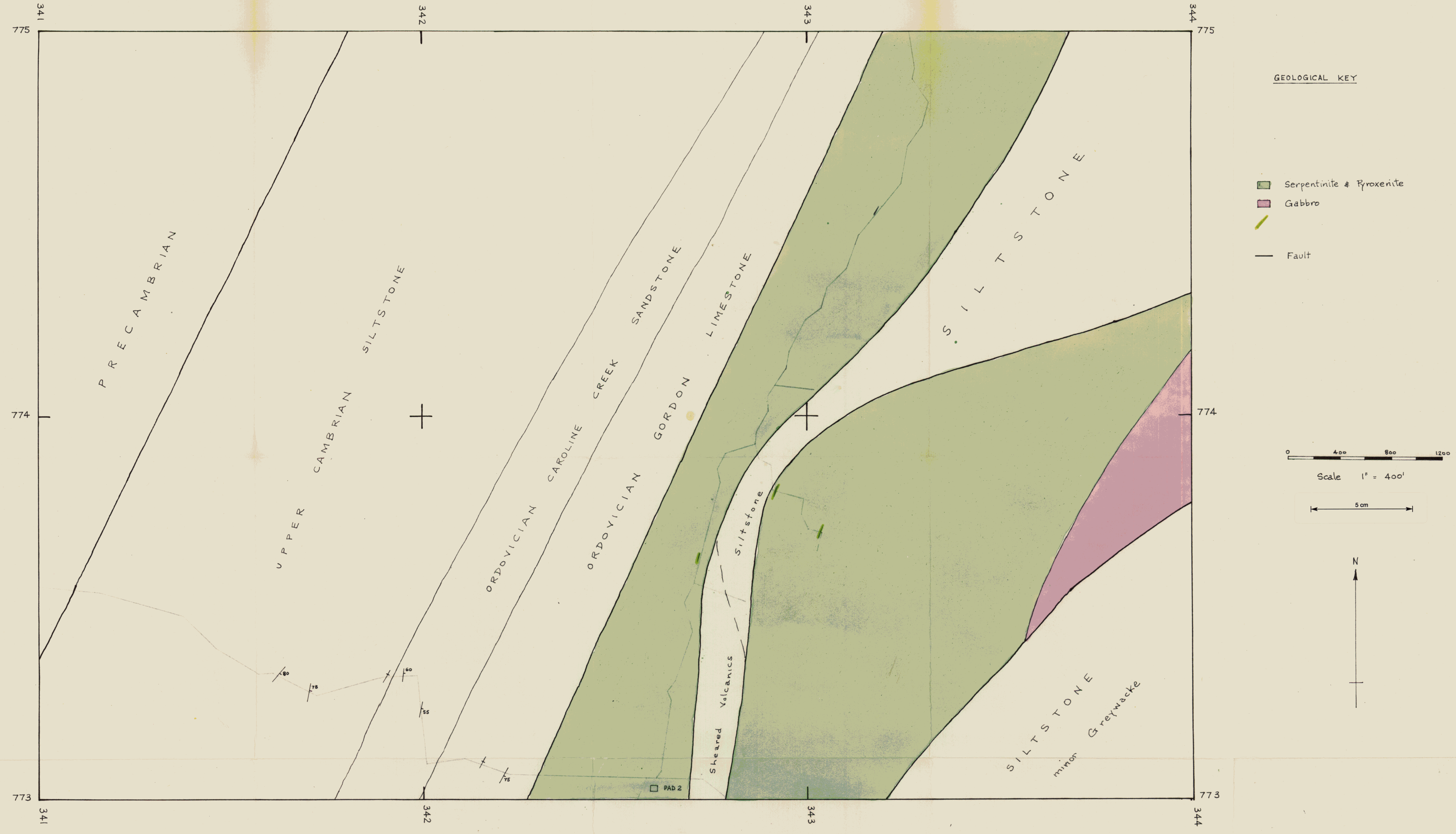
Fig. No: 11
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD. EXPLORATION DEPARTMENT		
E.L. 13/65 SOUTH WEST TASMANIA DETAIL GEOLOGICAL MAP AREA NORTH OF FERN CREEK SHEET HB 13		
Drawn: P. McG.	Date: 3-5-68	Centre: Melbourne
Traced: Checked: O.I.C.:	Drawing No: A1-1140	Project No: TSW-56

3561

69-555

FIG. 12



084160

Fig. No: 12
To accompany: 1967-8 Report No 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

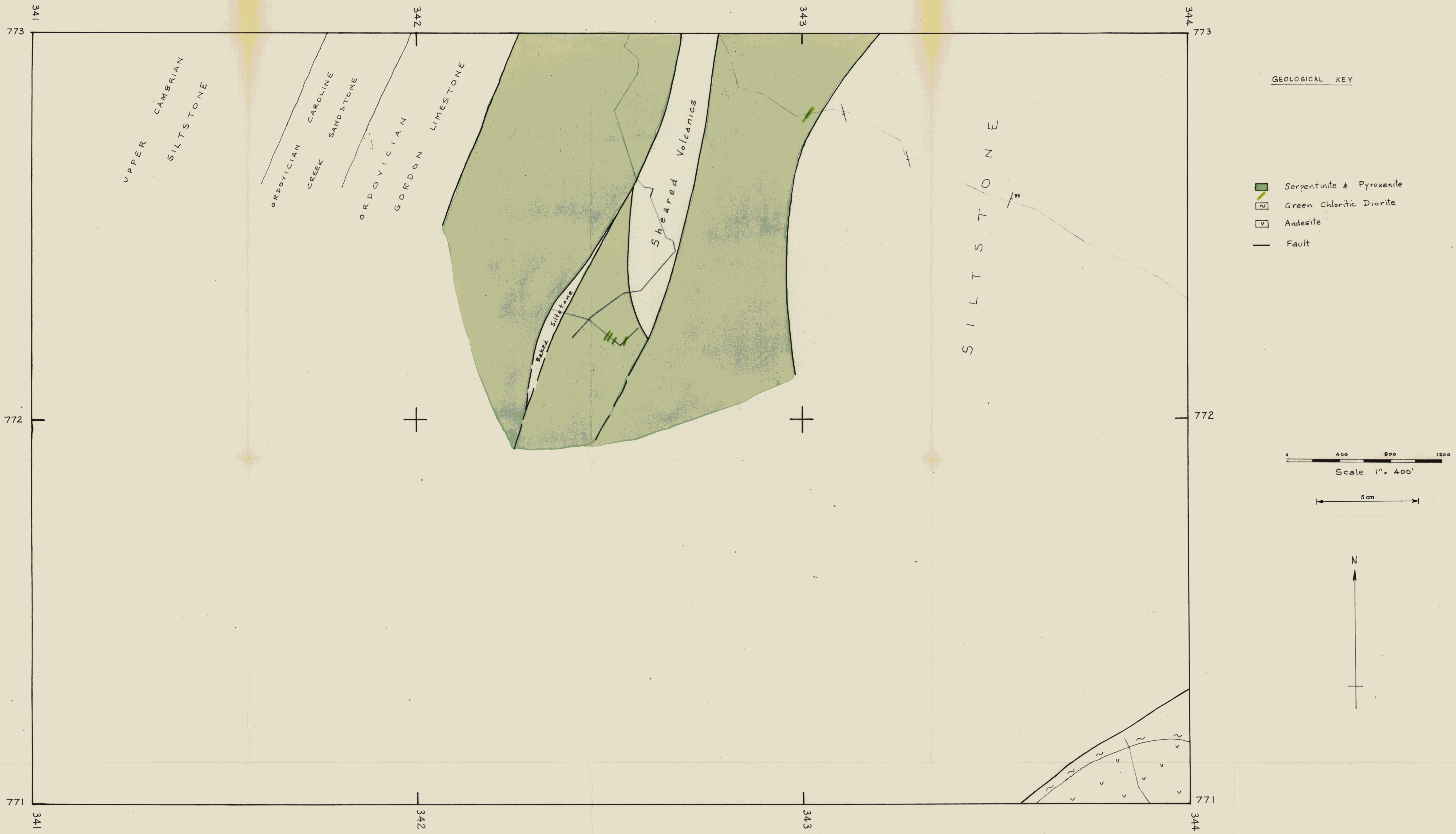
E.L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
FERN CREEK AREA
SHEET HB 17

Drawn: P. McG	Date: 3-5-68	Centre: Melbourne
Traced:	Drawing No: A1-1141	Project No: TSW-57
Checked:		
O.I.C.:		

3562

69-555

FIG. 13



084161

Fig. No: 13
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E. L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
FERN CREEK AREA
SHEET HB 21

Drawn: P. McG.	Date: 3-5-68	Centre: Melbourne
Traced:	Drawing No:	Project No:
Checked:	A1-1142	TSW-58
O.I.C.:		

3563

69-555

FIG. 14

084162

Fig. No: 14
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
NODDY CREEK AREA.
SHEET HB 6

Drawn: P. McG.	Date: 2 - 5 - 68	Centre: Melbourne
Traced:	Drawing No: A1-1143	Project No: TSW-59
Checked:		
O.I.C.:		

3564

69-555

FIG. 15

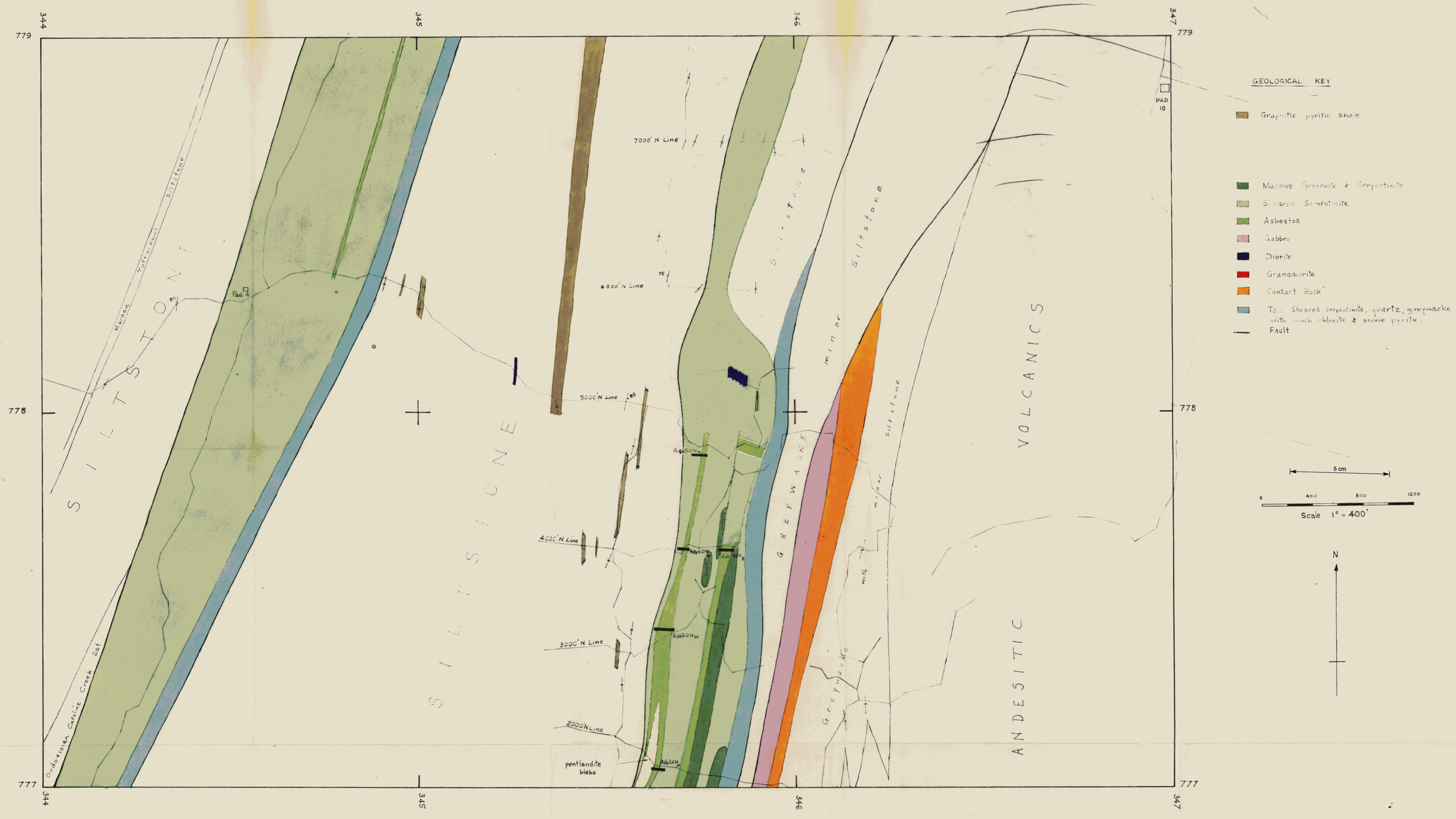


Fig. No: 15
To accompany: 1967-8 Report No 793
Dated: April 1969

084163

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
NODDY CREEK AREA.
SHEET HB 10

Drawn: P. McG	Date: 13-2-68	Centre: Melbourne
Traced:	Drawing No: A1-1144	Project No: TSW-60
Checked:		
C.I.C.:		

3565

69-555

FIG. 16

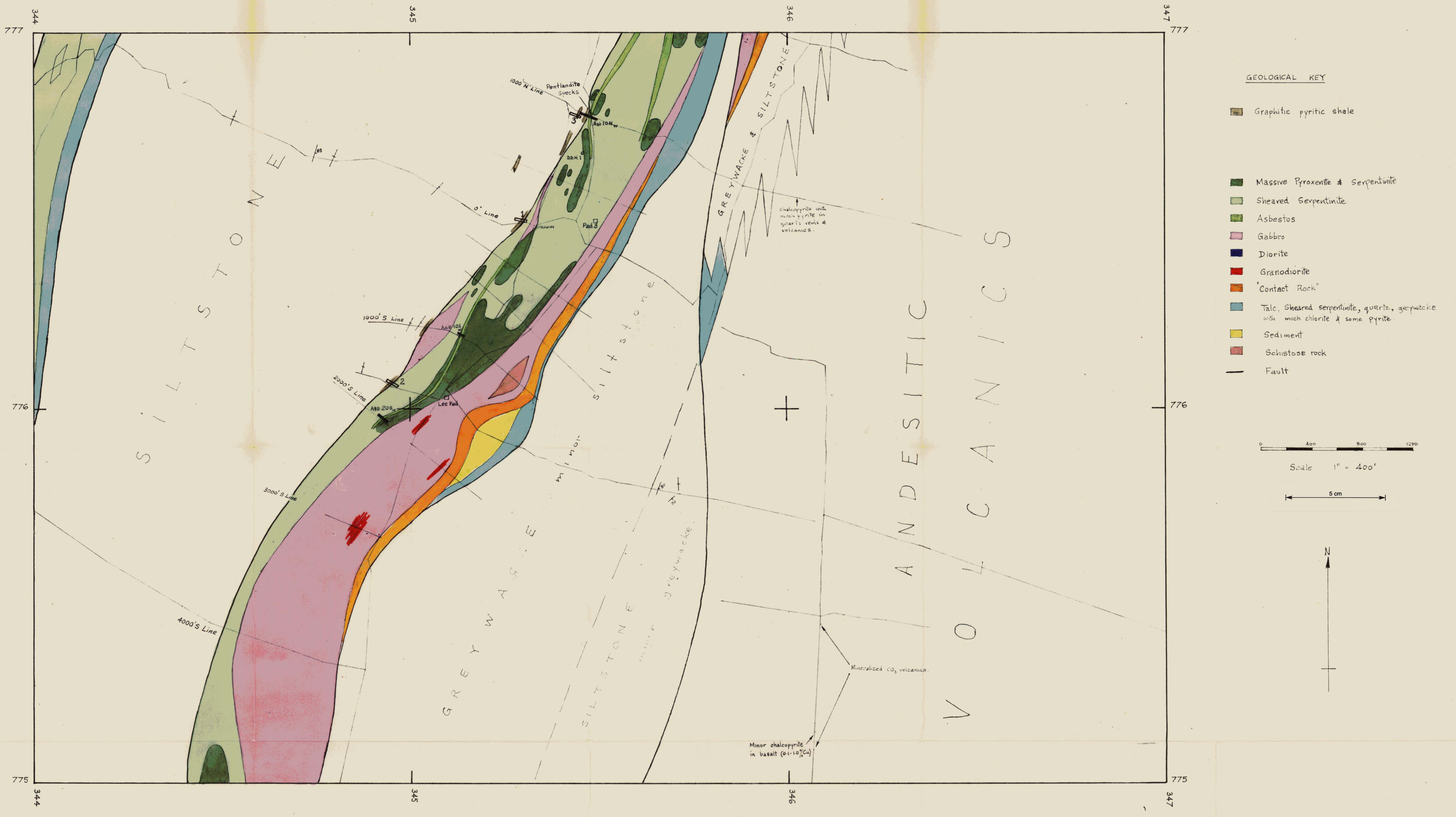


Fig. No. 16
To accompany: 1967-8 Report Nº 793
Issued: April 1969

084164

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

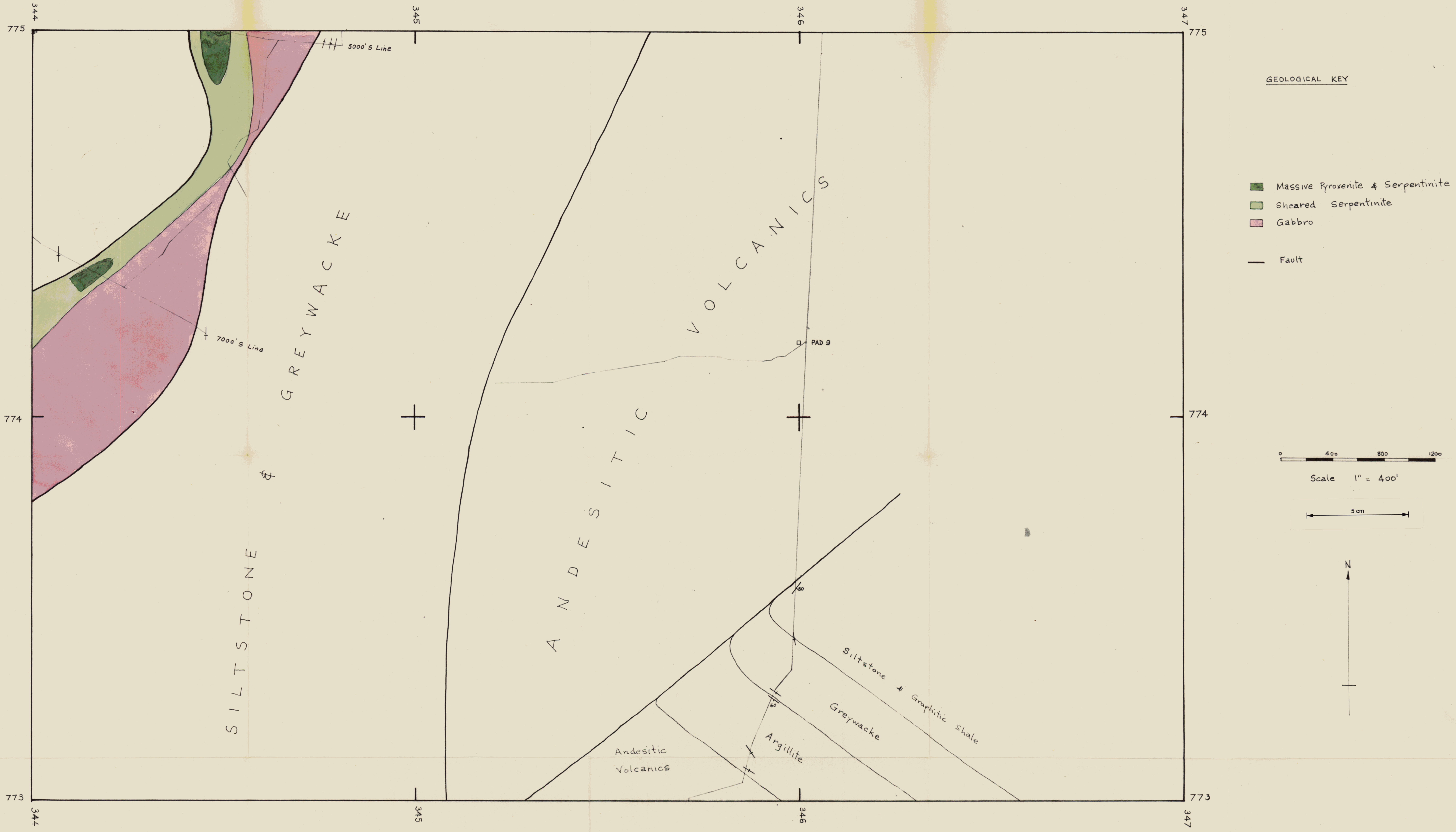
E.L. 13/65 SOUTH WEST TASMANIA
DETAIL GEOLOGICAL MAP
NODDY CREEK AREA
SHEET HB 14

Drawn: P. McG.	Date: 12-2-68	Centre: Melbourne
Traced:	Drawing No: A1-1145	Project No: TSW-61
Checked:		
O.I.C.:		

3566

69-555

FIG. 17



084165

Fig. No: 17
To accompany: 1967-8 Report Nº 793
Dated: April 1969

THE BROKEN HILL PROPRIETARY CO. LTD. EXPLORATION DEPARTMENT		
E.L. 13/65 SOUTH WEST TASMANIA DETAIL GEOLOGICAL MAP NODDY CREEK AREA SHEET HB 18		
Drawn: P. McG	Date: 3-5-68	Centre: Melbourne
Traced: Checked: O.I.C.:	Drawing No: A1-1146	Project No: TSW-62

3567

69-555

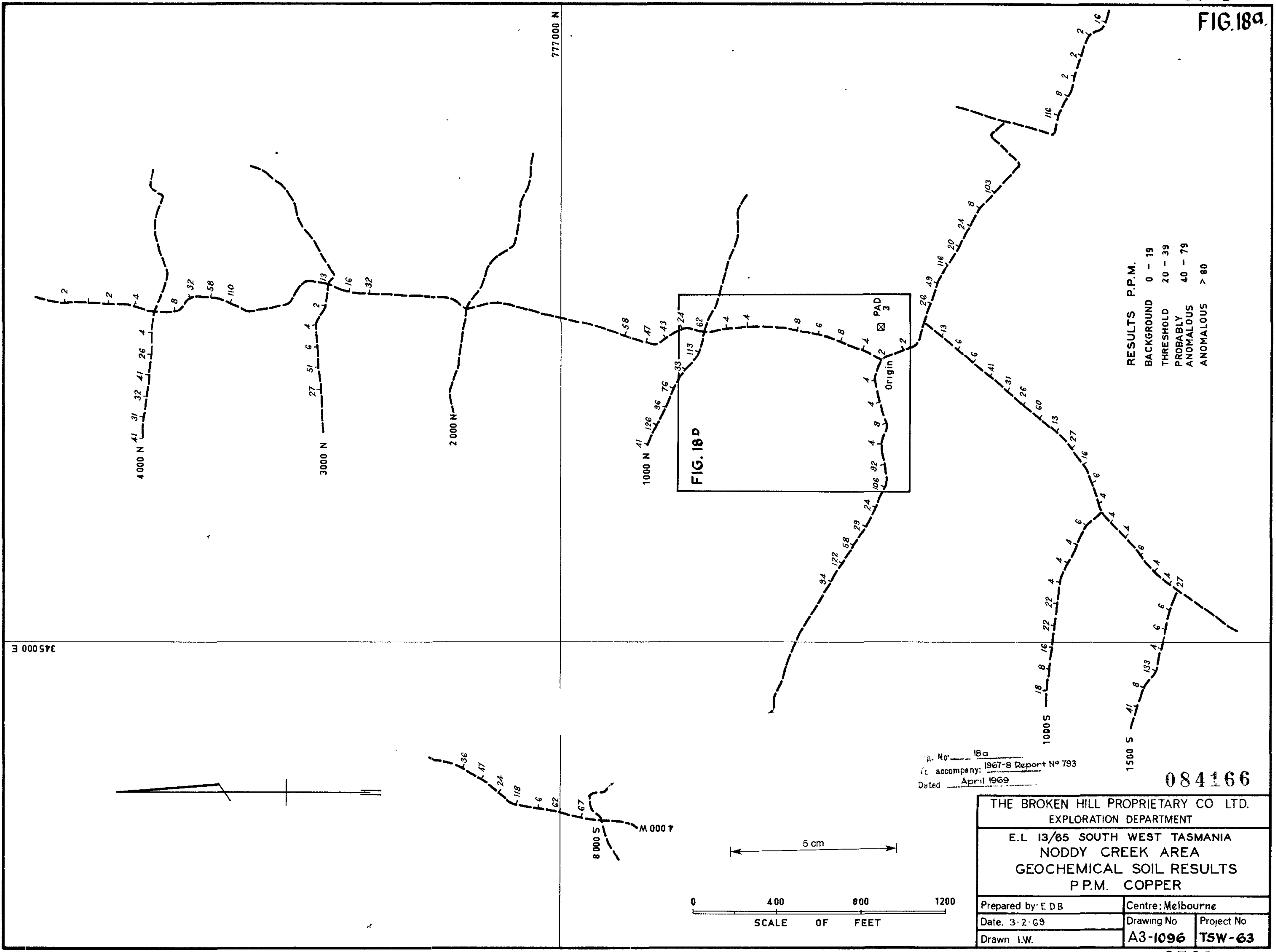


Fig. No. 18a
To accompany: 1967-8 Report No 793
Dated April 1969

084166

THE BROKEN HILL PROPRIETARY CO LTD.
EXPLORATION DEPARTMENT

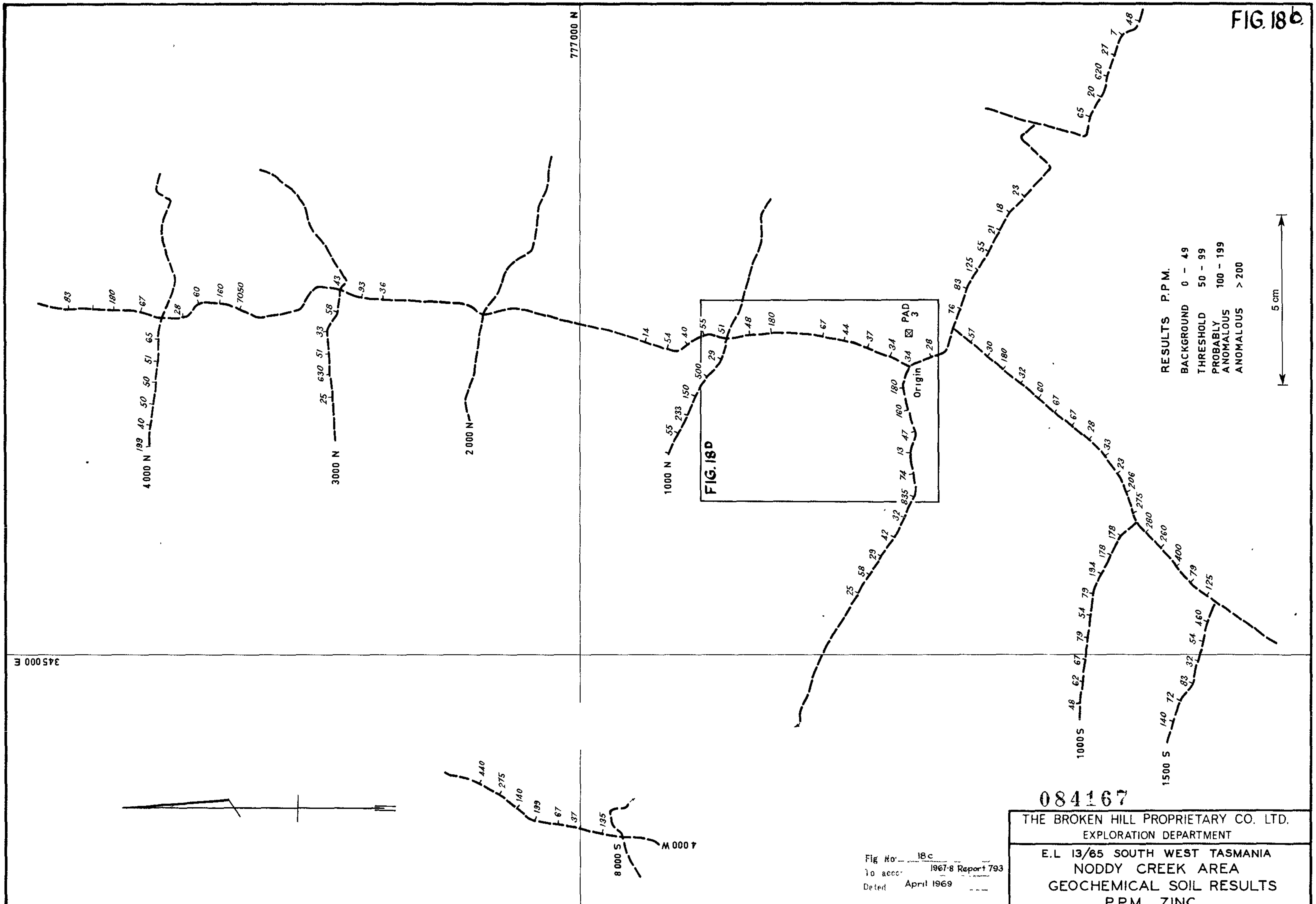
E.L 13/65 SOUTH WEST TASMANIA
NODDY CREEK AREA
GEOCHEMICAL SOIL RESULTS
P.P.M. COPPER

Prepared by: E D B	Centre: Melbourne	
Date. 3-2-69	Drawing No	Project No
Drawn I.W.	A3-1096	TSW-63

3568

69-555

FIG. 18b



084167

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L 13/65 SOUTH WEST TASMANIA
NODDY CREEK AREA
GEOCHEMICAL SOIL RESULTS
P.P.M ZINC

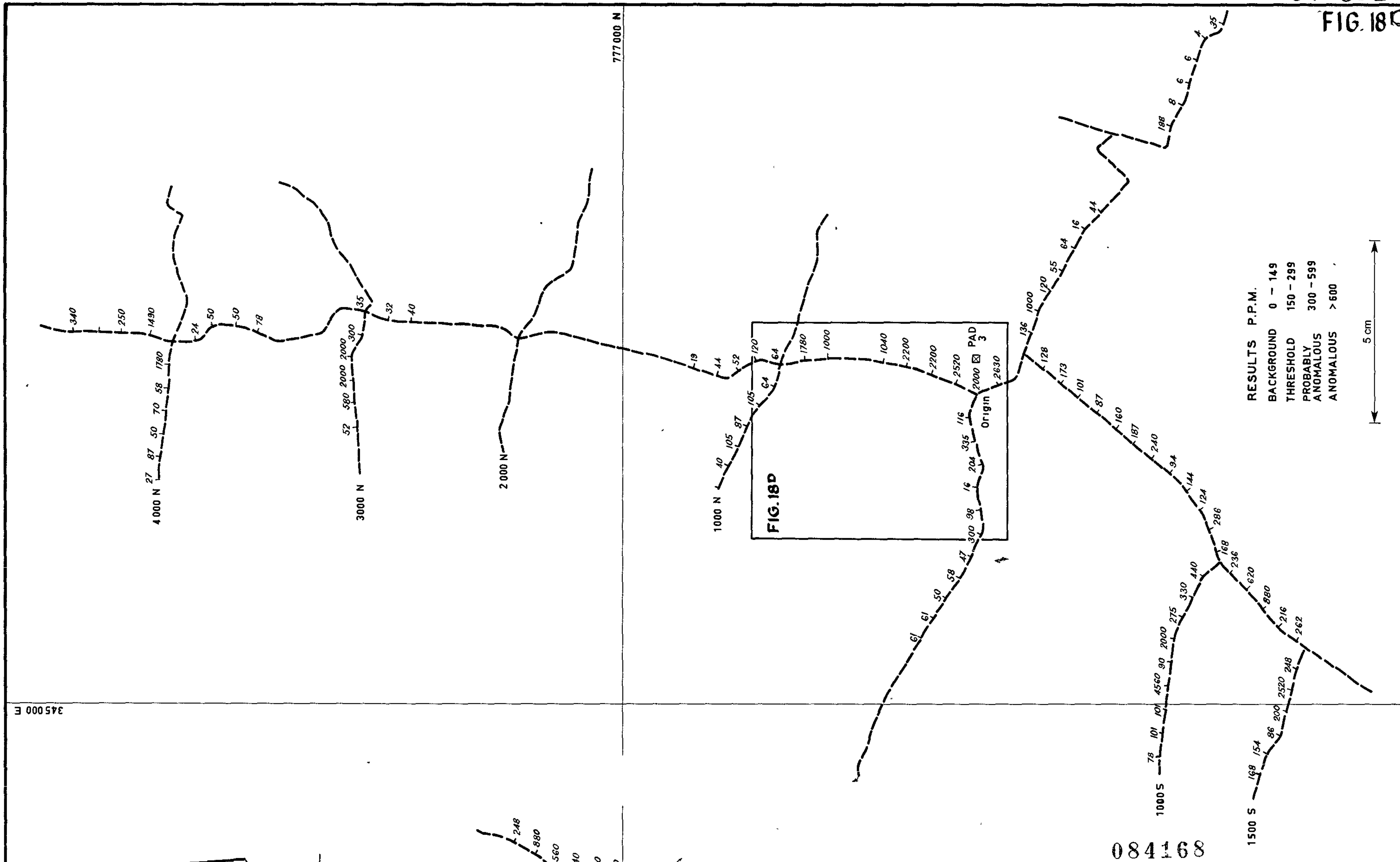
Fig No 18c
To accompany 1967-8 Report 793
Dated April 1969

Prepared by E.D.B.	Centre: Melbourne	
Date 3-2-69	Drawing No A3-1097	Project No TSW-64
Drawn. I.W.		

3570

69-555

FIG. 18C



084168

Fig. No 18 b
To accompany 1967-8 Report 793
Dated. April 1969

0 400 800 1200
SCALE OF FEET

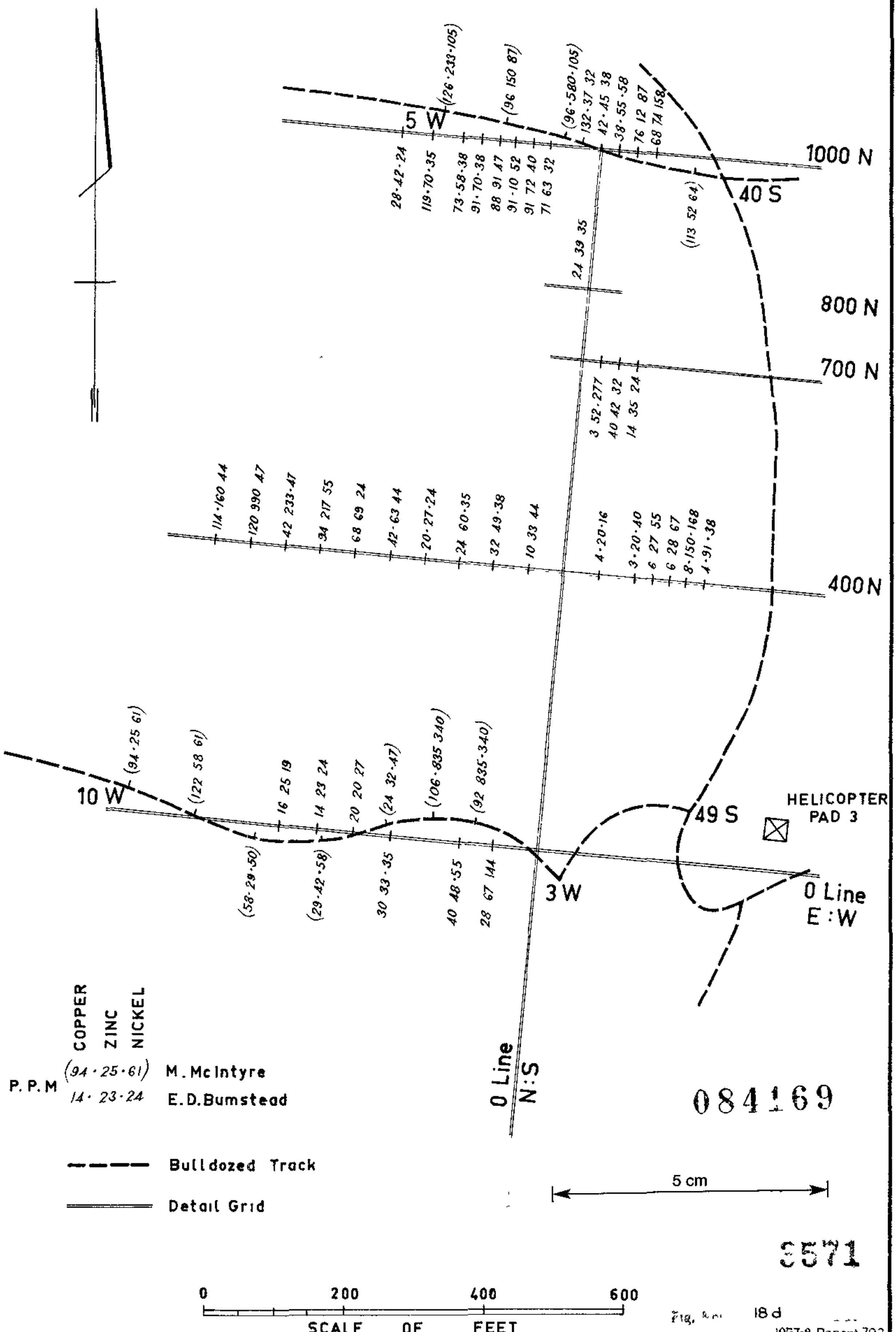
THE BROKEN HILL PROPRIETARY CO LTD.
EXPLORATION DEPARTMENT

E.L. 13/65 SOUTH WEST TASMANIA
NODDY CREEK AREA
GEOCHEMICAL SOIL RESULTS
P.P.M. NICKEL

Prepared by: E.D.B	Centre: Melbourne
Date. 3-2-69	Drawing No: A3-1098 / Project No TSW-65
Drawn I.W	

3569

FIG. 18d.



084169

3571

69-555

Fig. No. 18 d
1967-8 Report 793
Date April 1969

Centre Melbourne	THE BROKEN HILL PROPRIETARY CO LTD E.L. 13/65 SOUTH WEST TASMANIA NODDY CREEK AREA GEOCHEMICAL RESULTS - P.P.M. COPPER, ZINC, NICKEL	Project No TSW-66
Date 3·2 69		Drawing No A4/ 1143

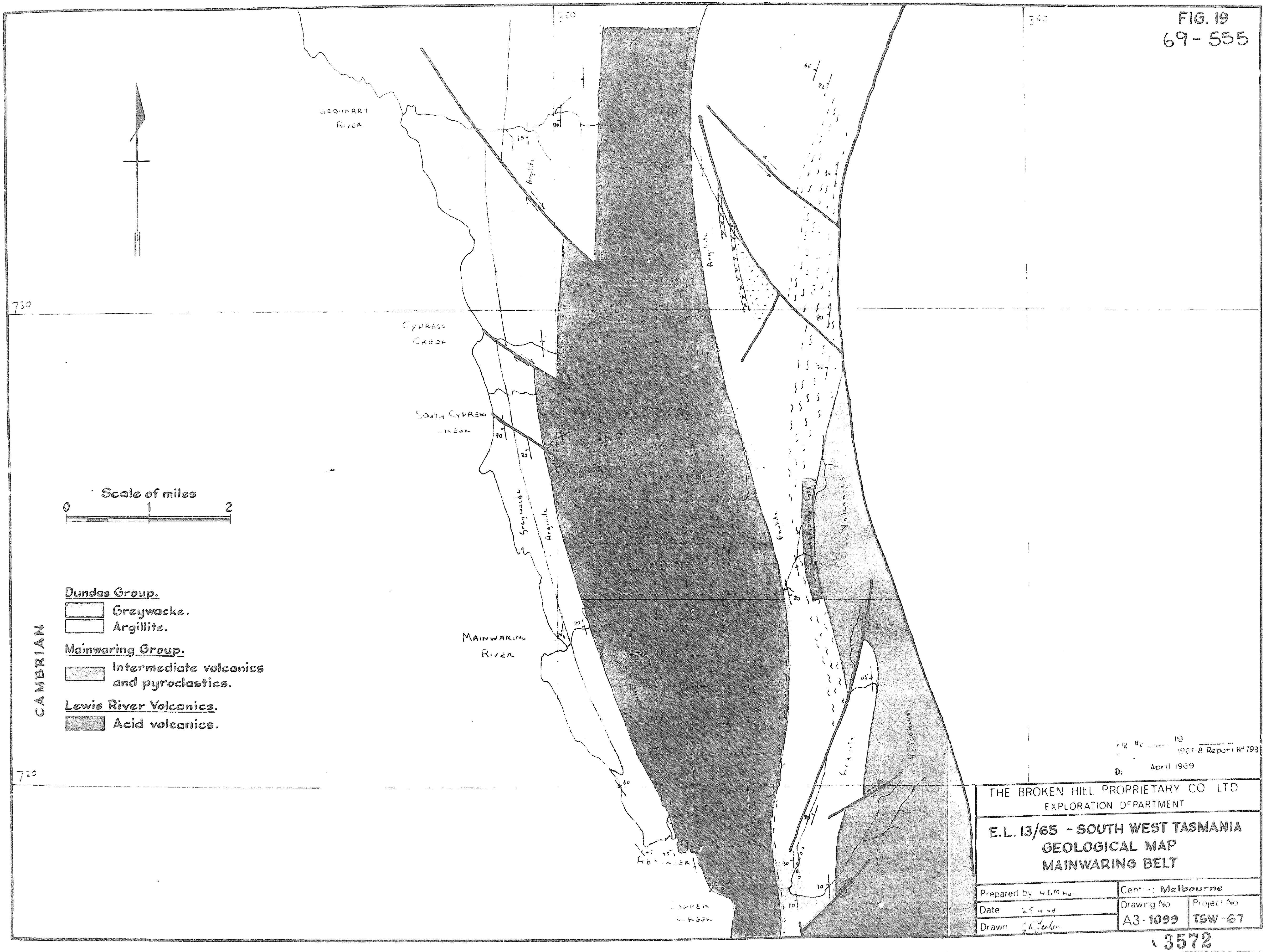


FIG. 19
69-555
URQUHART RIVER
Argillite
CYPRESS CREEK
SOUTH CYPRESS CREEK
Greywacke
Argillite
MAINWARING RIVER
Volcanics
Volcanics
Scale of miles
0 1 2
CAMBRIAN
Dundas Group.
Greywacke.
Argillite.
Mainwaring Group.
Intermediate volcanics and pyroclastics.
Lewis River Volcanics.
Acid volcanics.
1967-8 Report No 793
April 1969
THE BROKEN HILL PROPRIETARY CO LTD
EXPLORATION DEPARTMENT
E.L. 13/65 - SOUTH WEST TASMANIA
GEOLOGICAL MAP
MAINWARING BELT
Prepared by
Centre Melbourne
Date
Drawing No
A3-1099
Project No
TSW-67
Drawn

3572


760000YN
HIBBS LAGOON
Thomas Ck.
HIBBS BAY
Evans Ck.
Oxley Ck.
POINT HIBBS
SPERO BAY
NEILSON COVE
Rt. McCarl
SPERO RIVER
Fern Ck.
Hobbs Ck.
SORELL RIVER
750
CONDOR POINT
ENDEAVOUR BAY
SPRENT RIVER
CONDER RIVER
Florance Ck.
WANDERER RIVER
740
CHRISTMAS COVE
HALES RIVER
WANDERER
HIGH ROCKY POINT
URQUHART RIVER
RIVER
730
Cypress Ck.
South Cypress Ck.
MAINWARING RIVER
RIVER
720
Abo Ck.
Ck.
Copper
SCALE OF MILES
0 1 2 3 4
5 cm
HUDSON RIVER
LEWIS
LITTLE ROCKY RIVER
710
LOW ROCKY POINT
360000YE
350
340
330
084171
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT
E.L. 13/65 - SOUTH WEST TASMANIA
POINT HIBBS - LOW ROCKY POINT
GEOCHEMICAL STREAM SEDIMENT SURVEY
RESULTS-PPM COPPER
Drawn C.I.
Traced C.I.
Checked
O.I.C.
Date June 1969
Centre Melbourne
Drawing No A1-1147
Project No TSW-68
FIG. 20A
69-555
3573

084172

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L. 13/65 - SOUTH WEST TASMANIA
POINT HIBBS - LOW ROCKY POINT
GEOCHEMICAL STREAM SEDIMENT SURVEY
RESULTS—PPM ZINC

Drawn C.I.	Date June 1969	Centre Melbourne	
Traced C.I.		Drawing No	Project No
Checked		A1-1148	TSW-69
O.I.C.			

3574

69-555

084173

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

EL. 13/65 - SOUTH WEST TASMANIA
POINT HIBBS - LOW ROCKY POINT
GEOCHEMICAL STREAM SEDIMENT SURVEY
RESULTS-PPM NICKEL

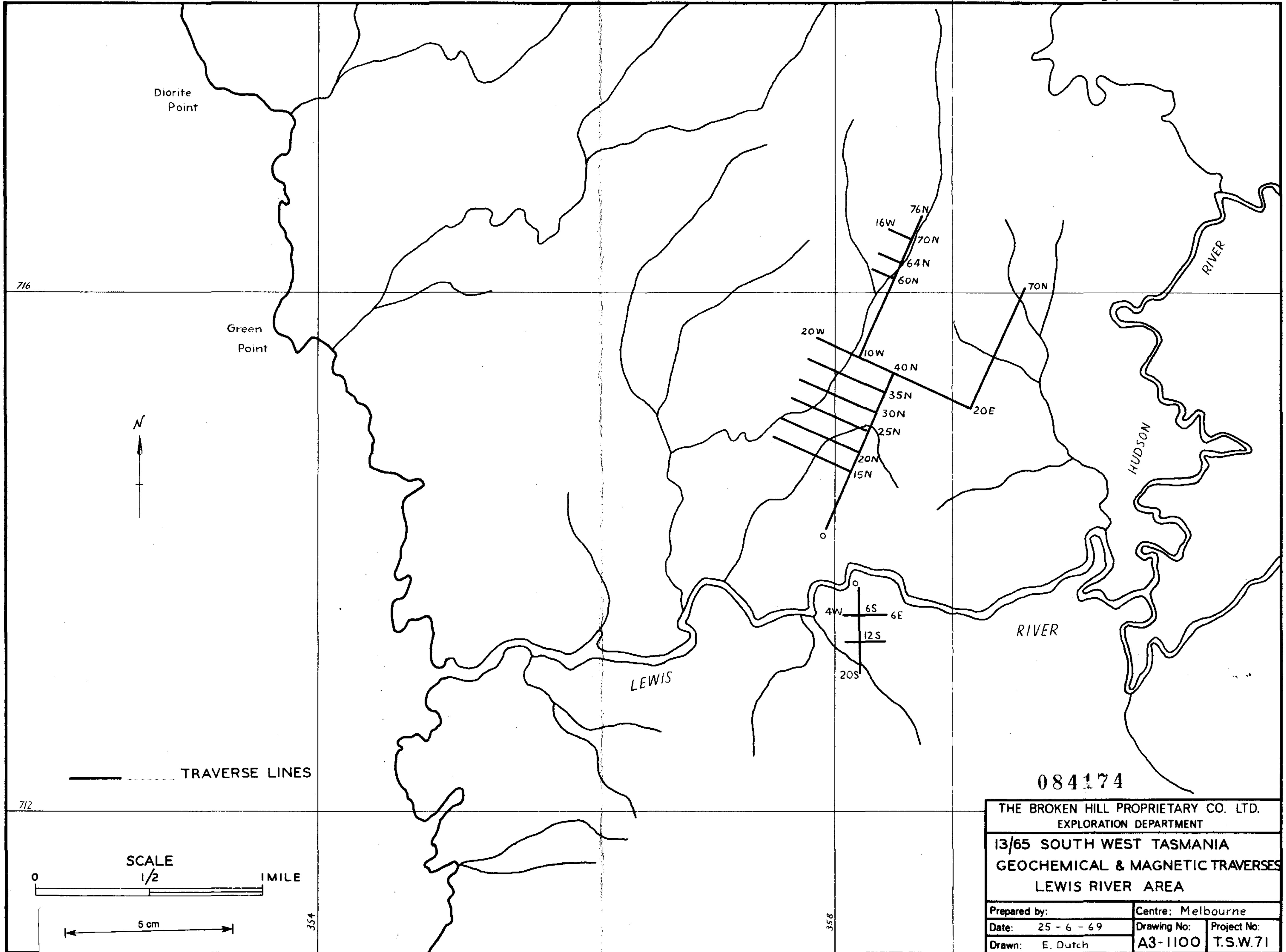
Drawn C.I.	Date June 1969	Centre Melbourne
Traced C.I.	Drawing No A1-1149	Project No TSW-70
Checked		
O.I.C.		

FIG. 20c

69-555

3575

69-355 FIG. 21



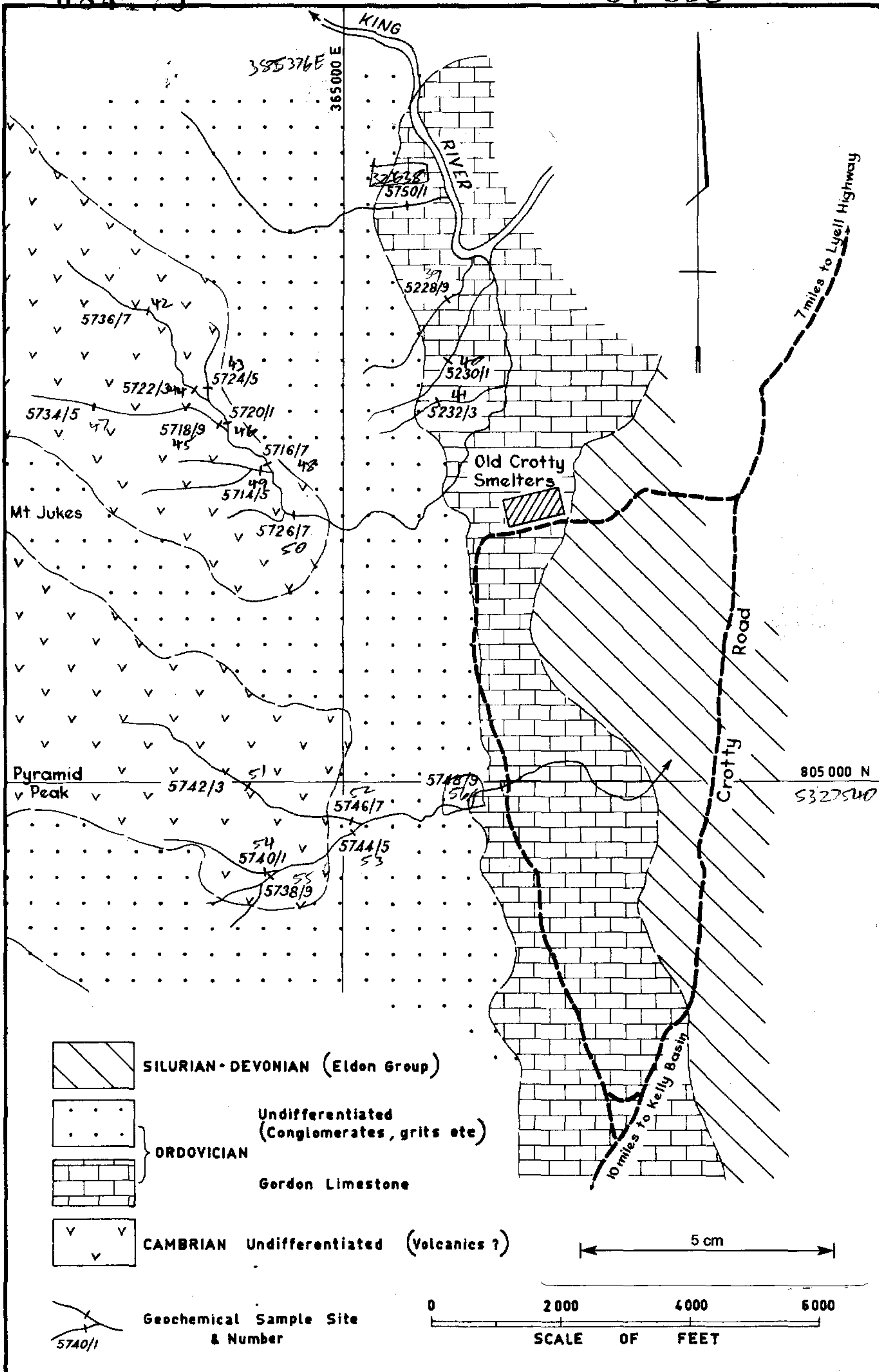
084174

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

13/65 SOUTH WEST TASMANIA
GEOCHEMICAL & MAGNETIC TRAVERSES
LEWIS RIVER AREA

Prepared by:	Centre: Melbourne	
Date: 25 - 6 - 69	Drawing No: A3-1100	Project No: T.S.W.71
Drawn: E. Dutch		

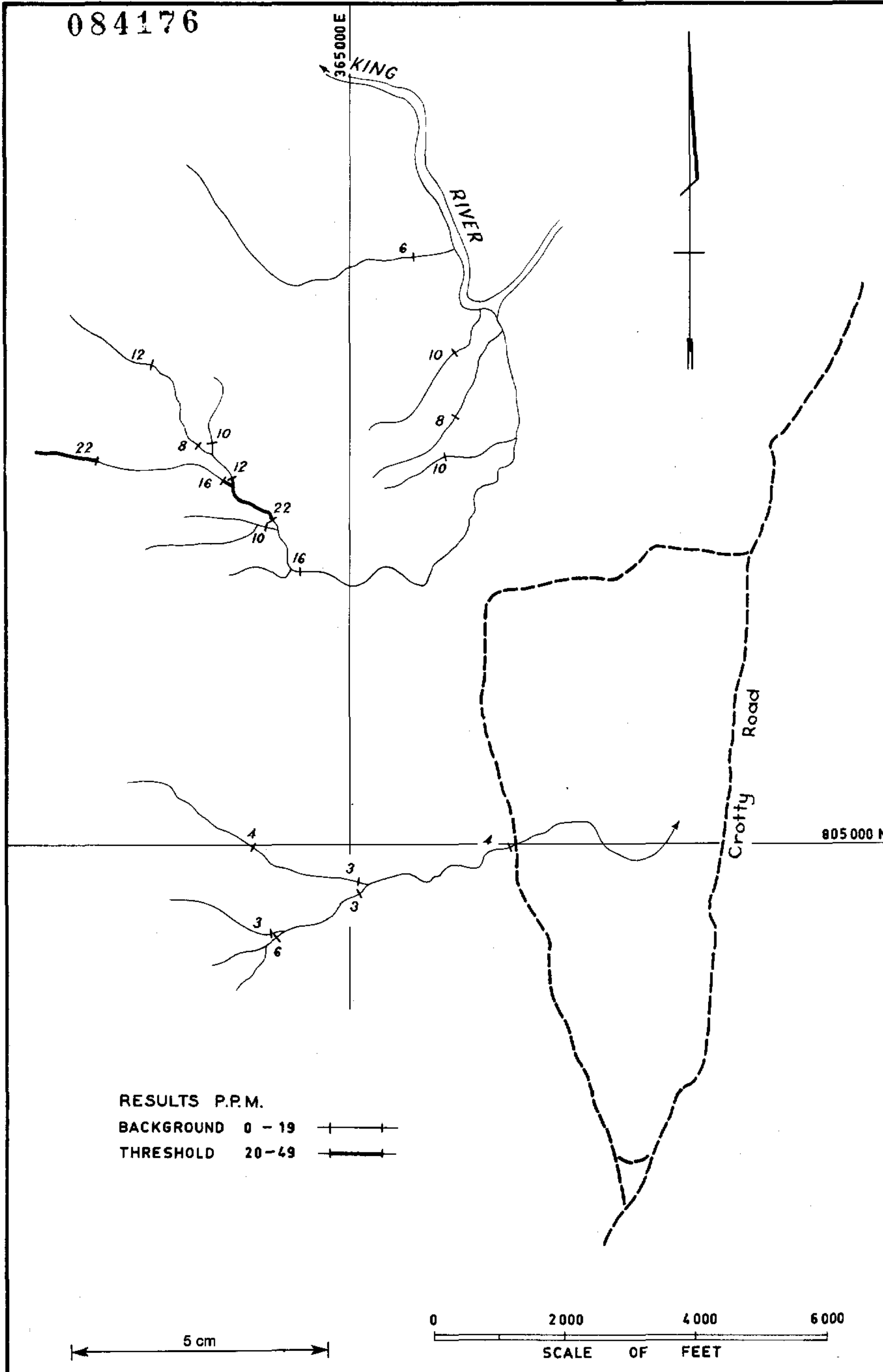
144 084175 69-555 FIG. 22A



Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA	Project No. TSW - 72
Date 3 2-69	CROTTY SMELTER AREA GEOLOGICAL MAP & GEOCHEMICAL SAMPLES	Drawing No. A4/1144

69-535 FIG. 22B

084176

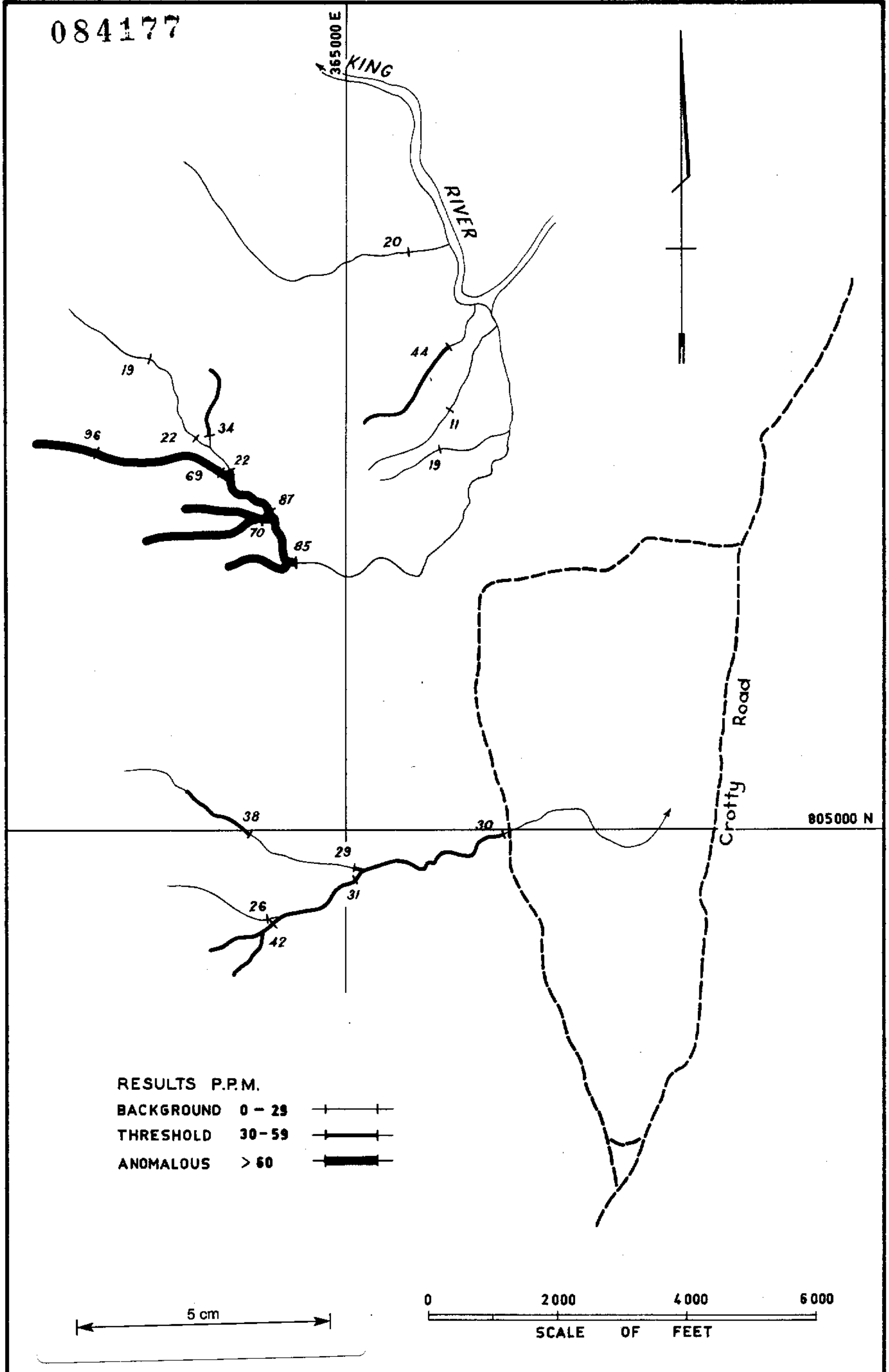


Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA	Project No. TSW - 73
Date 3-2-69	CROTTY SMELTER AREA GEOCHEMICAL RESULTS - P.P.M. COPPER	Drawing No. A4/1145

147

69-555 FIG. 22c

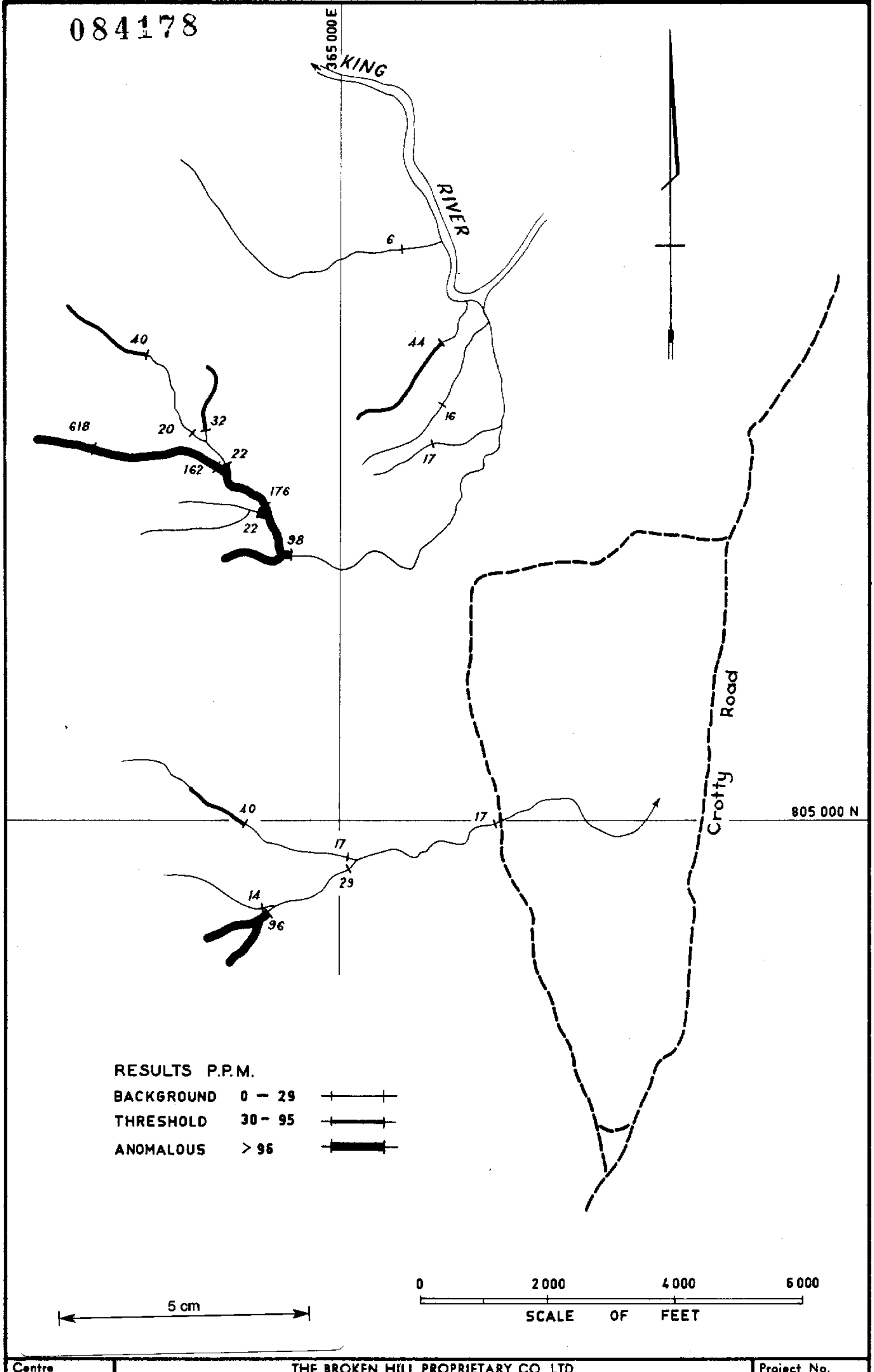
084177



Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA CROTTY SMELTER AREA GEOCHEMICAL RESULTS - P.P.M. ZINC	Project No. TSW - 74
Date 3-2-69		Drawing No. A4/1146

146

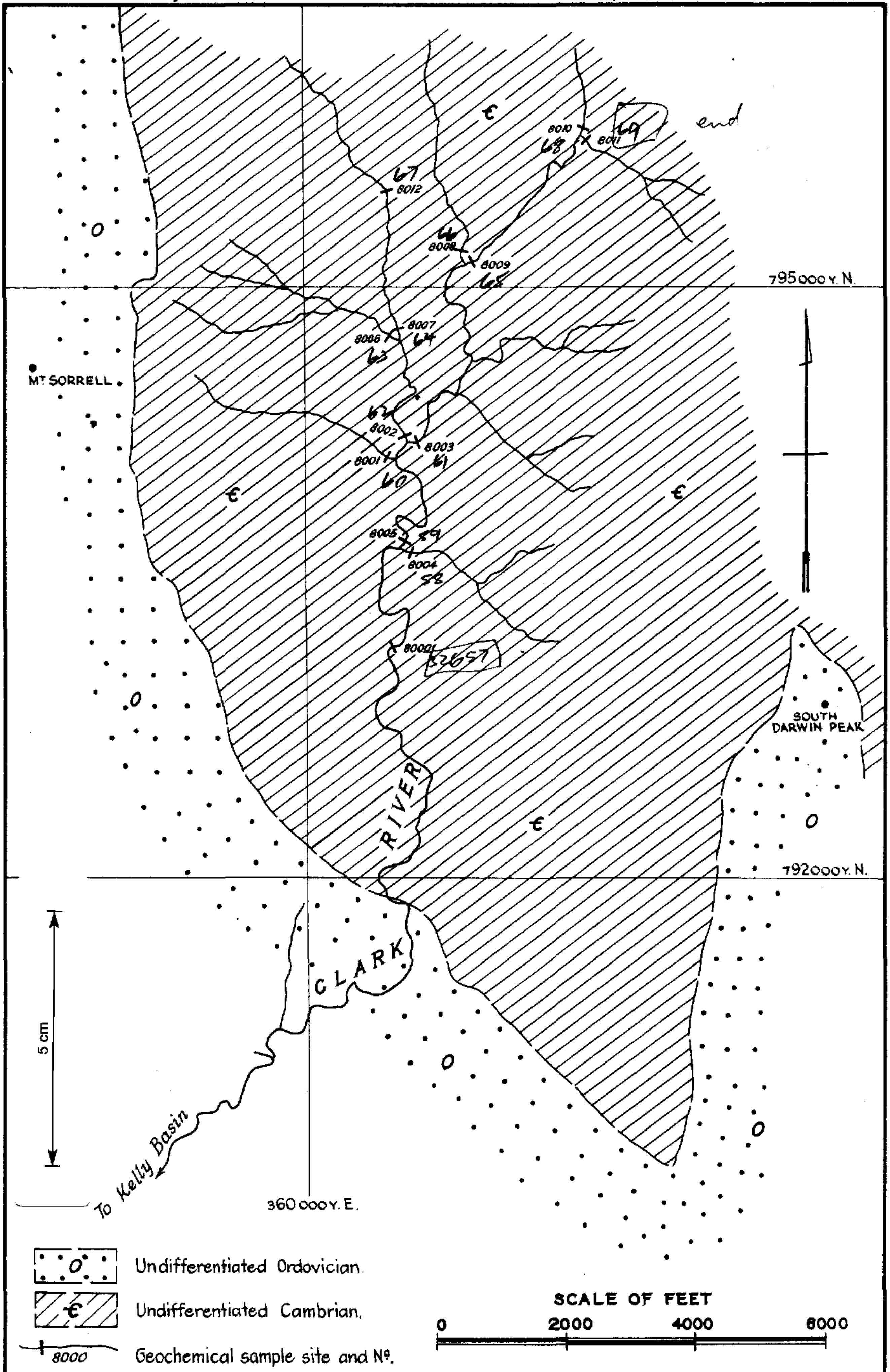
084178



Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD.	Project No. TSW - 75
	E.L. 13/65 SOUTH WEST TASMANIA	
Date 3-2-69	CROTTY SMELTER AREA GEOCHEMICAL RESULTS - P.P.M. LEAD	Drawing No. A4/1147

084179

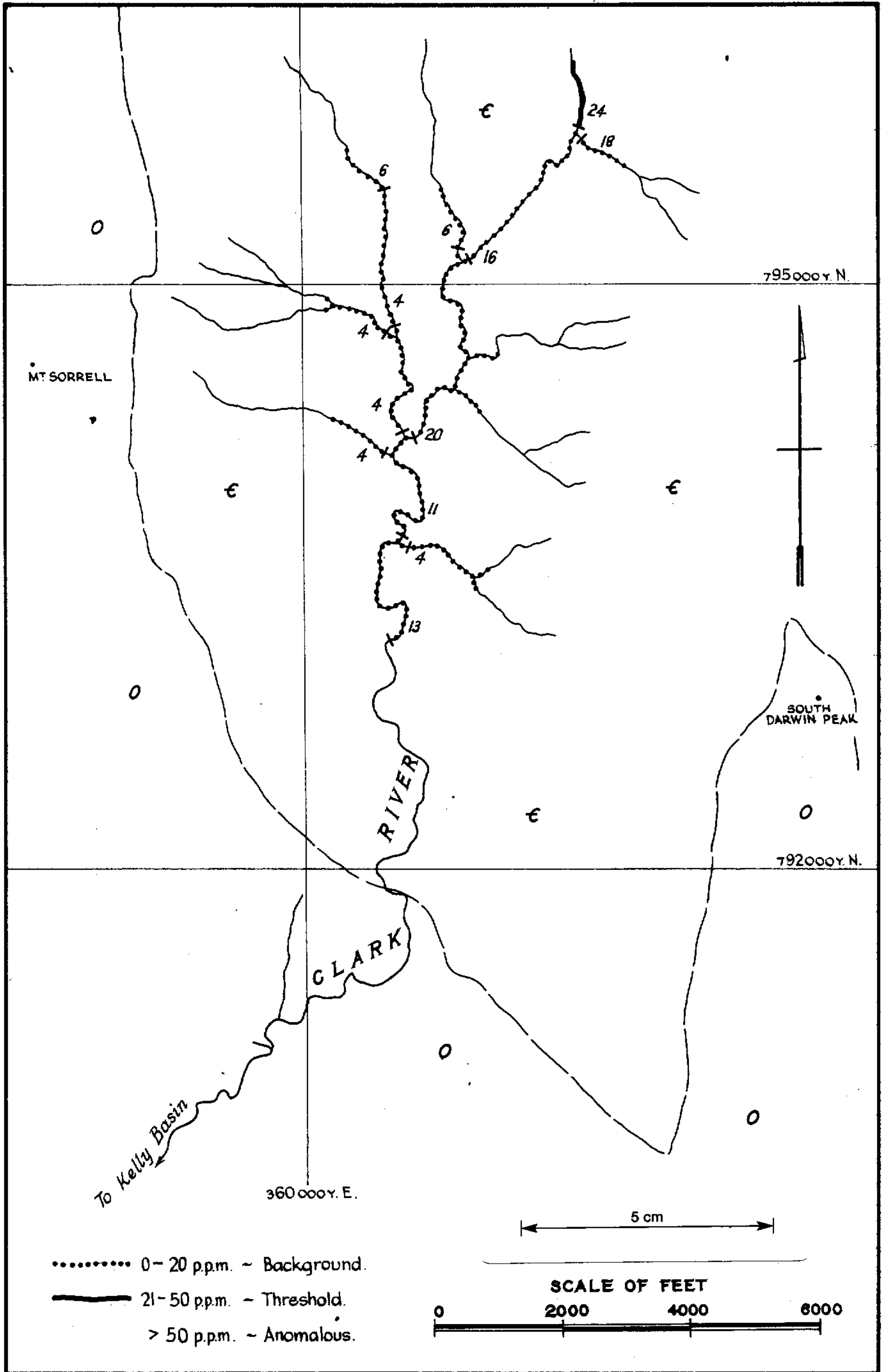
69-555 FIG.23A



Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65, SOUTH WEST TASMANIA	Project No. T. SW 38
Date 21.4.69	CLARK RIVER AREA GEOCHEMICAL SAMPLE SITES AND GEOLOGY	Drawing No. A4/ 1126

69-555 FIG.23B

084180 150

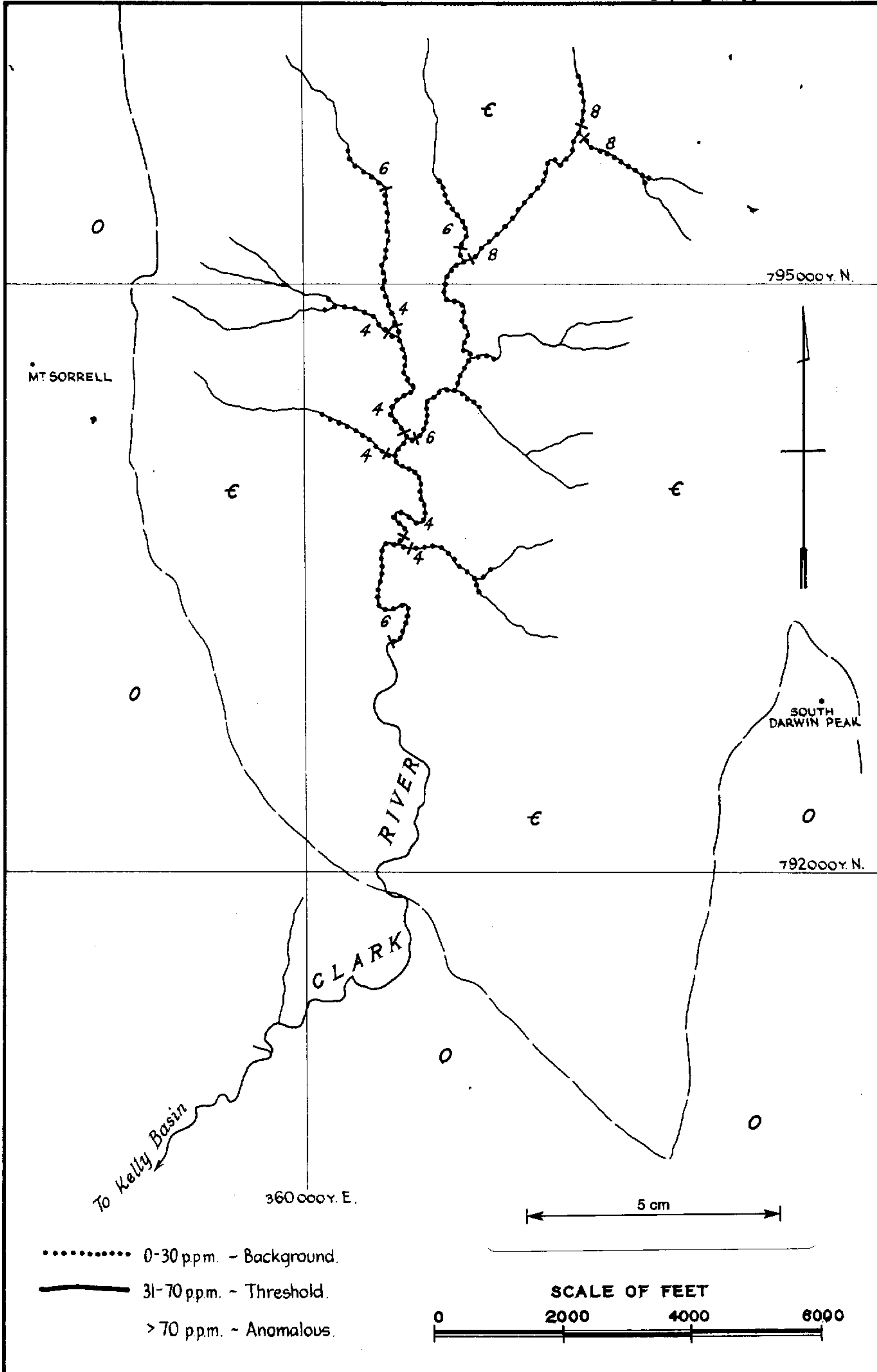


Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65, SOUTH WEST TASMANIA	Project No. TSW 39
Date 21. 4. 69	CLARK RIVER AREA GEOCHEMICAL RESULTS - PPM COPPER	Drawing No. A4/1127

69-555 FIG.23

149

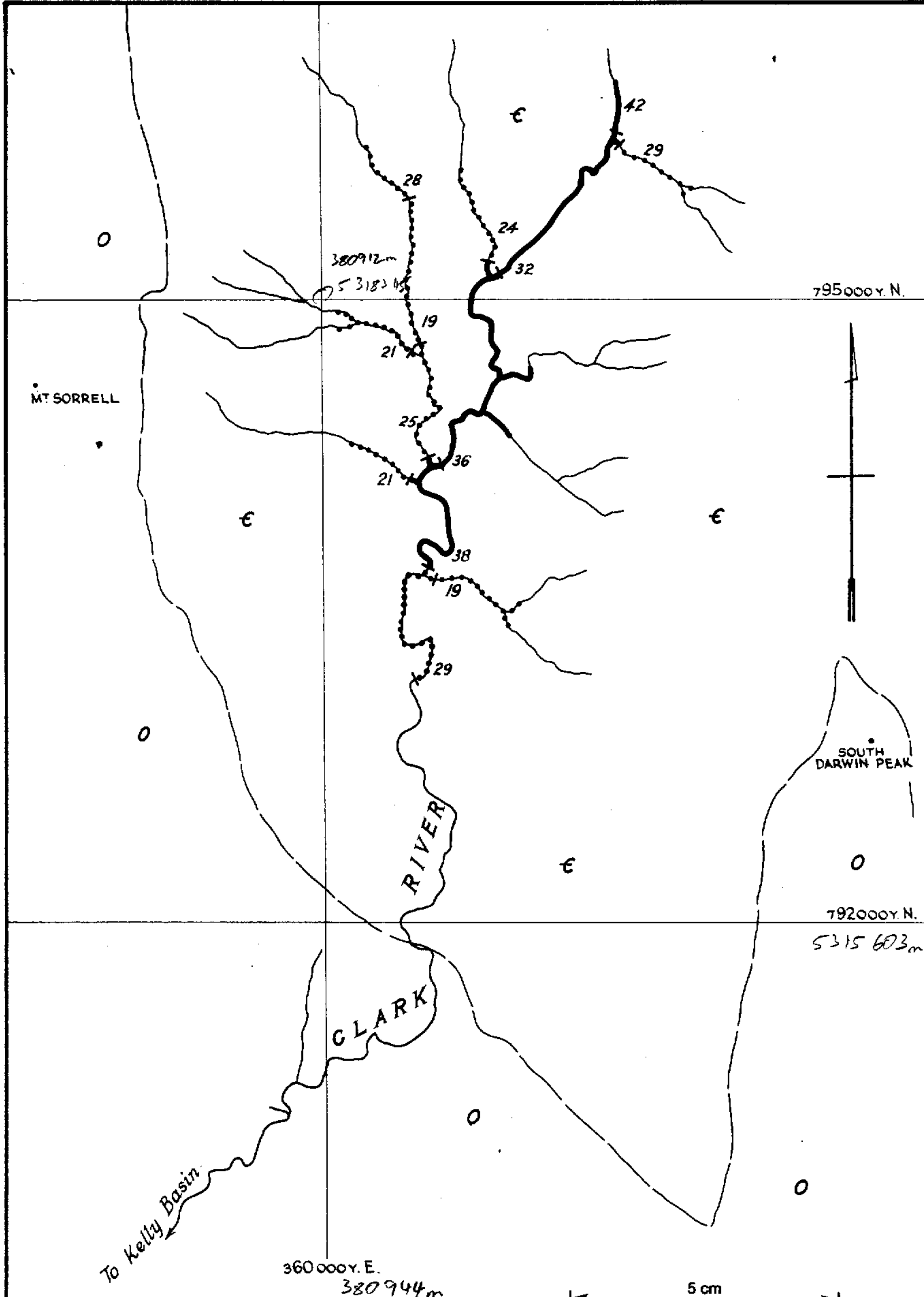
084181



Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65, SOUTH WEST TASMANIA	Project No. TSW40
Date 21.4.69	CLARK RIVER AREA GEOCHEMICAL RESULTS - PPM NICKEL	Drawing No. A4/ 1128

69-555 FIG. 23D

084182



0-30 p.p.m. - Background

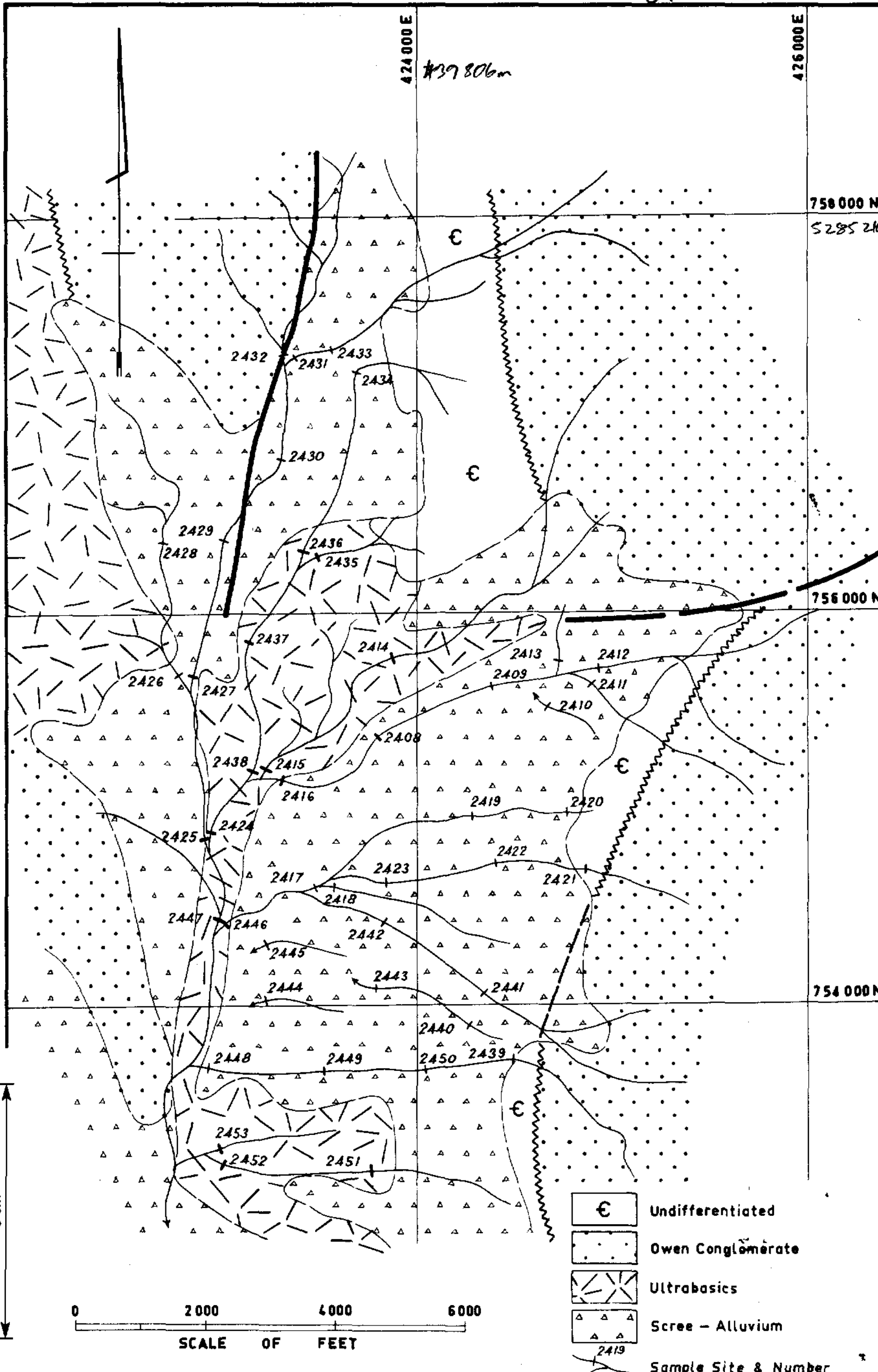
31-80 p.p.m. - Threshold.

> 80 p.p.m. - Anomalous.

Centre Melbourne	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65, SOUTH WEST TASMANIA CLARK RIVER AREA GEOCHEMICAL RESULTS - P.P.M. ZINC	Project No. TSW41
Date 21.4.69		Drawing No. A4/1129

69-555 FIG. 24A

084183

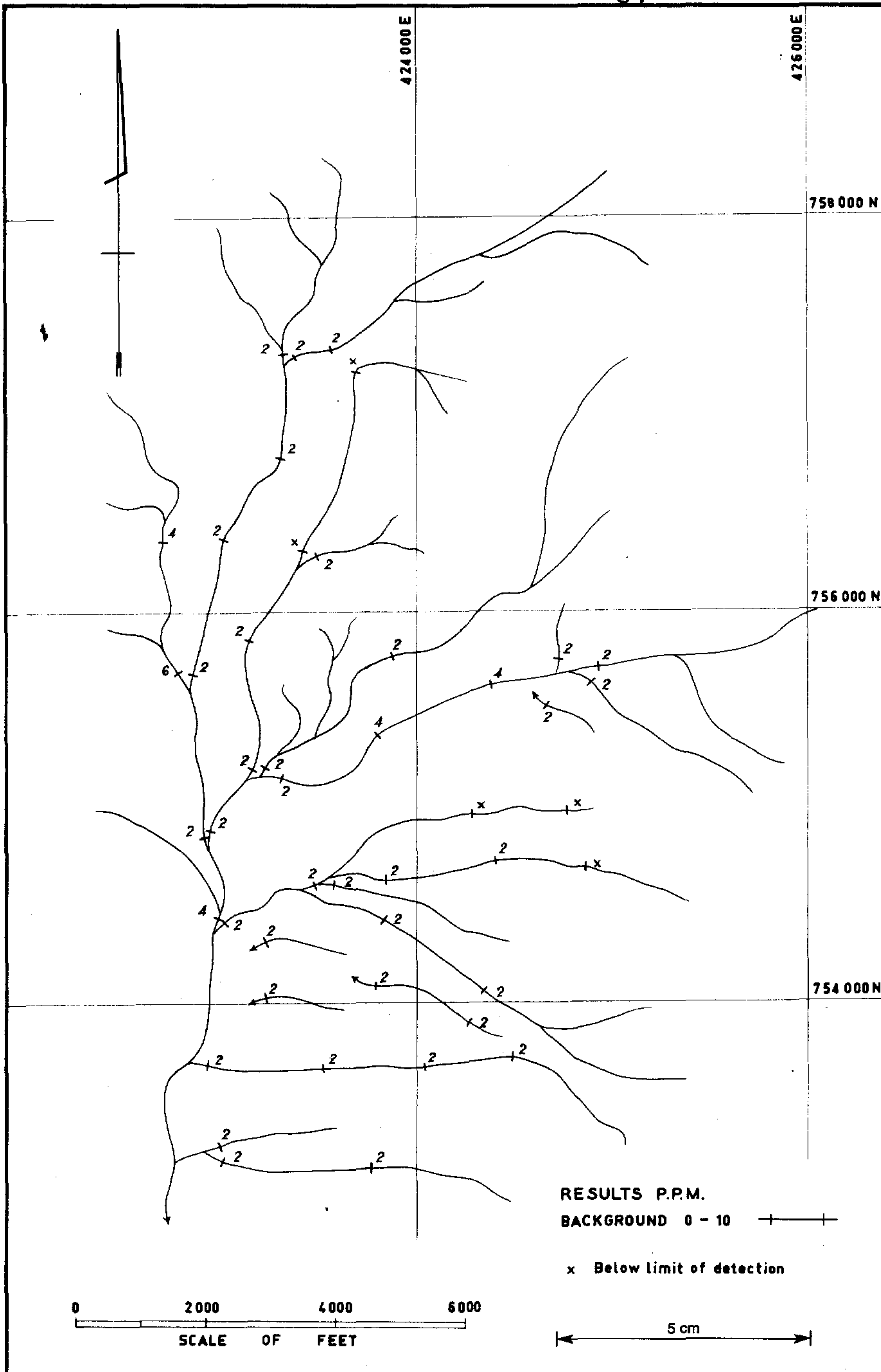


Centre Melbourne.	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA BOYES RIVER GEOLOGICAL MAP & GEOCHEMICAL SAMPLES	Project No. TSW - 76
Date 3-2-69		Drawing No. A4/1148

154

084184

69-555 FIG.24

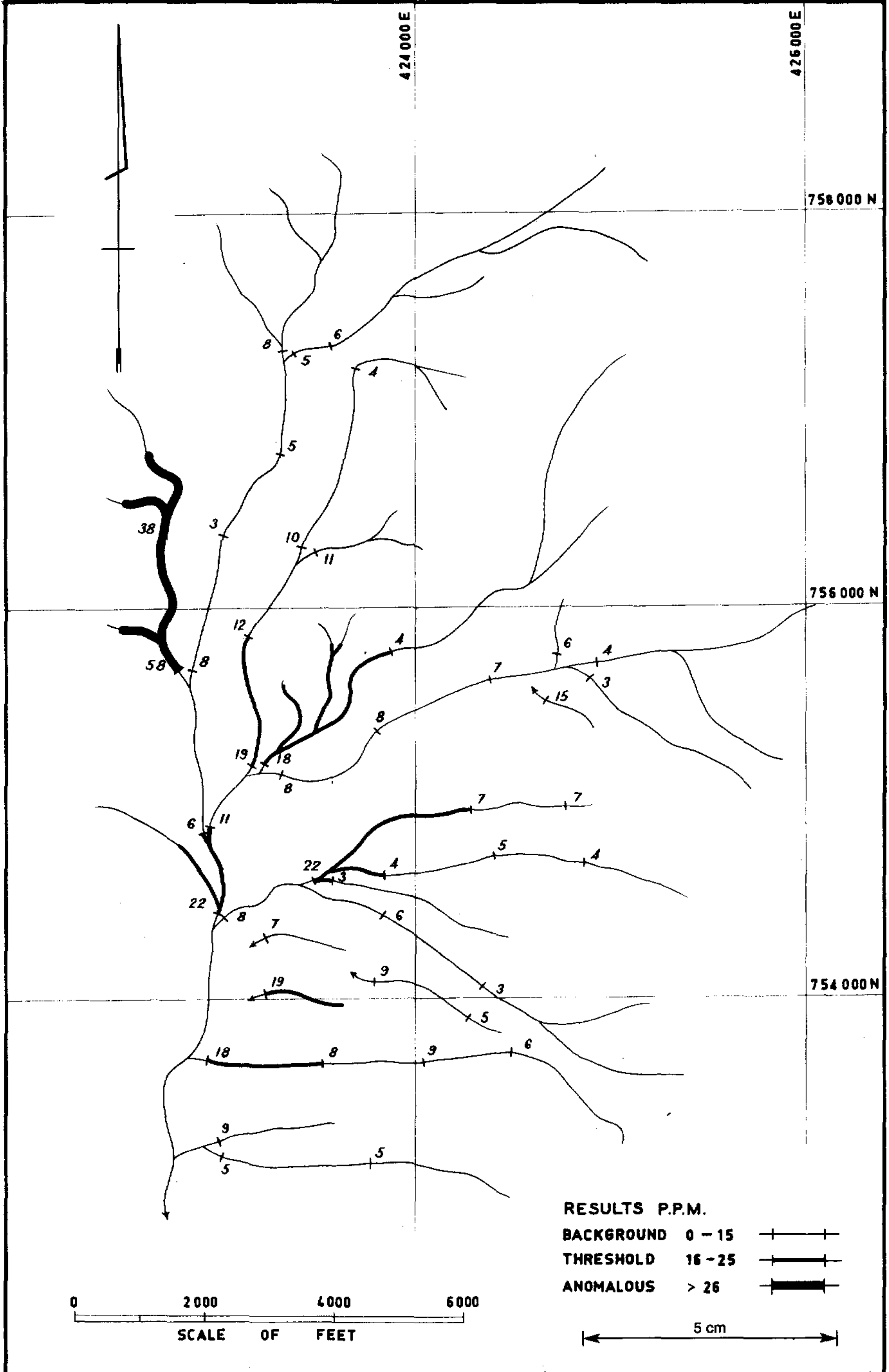


Centre Melbourne.	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA BOYES RIVER GEOCHEMICAL RESULTS - P.P.M. COPPER	Project No. TSW - 77
Date 3-2-69		Drawing No. A4/1149

69-555 FIG. 24c

153

084185

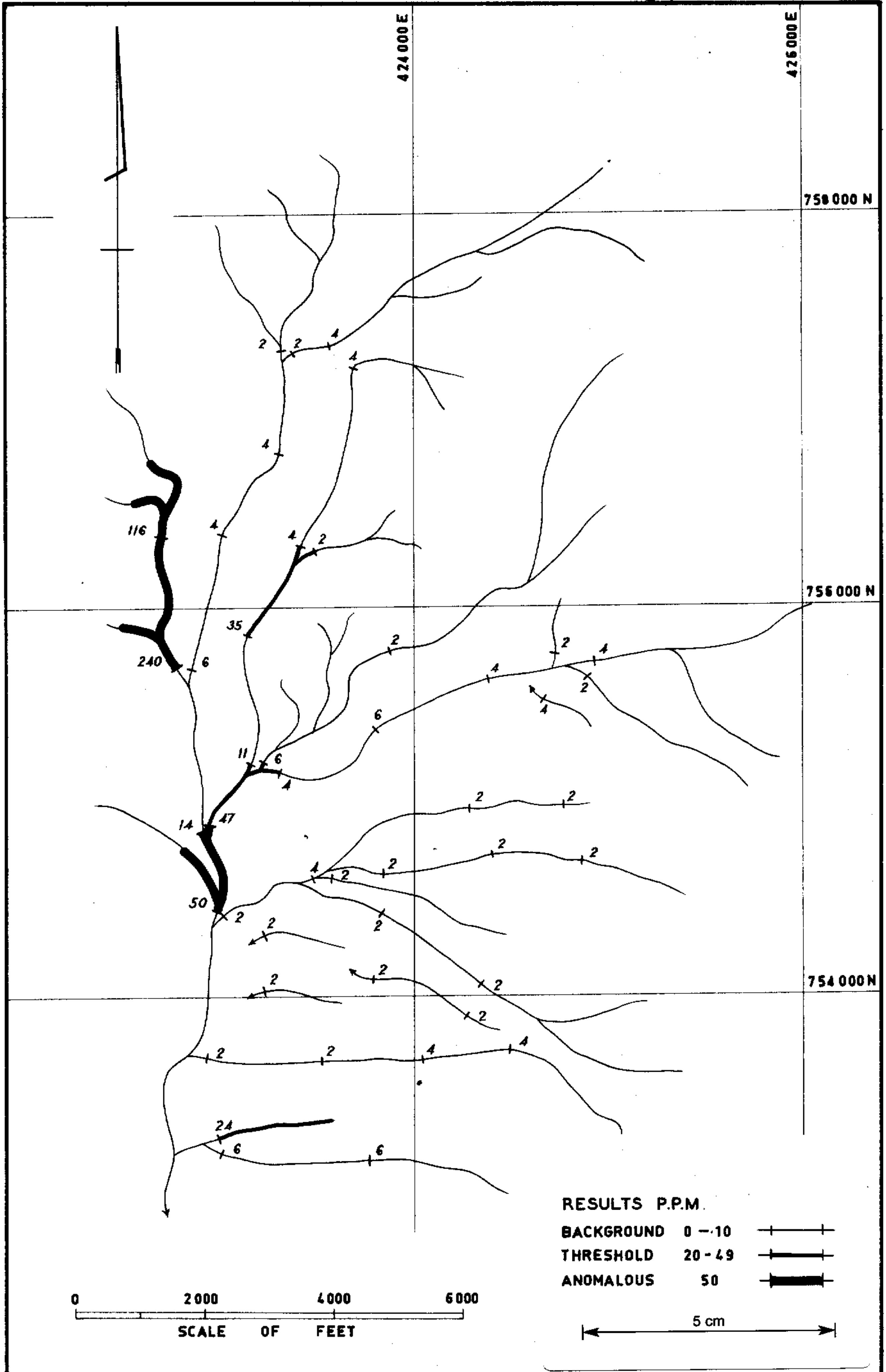


Centre Melbourne.	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA BOYES RIVER GEOCHEMICAL RESULTS - P.P.M. ZINC	Project No. TSW - 78
Date 3-2-69		Drawing No. A4/ 1150

152

084186

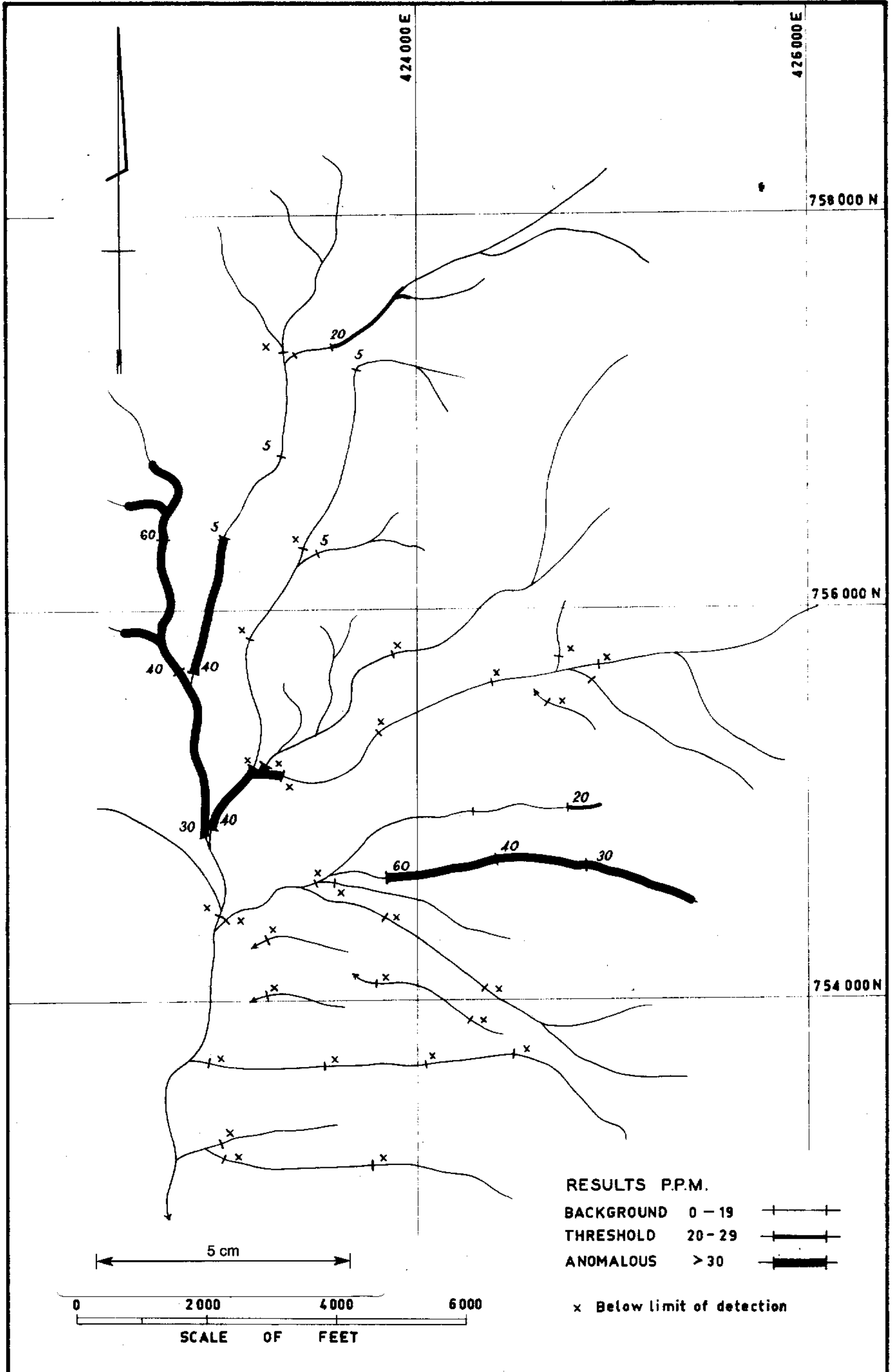
69-555 G.22D



Centre Melbourne.	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA	Project No. TSW - 79
Date 3-2-69	BOYES RIVER GEOCHEMICAL RESULTS - P.P.M. NICKEL	Drawing No. A4/1151

64-555 G.24E

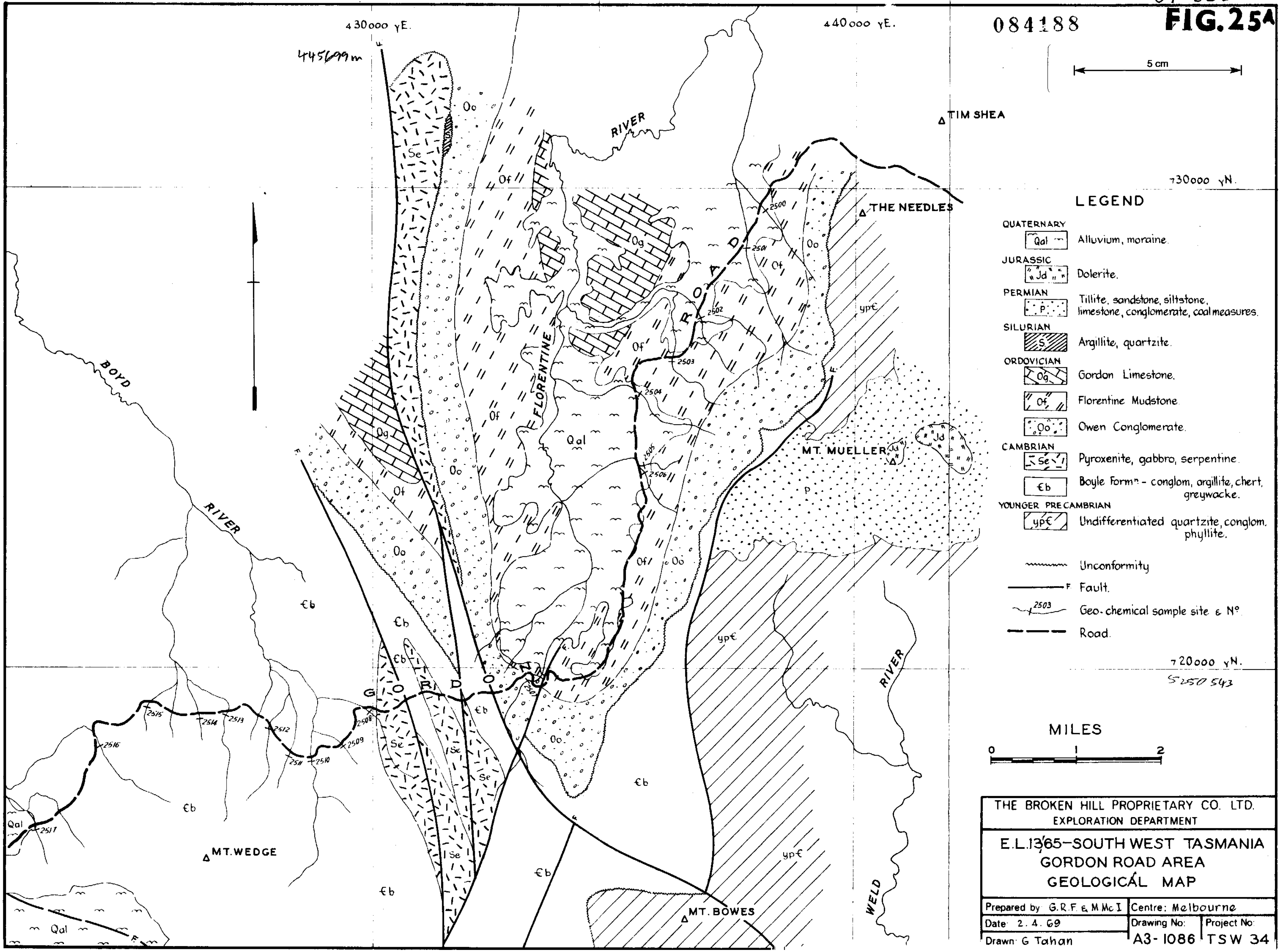
084187



Centre Melbourne.	THE BROKEN HILL PROPRIETARY CO. LTD. E.L. 13/65 SOUTH WEST TASMANIA	Project No. TSW - 80
Date 3·2·69	BOYES RIVER GEOCHEMICAL RESULTS - P.P.M. ARSENIC	Drawing No. A4/1152

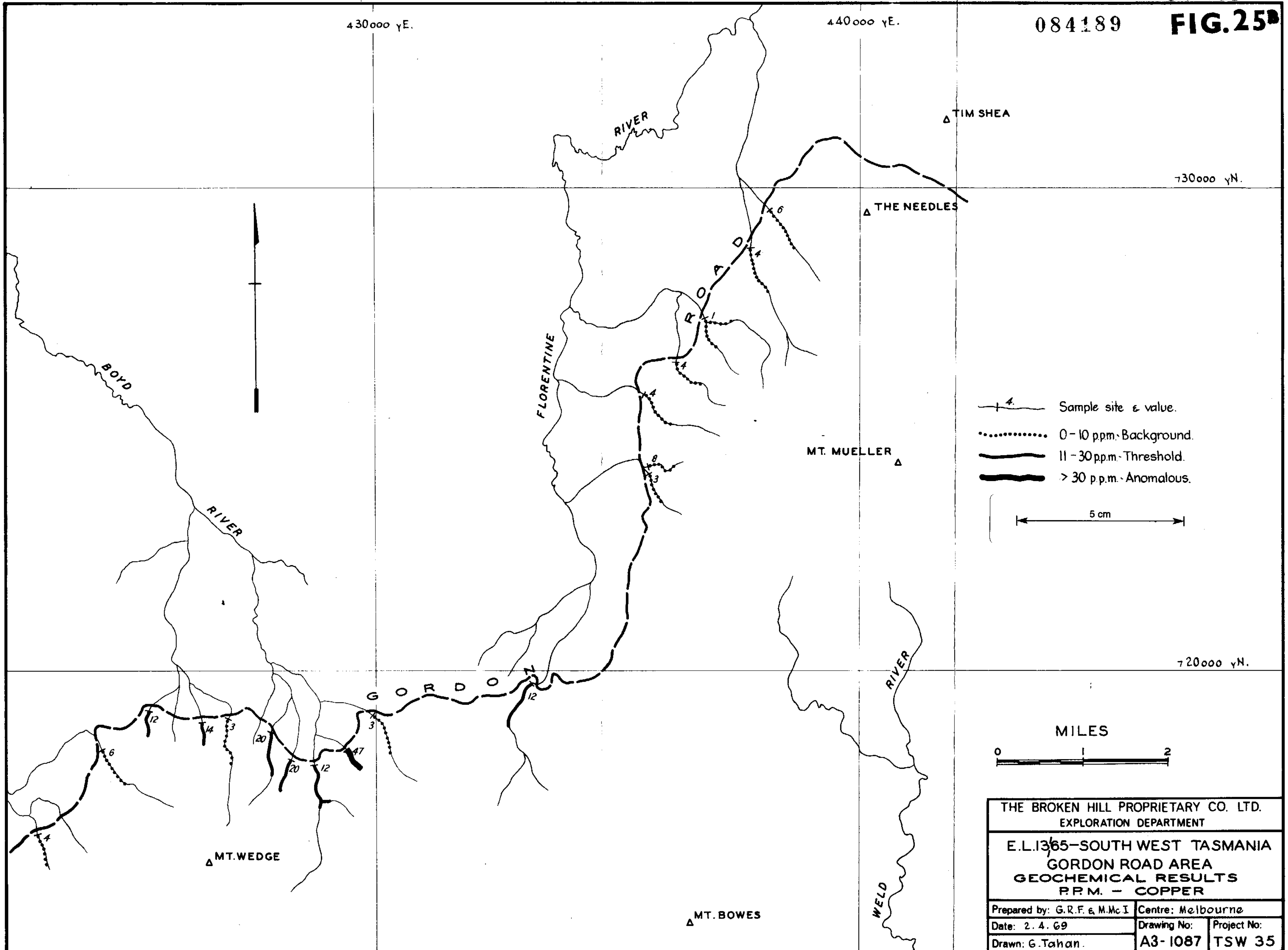
160

69-555


084188
FIG.25A
430000 yE.
440000 yE.
445699m
730000 yN.
720000 yN.
5250 543
5 cm
TIM SHEA
THE NEEDLES
MT. MUELLER
MT. WEDGE
MT. BOWES
RIVER
BOYD
RIVER
FLORENTINE
GORDON
ROAD
WELD
RIVER
Se
Oo
Of
Og
Qal
Eb
Se
ypE
Jd
P
2500
2501
2502
2503
2504
2505
2506
2507
2508
2509
2510
2511
2512
2513
2514
2515
2516
2517
LEGEND
QUATERNARY
Qal Alluvium, moraine.
JURASSIC
Jd Dolerite.
PERMIAN
P Tillite, sandstone, siltstone, limestone, conglomerate, coal measures.
SILURIAN
S Argillite, quartzite.
ORDOVICIAN
Og Gordon Limestone.
Of Florentine Mudstone.
Oo Owen Conglomerate.
CAMBRIAN
Se Pyroxenite, gabbro, serpentine.
Eb Boyle Formn - conglom, argillite, chert, greywacke.
YOUNGER PRECAMBRIAN
ypE Undifferentiated quartzite, conglom. phyllite.
Unconformity
Fault.
2503 Geo-chemical sample site & No.
Road.
MILES
0
1
2
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT
E.L.13/65-SOUTH WEST TASMANIA
GORDON ROAD AREA
GEOLOGICAL MAP
Prepared by G.R.F. & M.McI
Centre: Melbourne
Date 2.4.69
Drawing No: A3-1086
Project No: TSW 34
Drawn: G Tahan

159

69-555

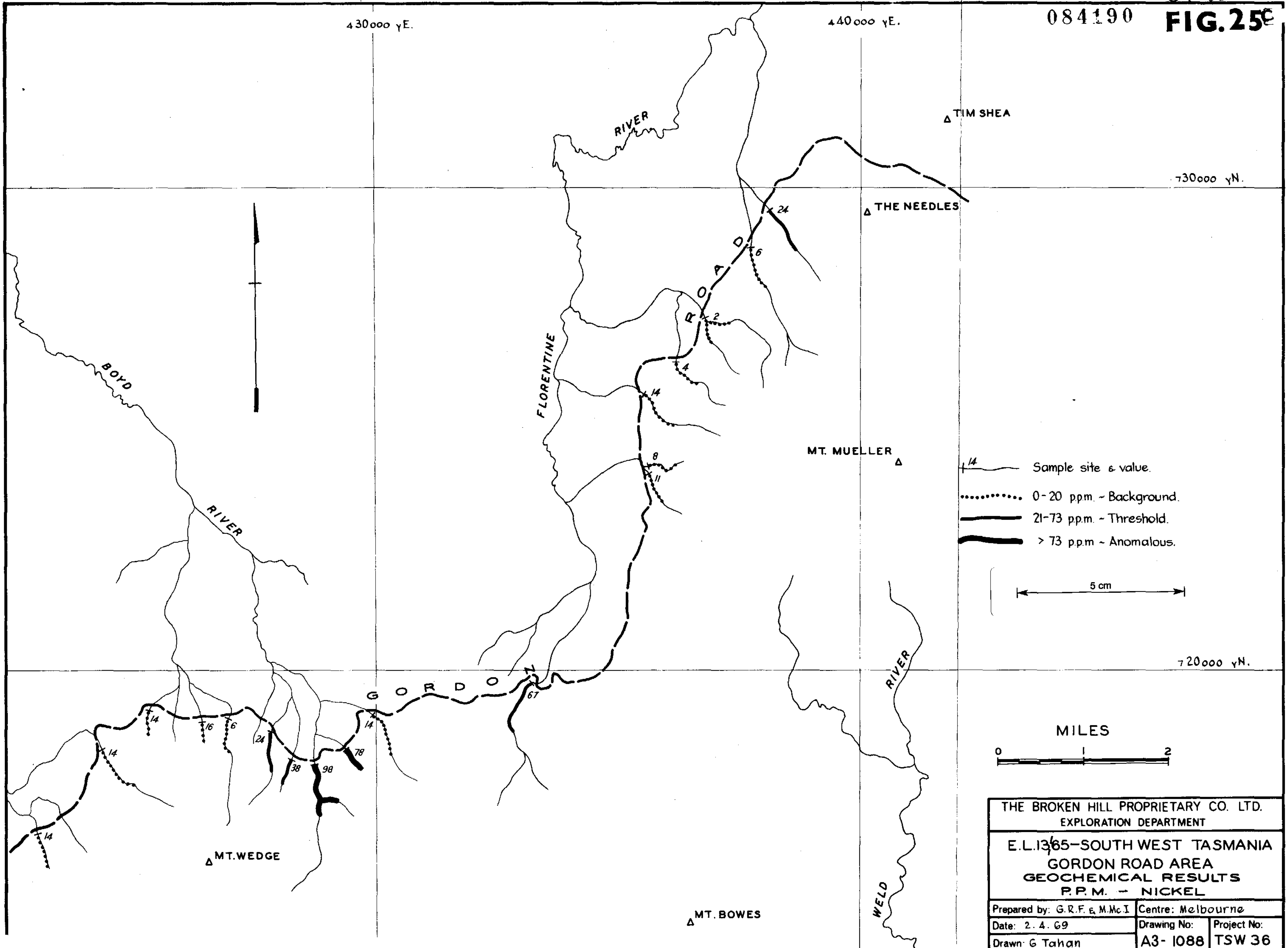

084189
FIG. 25B
430000 yE.
440000 yE.
730000 yN.
720000 yN.
TIM SHEA
THE NEEDLES
MT. MUELLER
MT. WEDGE
MT. BOWES
RIVER
ROAD
FLORENTINE
BOYD
RIVER
GORDON
RIVER
WELD
Sample site & value.
0 - 10 p.p.m. - Background.
11 - 30 p.p.m. - Threshold.
> 30 p.p.m. - Anomalous.
5 cm
MILES
0
1
2
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT
E.L.13/65 – SOUTH WEST TASMANIA
GORDON ROAD AREA
GEOCHEMICAL RESULTS
P.P.M. – COPPER
Prepared by: G.R.F. & M.Mc I
Centre: Melbourne
Date: 2. 4. 69
Drawing No: A3-1087
Project No: TSW 35
Drawn: G. Tahan.

157

69-555

084190

FIG. 25C



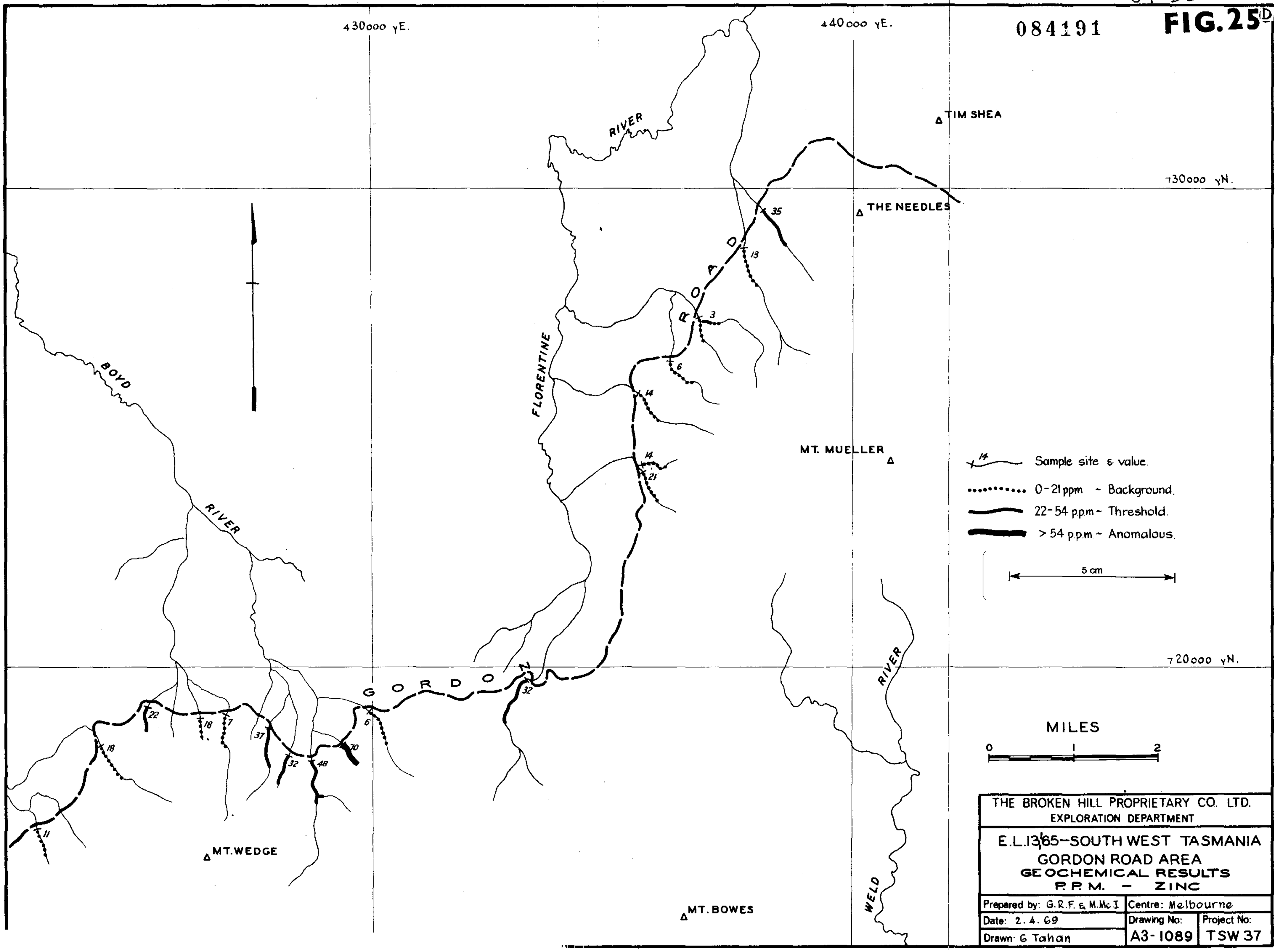
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

E.L.13/65–SOUTH WEST TASMANIA
GORDON ROAD AREA
GEOCHEMICAL RESULTS
P.P.M. – NICKEL

Prepared by: G.R.F. & M.McI	Centre: Melbourne	
Date: 2. 4. 69	Drawing No: A3-1088	Project No: TSW 36
Drawn: G Tahan		

158

69-555

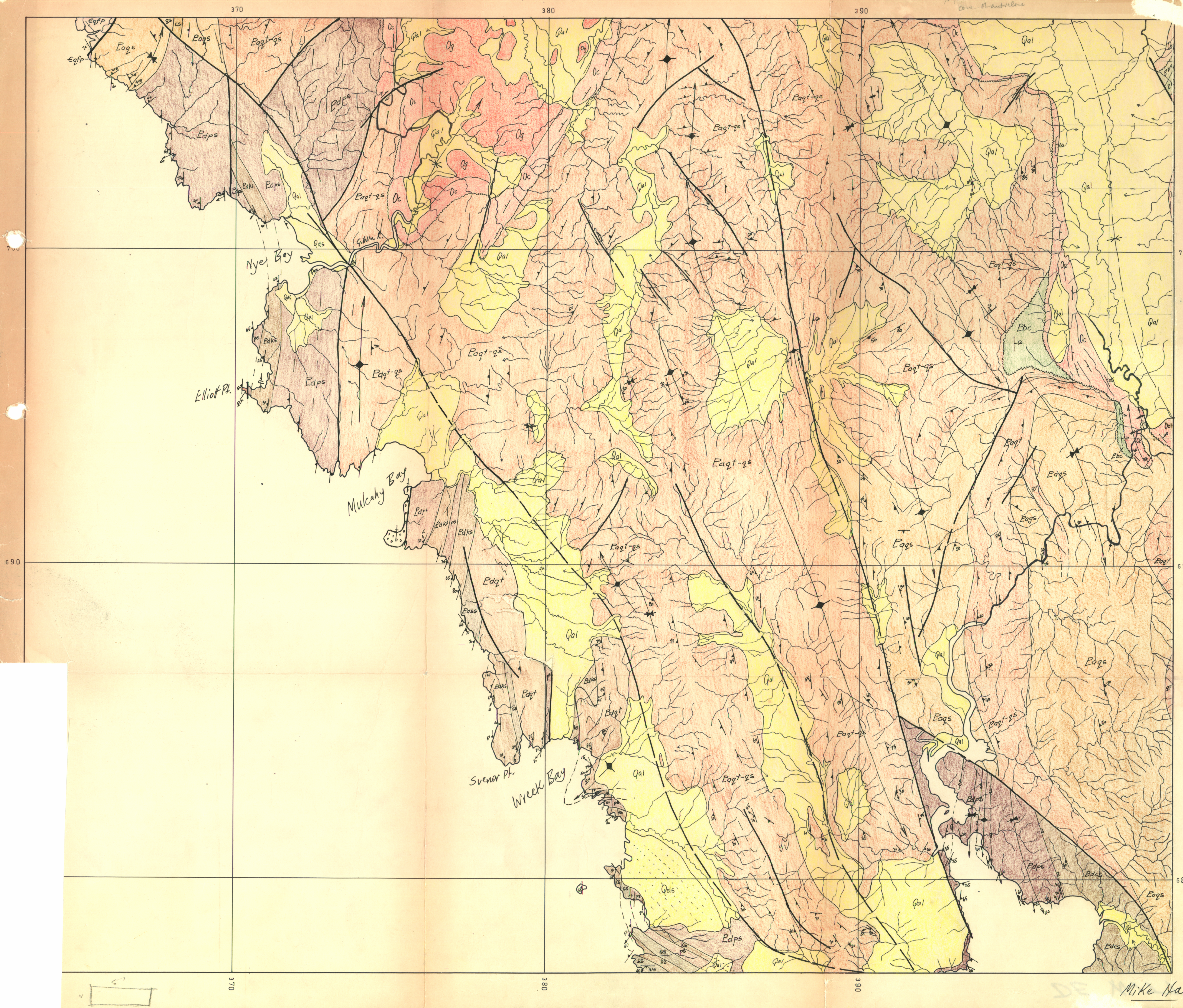

084191
FIG. 25D
430000 yE.
440000 yE.
730000 yN.
720000 yN.
TIM SHEA
THE NEEDLES
MT. MUELLER
MT. WEDGE
MT. BOWES
RIVER
FLORENTINE
BOYD RIVER
GORDON ROAD
WELD RIVER
Sample site & value.
0-21 ppm ~ Background.
22-54 ppm ~ Threshold.
> 54 p.p.m. ~ Anomalous.
5 cm
MILES
0 1 2
THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT
E.L.13/65 – SOUTH WEST TASMANIA
GORDON ROAD AREA
GEOCHEMICAL RESULTS
P.P.M. – ZINC
Prepared by: G.R.F. & M.McI.
Centre: Melbourne
Date: 2.4.69
Drawing No: A3-1089
Project No: TSW 37
Drawn: G Tahan

DAVEY

THE BROKEN HILL PROPRIETARY CO. LTD.
EXPLORATION DEPARTMENT

Drawn:	Date:	Centre:
Traced:	Drawing No: A1-	Project No:
Checked:		
O.I.C.:		

DE WITT


370
380
390
700
690
680
Nye Bay
Elliott Pt.
Mulcahy Bay
Svenor Pt.
Wreck Bay
Gibbon R.
Qal
Qds
Og
Oc
Ebc
Eaqt-qs
Eaqs
Edps
Edks
Edqt
Edcs
Eqfp
Mike Hall

MONTGOMERY
ROCKY POINT
1:63360
350
360
370
380
390
730
720
710
URQUHART RIVER
CYPRESS Ck
STH CYPRESS Ck
Qal
Tms
Qgr
Emt
Emo
Elrv
Egfp
Eags
Eagt-gs
Edps
Eacs
Edcs
Oc
Og