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# Exploration Department



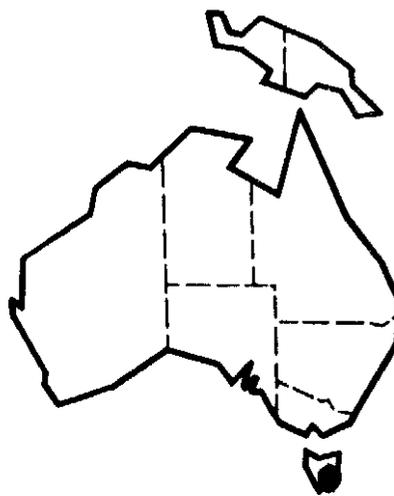
EXPLORATION LICENCE 30/80

SOUTH EAST TASMANIA

REPORT FOR THE SIX MONTHS ENDED  
15th OCTOBER, 1981

OPEN FILE

82-1672



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REPORT FOR THE SIX MONTHS ENDED 15th OCTOBER, 1981

**OPEN FILE**

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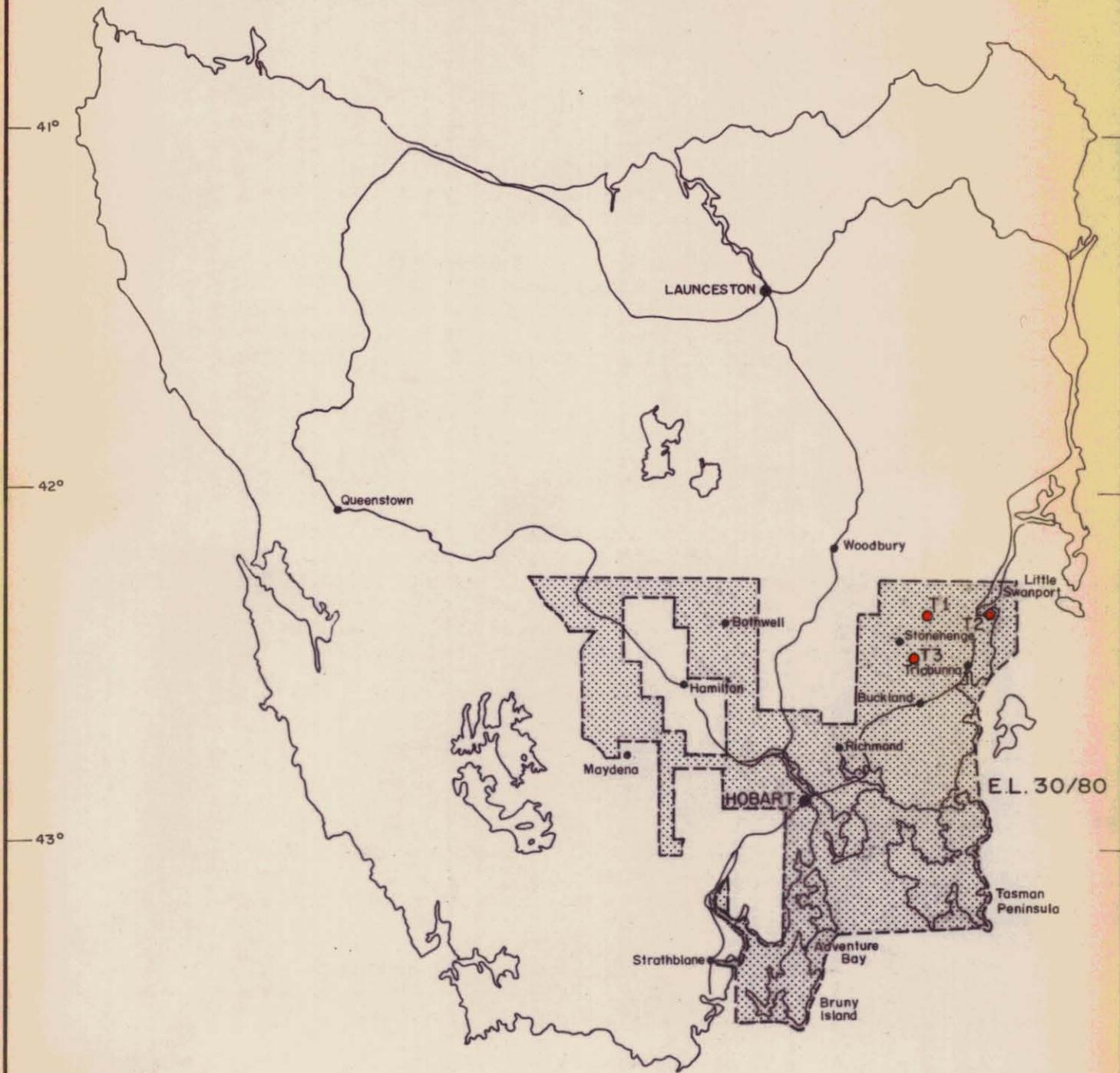
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SUMMARY

In August 1981 three holes were drilled in the Little Swanport-Buckland area of EL 30/80, Tasmania, to test for seams or indications of Triassic coal. The holes were sited in areas of previously untested Upper Triassic sediments.

No coal was encountered, although a few bands of carbonaceous mudstone and sandstone were intersected in two of the holes. The results appear to hold little promise for the discovery of economic coal seams in the areas drilled.



 E.L. 30/80

 T2 Diamond drill hole.

5 cm

0 20 40 60 80 100  
KILOMETRES

Centre  
Melbourne

Date  
OCT 1981

THE BROKEN HILL PROPRIETARY CO. LTD.  
E.L. 30/80  
SOUTHEAST TASMANIA  
LOCALITY MAP

Project No.  
C350-2

Drawing No.  
A4-2261

## 1. GENERAL

The Broken Hill Proprietary Company Limited was granted Exploration Licence 30/80 of 12,900 square kilometres in South Eastern Tasmania on 15 April, 1981, expiring on 15 October, 1981. The licence was taken out for the purpose of coal, oil and oil shale exploration.

Exploration Licence 30/80 covers perhaps an eighth of Tasmania. The present drilling program was confined to the Buckland-Little Swanport region (see Figure 1 ). The region is hilly and largely covered by open eucalypt forest. The coastal region to the east is predominantly cleared farmland. Although the Tasman Highway runs along the coastal region, access to most of the region is poor, with only a sparse network of tracks.

Small quantities of coal have been known in sediments of Triassic age throughout EL 30/80 for over one hundred years (see Section 3.2), and sporadic exploration by individuals, companies and the Mines Department has been carried out over this period. Small mines have operated in the past, although the deposits worked were so small as to be uneconomic by modern standards.

## 2. EXPLORATION PHILOSOPHY AND OBJECTIVES

The purpose of the present work was to attempt to find indications of further Triassic coal resources within EL 30/80. Since all the known coal occurrences in the licence area had previously been indicated to have sub-economic reserves, it was decided to drill 3 wildcat holes (T 1, 2, 3) in previously untested areas. The areas chosen all fell within the Little Swanport-Buckland area of the south east coastal region.

## 3. GEOLOGY

### 3.1 Triassic Sediments in South East Tasmania

The only operating coal mine in Tasmania is presently mining Upper Triassic coals in the Fingal Valley of north east Tasmania. Although minor Permian coals occur in Tasmania the best prospects for further coal discoveries seem to be in Triassic sediments.

Broadly speaking, the Triassic sediments of Tasmania belong to a unit referred to as the Upper Parmeener Super-Group (Banks, 1973). In south eastern Tasmania these rocks fall into a three-fold division (Farmer, 1979, p 13):

a) The lowest part, of Late Permian to Early Triassic age, is a coal measure sequence of variable thickness (absent in places) consisting of fluvial and floodplain feldspathic arenites with minor mudstone and carbonaceous mudstone. Workable coal seams are apparently rare and thin.

b) The middle part consists of massive, well sorted clean fluvial quartz sandstone, with very minor mudstone. Coal is not present.

c) The upper part is a coal measure sequence of feldspathic and lithic arenites with minor mudstones and workable but very variable coal seams. All present coal production in Tasmania is from seams associated with the lithic arenites of this Upper Division of the Triassic rocks (Hale, 1962). Triassic basalt flows and tuffs occur in this Upper Division.

Throughout eastern Tasmania, the geology of the Triassic rocks is complicated by extensive Jurassic dolerite intrusions and widespread faulting.

### 3.2 Triassic Coal Occurrences in Exploration Licence 30/80

The following is a brief listing of known Triassic coal occurrences within EL 30/80. Unless otherwise noted, the information is from the last comprehensive review of Tasmanian coal deposits by Hills, et al (1922).

a) Triabunna: A 1.6 metre thick seam occurs at 30-40 metres depth in Late Triassic feldspathic and carbonaceous sediments occurring beneath a dolerite sill in a hill just east of the township. Assuming that the coal seam extends through the entire hill, has an approximately constant thickness, and given coal specific gravity of 1.2, it is estimated that up to 7.6 million tonnes of coal may be present.

b) Buckland: Thin seams (maximum 1.0 metres thick) are known from two small fault blocks north of Buckland township (see also Blake, 1958). Shafts were put into the prospects at the turn of the century, but the known fault blocks are too small to contain economic quantities of coal.

c) Tasman Peninsula: Thin seams (thickness unspecified) were mined for many years in the nineteenth century by convicts at Saltwater River. However, these seams could not be profitably mined by paid labour. At Premaydena, coal seams 0.05-0.15m thick are known, whereas at Dunalley, 0.07 to 0.2 metre seams occur in an area of 40 acres bounded by dolerite intrusions and the sea.

d) Bruny Island-Gordon: Early Triassic seams have been exploited at Adventure Bay on Bruny Island and trial shafts were sunk at Gordon and Sheepwash Bay. The thickest seam, at Adventure Bay, was 0.3-9.5 metres thick.

e) Strathblane: Outside of EL 30/80, at Strathblane, coal seams up to 1.6 metres thick (generally 0.8 metres) are known.

f) Hobart Area: Late Triassic coal-bearing sediments are exposed on Hobart's new Northern Outlet freeway, where they are thin, have steep dips, and are intruded by dolerite.

At Newtown, four thin seams (thickest 0.75m) were worked for ten years in the late nineteenth century, yielding bituminous steaming coal. Estimated geological reserves were 900,000 tonnes of coal.

Thin coal seams are also present in the Late Triassic sediments in many places near Hobart (eg Mt Lloyd, Kaoota), although they do not appear to be more promising than the Hobart occurrences in terms of thickness.

g) Richmond - Brighton Area: The most promising areas, at Colebrook, are not held in the licence area. Two seams (0.22m and 0.05m thick) crop out in Late Triassic sediments along the Coal River east of Richmond township. A bore drilled adjacent to the outcrops encountered a 0.4m seam at 8.4m, a 0.5m seam at 77m, and a 0.67m seam at 133m depth.

A drill program in Tertiary sediments north of Richmond (Leaman, 1971) intersected "thin" coal seams (presumably of Tertiary age) at depths of 30 to 200 metres.

h) Bothwell (Clyde River) Area: The Lower (carbonaceous) division of the Triassic is up to 60 metres thick between the Clyde and Coal Rivers (in the eastern part of the Bothwell area) and contains "rare" coal seams (Forsyth and Gulline, 1979, p 9).

i) Hamilton Area: Coal seams are known in the Hamilton area, however, they are not held under the Exploration Licence 30/80 by the company.

#### 4. WORK COMPLETED AND DRILL PROGRAM RATIONALE

Examination of available information indicated that the only remaining areas of promising Triassic sediments which appear to have been largely untested were in the Buckland/Woodsdale/Stonehenge areas, and on the east coast in the Little Swanport area (see Figure 2 ). In these areas the 1:250,000 geological map sheet (Oatlands) shows large areas of "undifferentiated" (ie unmapped and unstudied) Triassic rocks, surrounded and intruded by large dolerite masses, close to the known coal occurrences near Buckland and Triabunna.

In the case of the Woodsdale/Stonehenge/Buckland area, Permian sediments crop out in the western part of the area, whereas the Late Triassic coal occurrences crop out towards the eastern margin of the area. It was therefore suspected that the sediments had a regional dip towards the east, which implied that the Late Triassic, potentially coal bearing sediments, would be restricted to the eastern margin of the area. Hole T3 was accordingly sited close to the eastern margin of the sedimentary mass, north of the known coal occurrences. Hole T1 was sited in another area of Triassic sediments, north of the eastern margin of the main Triassic area. A local landowner, Mr W Dunbabin, had reported outcrops of a thin coal seam in the valley of the Little Swanport River, which runs through the area. Triassic sediments near hole T1 dip towards the south east, supporting the idea of a regional dip to the east.

In the Triassic sediments at Little Swanport, a number of outcrops all indicate an easterly dip. Consequently hole T2 was sited on the Seaford Road (see Figure 2 ) as far east as was practicable in order to drill as high in the Triassic sequence as possible.

The drilling was carried out between 31 July 1981 and 17 August 1981. Holes T1 and T2 were drilled on private land, by arrangement with the landowners, and hole T3 was drilled on the Buckland Army Training Reserve by arrangement with the Army and the Department of Administrative Services.

## 5. DRILLING RESULTS

All holes were fully cored, with NQ size core being sampled, apart from short collars which were open holed and cased with steel casing. Core was measured, logged, photographed in colour and returned to Hobart for storage. Target depth for each hole was 100 metres, but this was not achieved in each case due to dolerite and contact metamorphosed rocks occurring at shallower depth than anticipated.

Each hole is discussed separately below:

### a) Hole T1

This hole was drilled north east of Stonehenge, on the 'Swanston' property of Mr W Dunbabin. The hole was sited as high on a hill as it was possible to get the rig, without crossing into the adjacent Army Reserve. This was to get as high in the Triassic section as possible.

Blocks of pale weathered quartz arenite occur on the surface at the drill-site. Approximately 2.5km north west of the drillsite an outcrop of pale yellow/brown quartz arenite dips at 18° towards 130° magnetic.

Yellow/brown quartz arenites, with minor clay pellet conglomerates interbedded with siltstones having fine anastomosing laminations, were intersected down to 22.98 metres. Below this depth sediments of a similar primary nature occur, however, the sediment is partially recrystallised giving it a more siliceous appearance and making it progressively harder downwards. Drilling was stopped at 52.01 metres after the last one metre took over four hours to drill. The recrystallisation is probably due to contact metamorphism resulting from the nearby intrusion of dolerite. Although dolerite was not intersected the rock was baked over the unusually large interval of at least 29 metres. This suggests that the hole was drilled parallel to the side of a nearby steeply dipping intrusive body. Vertical fractures are common in the baked sediments, and could result from cooling shrinkage around such a dolerite body.

The absence of lithic components in the sediments and the virtually complete absence of carbonaceous material indicate that the sediments drilled probably belong to the Lower or Middle Division of the Upper Parmeener Super-Group. The thin coal seam exposed in the Little Swanport River valley probably belongs to the Lower Division.

### b) Hole T2

Hole T2 was drilled south east of Little Swanport, on the 'Banwell' property of Mr D Madsen. Field reconnaissance indicated that the dolerite intrusions in the area are more extensive than indicated on the 1:250,000 Oatlands Geological Map Sheet, and it was accordingly necessary to site the hole further west (and thus lower in the Triassic sequence) than was desired. An outcrop of grey/brown medium grained planar crossbedded quartz arenite 200 metres north of the collar has a dip of 11° towards 98° magnetic.

The hole was drilled to a total depth of 83.0 metres. Dolerite was intersected at 77.82 metres. Alteration of the sediments is only evident for about four metres above the dolerite contact.

The sediments drilled consist largely of crossbedded medium grained quartz arenites (minor mica and feldspar present in the upper part of the hole) with minor interbeds of mudstone and clay-pellet conglomerates. In the lower half of the hole, a number of interbeds of black carbonaceous mudstone occur, the thickest being 0.9 metres.

However, there is no trace of coal or woody material. A sample from the interval 68.6m to 69.4m contained 3.2% volatile matter and 4.6% moisture (see analysis report).

It is difficult to say where these sediments fall in the Triassic section; on account of their minor mica and feldspar content and their carbonaceous interbeds, they may belong to the Upper Division of the Triassic.

c) Hole T3

This hole was drilled on the Buckland Army Reserve following negotiations with Army personnel and the Department of Administrative Services. The hole was sited below a dolerite-capped hill near the eastern margin of the main Stonehenge/Woodsdale/Buckland undifferentiated Triassic mass. The nearest of the small fault blocks on which coal has been previously recorded is approximately 7 kilometres to the south.

The hole was drilled to a total depth of 98.3m, with dolerite being encountered at 89.2m. The sediments drilled consist almost entirely of medium grained quartz arenites with very minor mudstones, clay-pellet conglomerates, and with small amounts of mica and feldspar near the top. The quantity of mica/feldspar in the arenites is probably too small to classify them as lithic arenites. The only carbonaceous materials in the holes are some bands of carbonaceous mudstones and sandstones in the top 20 metres.

The presence of mica, feldspar and carbonaceous materials in the top of the hole, and their absence in the bottom half, could imply that this hole was drilled on the approximate boundary between the Middle and Upper (Coal Measure) divisions of the Upper Parmeener Super-Group.

Fracturing occurs throughout the hole, and is particularly intense in some bands, to the extent of shattering the rock (fault breccias?). Below 34 metres these fractures are commonly lined with a dark black mineral of high S.G., and with pyrite. At 61.5-61.74m a 5mm thick pyrite vein with a black mineral coating fills a large fracture. The sandstone below 34 metres depth commonly contains disseminated grey metallic grains up to 1mm diameter, in concentrations of up to 30% on some bedding planes. Sandstone adjacent to the "mineralised" zones is appreciably darker and denser, an effect which may be due to impregnation of the sediments by a mineralising solution.

Trace amounts of base metals, silver, molybdenum and arsenic were recorded in samples from this zone (see analysis report).

## 6. CONCLUSIONS

No coal was intersected in any of the holes drilled. Carbonaceous beds occur in holes T2 and T3 although no lithic arenites were intersected. On the basis of the sediments intersected, which are probably as high in the Triassic sequence as it was possible to drill at each locality, it seems likely that the Middle or Lower Upper Division of the Triassic sequence was drilled. Consequently there is not much potential for the location of extensive coal seams in the vicinity of these holes.

Field reconnaissance prior to drilling indicated that there is a more complex pattern of dolerite distribution around drillsite T2 than had previously been suggested. In addition, topographic features in the areas drilled suggest more faulting than has previously been mapped, has taken place.

Since the known coal occurrences north of Buckland occur on downthrown fault-blocks, it is possible that further fault-blocks containing coal could be found in the area. However, their discovery would require intensive exploration.

## 7. SUMMARY OF WORK PROPOSED

1. Re-evaluate coal potential of the area.
2. Evaluate oil/oil shale potential of the area.

8. REFERENCES

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FIG. 2

E. L. 30/80



LEGEND

- Jurassic dolerite
- Late Triassic sediments
- Triassic undifferentiated sediments
- Permian sediments

SYMBOLS

- Normal faulting, downthrow side indicated
- Geological boundary - approximate
- Known coal deposit
- B.H.P. Diamond drill hole.
- E.L. 30/80 boundary

5 cm

SCALE

1:250 000

5 0 5 10km

Adapted from 1:250 000 Geological Series, Oatlands Sheet SK 55/6, 1976

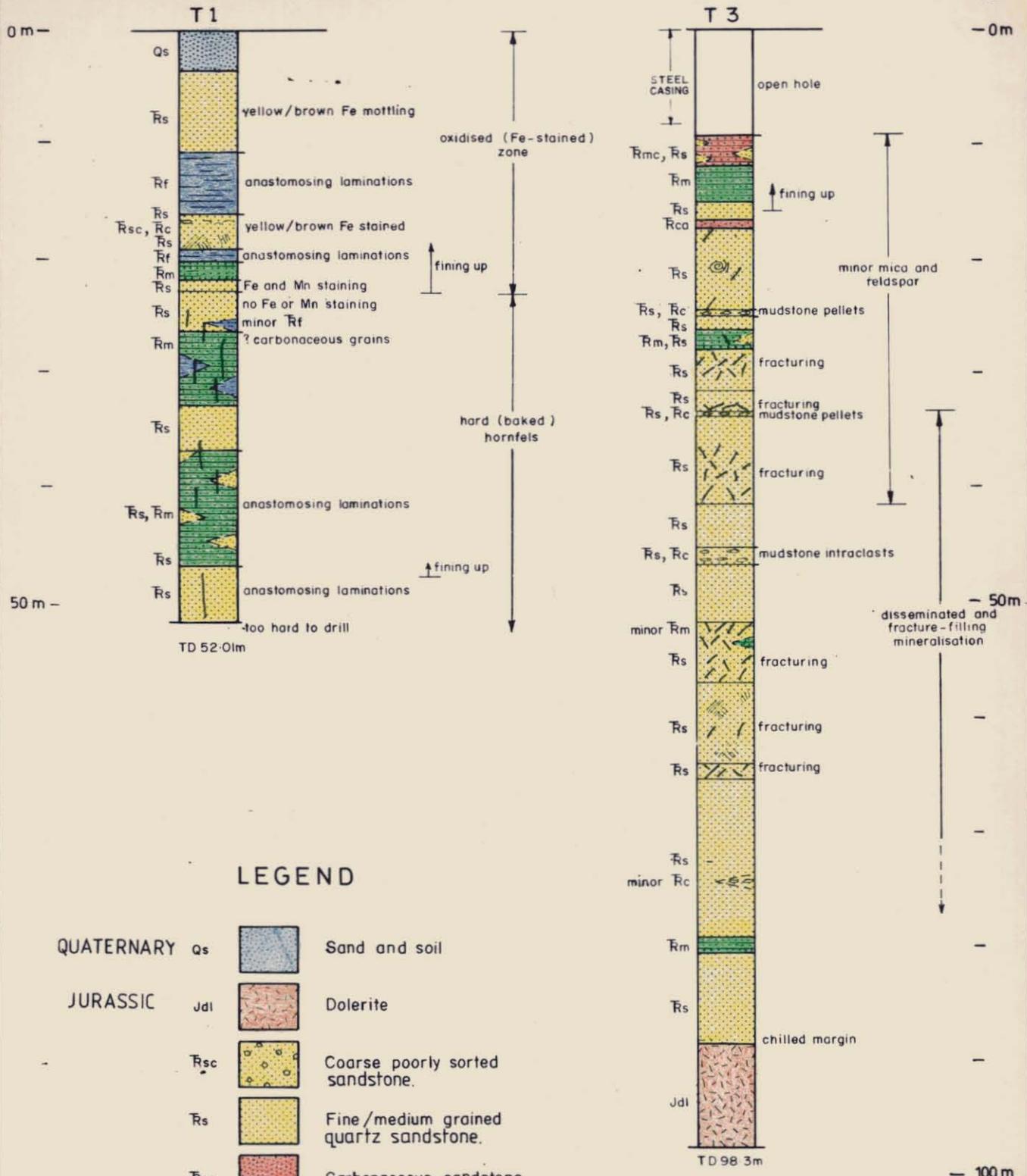
Centre  
Melbourne

Date  
OCT 1981

THE BROKEN HILL PROPRIETARY CO. LTD.  
E.L. 30/80 - SOUTHEAST TASMANIA  
GEOLOGICAL MAP OF LITTLE SWANPORT - BUCKLAND REGION  
AND DRILL HOLES T1, T2, T3.

Project No.  
C 350-3

Drawing No.  
A4-2262

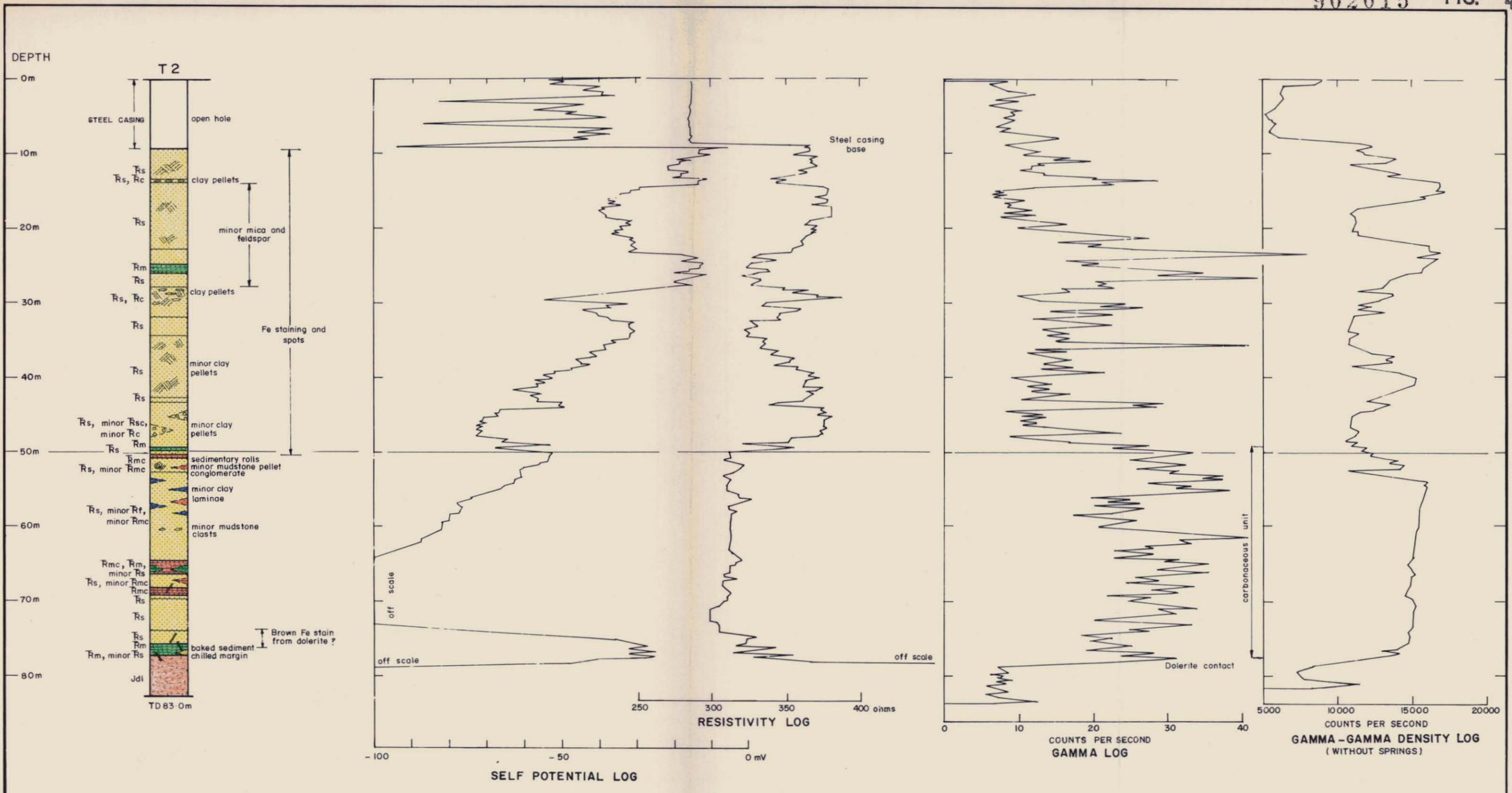


LEGEND

- |            |     |  |                                       |
|------------|-----|--|---------------------------------------|
| QUATERNARY | Qs  |  | Sand and soil                         |
| JURASSIC   | Jdl |  | Dolerite                              |
|            | Rsc |  | Coarse poorly sorted sandstone.       |
|            | Rs  |  | Fine/medium grained quartz sandstone. |
|            | Rca |  | Carbonaceous sandstone.               |
| TRIASSIC   | Rm  |  | Mudstone.                             |
|            | Rmc |  | Carbonaceous mudstone                 |
|            | Rf  |  | Siltstone                             |
|            | Rc  |  | Clay pellet conglomerate              |

5 cm

- |  |                            |
|--|----------------------------|
|  | Fracturing                 |
|  | Cross-bedding              |
|  | Disrupted/deformed bedding |



LEGEND

- |            |     |  |                                       |     |  |                          |  |                            |
|------------|-----|--|---------------------------------------|-----|--|--------------------------|--|----------------------------|
| QUATERNARY | qs  |  | Sand and soil                         | Rm  |  | Mudstone.                |  | Fracturing                 |
| JURASSIC   | Jdl |  | Dolerite                              | Rmc |  | Carbonaceous mudstone    |  | Cross-bedding              |
| TRIASSIC   | Rsc |  | Coarse poorly sorted sandstone.       | Rf  |  | Siltstone                |  | Disrupted/deformed bedding |
|            | Rs  |  | Fine/medium grained quartz sandstone. | Rc  |  | Clay pellet conglomerate |  |                            |
|            | Rca |  | Carbonaceous sandstone.               |     |  |                          |  |                            |

5 cm

THE BROKEN HILL PROPRIETARY CO. LTD. EXPLORATION DEPARTMENT		
E.L. 30/80 SOUTHEAST TASMANIA GRAPHIC AND GEOPHYSICAL LOG - T 2		
Prepared by: C.S.	Centre: PERTH	
Date: OCT 1981	Drawing No.	Project No.
Drawn:	A3-1537	C350-5

APPENDIX 1

DRILL LOGS

HOLE NO: TRIASSIC NO.1 (T.1)  
 LOCALITY: 'Swanston' property, upper Little Swanport River CO-ORDS 147°46'05"E 42°21'18"S  
 DATE COMMENCED: 31.7.81  
 DATE COMPLETED: 6.8.81  
 DRILLED BY: STACPOOLE DRILLING R.L. 280m ASL  
 DRILLER: Wayne Bald CASING 3m collar  
 LOGGED BY: Chris Sharples DEPRESSION vertical  
 BEARING -  
 RIG: Foxmobile B-80 Diamond Drill Rig

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
0.00	3.68	3.68	SAND: Thin grey sandy soil layer at top, underlain by medium white-grey well sorted subrounded quartz sand with trace humic particles and <5% white clay chips. A few yellow Fe-cemented sandstone chips.	OPEN HOLED 0-3.68m
3.68	10.95	7.27	SANDSTONE: Hard white/grey quartz sandstone (cement <5%) with common yellow/brown Fe mottling. Grains medium angular-subangular well sorted. Bedding massive. sediment appears "moderately porous. Fracturing (usually subvertical)" is evident at 6-8m. No mineral grains other than quartz noted. Cement usually white, becoming more abundant (5-10%) and browner towards bottom. Minor Liesegang Rings at 10.38-10.5m. Yellow clay pellet at 10.75m (15mm dia.) Base of unit (10.8-10.95m) is a brown iron-stone band (up to ~70% brown Fe oxide cement).	CORED 3.68m ON ↓ QUARTZ ARENITE IRONSTONE BAND
10.95	16.01	5.06	SILTSTONE: Finely laminated (≤1mm laminae) well sorted siltstone, a little clayey (especially in top 1m). Laminations sub-horizontal and regular, but occasionally crossbedded or anastomosing. Colour of unit: light yellow/brown at 10.95-12.0m, pale grey/tinge of green at 12.0-13.0m and grey/brown to slightly purple/pink at 13.0-15.9m. At 15.9-16.01, unit becoming yellow/brown, sandier and crossbedding evident.	CORE LOSSES: 11.73-12.0m 14.8-15.0m
16.01	19.33	3.32	SANDSTONE: Quartz arenite as at 3.68-10.95m, mostly brown (Fe stained), with Liesegang Rings, and with crossbedding (individual beds 10mm or thicker, defined by Fe-concentrations). Coarse, poorly sorted and with small white clay pellets at 16.93-17.06. Clay-rich band at 16.62-16.84m. White sandstone at 17.3-17.6m.	
19.33	21.79	2.12	SILTSTONE/MUDSTONE: Fine well sorted siltstone with laminae 1-5mm thick (sub-horizontal, 'anastomosing' or 'splitting' rather than cross bedded). Pale grey and pale yellow at 19.33-19.68m, pale grey/green at 19.68-19.84m, then alternating laminae of pale grey/green and pale pink/purple (19.84-21.2m). Siltstone breaks easily. Below 20.35m, sediment is a mudstone and less prone to breaking. Below 21.2m, sediment is grey/white mudstone with fine quartz sandstone interbeds up to 0.2m thick.	

HOLE NO: T.1

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
21.79	22.98	1.19	<u>SANDSTONE</u> : A little silty in top 0.2m. Yellow-brown (Fe stained) medium quartz sandstone as at 3.68-10.95m. Manganese dendrites and minor 10-20mm ironstone bands present. Sub-vertical brown (Fe) stained fractures present.	↑ WEATHERED 22.98m BASE OF OXIDISING ZONE. ↓ UNWEATHERED
22.98	26.52	3.54	<u>SANDSTONE</u> : Dense grey/white sandstone (harder and possibly a little finer than sandstones above). Medium well sorted angular-subangular-quartz grains (no other minerals noted). A few high angle fractures. Minor silty bands and pods near base.	
26.52	28.0	1.48	<u>MUDSTONE</u> : hard light and dark grey (mottled and banded) fine mudstone, quartzose, grains generally microscopic (recrystallised). Black specks visible (<3%). Sub-vertical fractures common, often lined with soft white/pale green minerals (2-3 fractures per metre).	?CARBONACEOUS SPECKS
28.00	33.0	5.0	<u>MUDSTONE/SILTSTONE</u> : Hard siliceous dark grey/green recrystallised finegrained well sorted mudstones interbedded with dark grey and light grey siltstone bands. Beds sub-horizontal, 5-100mm thick, generally. Minor dark (carbonaceous?) specks and blotches present. Bottom 0.75m of unit is fine hard dark grey massive siltstone. Vertical fractures common, lined with pale grey/green mineral.	HARD SED-IMENTS (RE-CRYSTALLISED?) BELOW 23m MAY BE BAKED BY NEARBY DOLERITE?? (i.e., THEY ARE HORNFELS?)
33.0	37.08	4.08	<u>SANDSTONE</u> : Hard dense dark grey/green to pale green fine-medium grained well sorted and quartzose. Recrystallised texture. Shows irregular wispy banding above 34.5m, massive below that. A few tight fractures. Bands 5mm thick - "Herringbone". Several large rounded bodies 0.1-0.2m dia. of lighter colour coarser sandstone occur in the core. Banding (5-10mm thick) again evident below 36.0m. Large vertical fracture from 36.3-38.1m (in next unit) .	VERY HARD DRILLING MAFIC CONTENT? (METASOMATIC ALTERATION FROM DOLERITE INTRUSION?)
37.08	46.7	9.62	<u>MUDSTONE/SANDSTONE</u> : Fine hard dark grey mudstone (looks recrystallised) with sub-horizontal banding 1-10mm thick (light-dark alternations, sometimes anastomosing or splitting). Interbedded is (30% of unit) dense grey/green fine-medium grained sandstone (looks recrystallised) in bands 0.1-0.40m thick. Shows fine indistinct cross-bedded laminations. A quartz arenite with minor fine dark specks. Sub-vertical fractures at 38.5-39m and 40.5-41.0 m.	

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
46.7	46.9	0.2	<u>SANDSTONE</u> : Hard pale green crossbedded recrystallised medium quartzose sandstone (as below).	
46.9	52.01	5.11	<p><u>SANDSTONE</u>: Top 0.8m grades down from a hard grey laminated recrystallised mudstone to sandstone as per remainder of unit:-</p> <p>Very hard pale white/green recrystallised medium grained sandstone: Individual grains indistinct but rock is ~60% white quartz, 30% green-stained and ?quartz blotches, and 10% fine-medium green-black grains (metamorphic or carbonaceous origin??)</p> <p>The green/black grains are often arranged in wispy sub-horizontal bands 1-3mm thick and up to several 100's of mm long, showing hints of crossbedding or "herringbone" bedding.</p> <p>A vertical fracture, lined with white and green minerals is present throughout the unit.</p>	<p>THIS UNIT IS VERY HARD DRILLING 4HRS/3M.</p> <p>FINAL 1m TOOK 4 hrs. TO DRILL</p>
52.01			<p>END OF HOLE - Hole terminated. A simple calculation shows it would take 3 weeks at this rate, to complete hole to 100 metres!</p>	

CONJECTURE - The vertical fractures may be due to cooling shrinkage around a vertically oriented dolerite body nearby (explaining relatively large thickness of metamorphosed sediments).

HOLE NO: T2  
 LOCALITY: Seaford Road, Little Swanport CO-ORDS 147°58'59"E 42°20'19"S  
 DATE COMMENCED: 10.8.81  
 DATE COMPLETED: 11.8.81  
 COLLAR R.L. 2m ASL  
 CASING COLLAR (~10m)  
 DEPRESSION Vertical  
 BEARING -  
 RIG: Foxmobile B-80 DD rig

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
0	9.38	9.38	<u>OPEN HOLE</u> - soil and weathered material - no recovery.	CORING FROM 9.38m DOWN
9.38	13.4	4.02	<u>SANDSTONE</u> grey-white medium lithified moderately friable sandstone. Grains well sorted, sub-angular to angular, appear to be 100% quartz. Cement v. minor component. Yellow-brown Fe staining (Mostly as Liesegang rings) is common and dark brown Fe-Oxide spots 0.5-2mm diameter occur throughout as a secondary cement around quartz grains within spots. 'Spots' comprise 30-40% of sediment. Cross bedding appears present, but is usually hard to distinguish from Liesegang Rings. Indistinct bedding present (bands 2-30mm thick), at ~10° to horizontal.	(EASY DRILLING) QUARTZ ARENITE
13.4	13.9	0.5	<u>SANDSTONE/CLAY PELLET CONG-LOMERATE</u> Sandstone as above with 20-30% pale grey/yellowish clay pellets 1-3mm thick, 2-30mm long, elongated horizontally. Minor (~1-2%) possible Feldspar grains.	0.4m CORE LOSS AT 14.49-14.9m
13.9	22.98	9.88	<u>SANDSTONE</u> As at 9.38-13.4m. Definite mica grains present (<1%) and probable feldspars (1-2%). Minor coarse quartz grains on a few bedding planes and minor (<2%) scattered clay pellets, mainly near bottom of unit - Fe-oxide spots most abundant (70-80% of sediment) at 21.3-22.5m. Base of unit marked by apparent minor 'unconformity' (as between crossbed sets) and by minor (~2%) black (?carbonaceous) grains.	0.42m CORE LOSS AT 16.48-17.9m 0.15m CORE LOSS AT 19.75-19.9m A QUARTZ ARENITE WITH MINOR LITHIC COMPONENTS.
22.98	25.2	2.22	<u>SANDSTONE</u> Grey/white medium (angular well sorted grains) quartz arenite with abundant Fe-stained brown bands and patches. Mica generally rare, but is common (~10%) on some bedding plaes. Minor content of dark black grains (carbonaceous?). Possible Feldspar minor. Sandstone breaks easily, clayey cement is obvious in places.	QUARTZ ARENITE WITH MINOR LITHIC COMPONENTS

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
25.2	26.1	0.9	<u>MUDSTONE</u> Fine brown/yellow mudstone with up to 20% fine mica in places. Minor ?Mn stains. Mudstone moderately clayey.	QUARTZ ARENITE WITH MINOR LITHIC COMPONENTS.
26.1	28.01	1.91	<u>SANDSTONE</u> grey/white well sorted fine quartz sandstone with common brown Fe banding and Fe-spots in bottom 0.5m. Bedding vague-defined by Fe-stained banding and bedding plane breaks (~10% from horizontal). Medium grained mica common on some bedding planes in top 0.5m of unit. Occurs together with common ~1.0mm dia. black spots (carbonaceous?). On these planes, Quartz ~60%, mica ~10-20%, black spots 10-20%, brown clay cement ~10%.	
28.01	32.0	3.99	<u>SANDSTONE/CLAY PELLET CONGLOMERATE</u> Brown to pale purple/brown medium quartz arenite with brown Fe-staining and spots (~1mm dia.). Fe-stain bands 3-10mm thick often define crossbedding. Trace (<2%) Feldspar grains appear to be present. At 28.01-30.1m up to 20% pale grey/grey clay pellets occur, 0.5-5.0mm thick and up to 30.0mm long, and elongated in direction of bedding (bedding-10° from horizontal)	QTZ. ARENITE
32.0	34.3	2.3	<u>SANDSTONE</u> grey/white medium friable well sorted quartz arenite with brown Fe-stain bands up to 10mm thick defining bedding (bedding ~10° to horizontal).	QTZ ARENITE
34.3	42.85	8.55	<u>SANDSTONE</u> grey/white medium friable well sorted quartz arenite, almost entirely light brown Fe-stained. Brown Fe spots and banding ubiquitous, sometimes defining crossbeds. Rare clay pellets (mostly <1mm dia.). No micas or feldspar identified.	QTZ. ARENITE
42.85	43.5	0.65	<u>SANDSTONE</u> grey/white medium friable well sorted quartz arenite, 50% of which is bands up to 20mm thick stained brown by Fe.	
43.5	49.6	6.1	<u>SANDSTONE</u> grey/white medium friable well sorted quartz arenite with Fe spots up to 2mm dia, and 80% of sediment light brown Fe stained. Scattered clay pellets present (~5%) and minor bands up to 30mm thick with coarse granule size poorly sorted quartz clasts. Clay pellets common in these bands, but no mica/feldspar seen.	
49.6	50.0	0.4	<u>MUDSTONE</u> dark brown and brown red (bands 5-20mm thick) fine grained mudstone.	
50.0	50.64	0.64	<u>SANDSTONE</u> fine grained brown clayey quartz arenite-featureless apart from Fe staining	
50.64	50.76	0.12	<u>SANDSTONE</u> fine grained pale grey quartz arenite. slightly clayey with sub-horizontal undulating bands 1-5mm thick (darker grey).	

OXIDISED  
SEDS.

UNOXIDISED  
SEDS.

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
50.76	50.98	0.22	<u>CARBONACEOUS SANDSTONE</u>	dull black finegrained ?quartz sandstone (well sorted) with fine black carbonaceous matrix. Massive, no banding. Grades into units above and below.
50.98	52.8	1.82	<u>SANDSTONE</u>	pale grey/green medium well sorted friable quartz arenite. Banding indistinct, 5-250mm thick. A few (1-2mm) red laminae, and at 52.25-52.34m, is a large allocthonous block of ?quartz arenite having pale grey/green laminae interlaminated with 80% red laminae. Laminae are contorted and end abruptly at edge of block ("Sedimentary Roll"?). Band of dull black carbonaceous sandstone at 52.7-52.72.
52.8	52.89	0.09	<u>CONGLOMERATE</u>	sandstone as above with 50% rounded elongate grey (red tinged) mudstone clasts up to 10x30cm.
52.89	52.97	0.08	<u>CARBONACEOUS MUDSTONE</u>	dull black fine grained carbonaceous mudstone.
52.97	64.85	11.88	<u>SANDSTONE</u>	pale grey/green fine/medium friable quartz arenite (no mica/feldspar identified) with minor red, black and yellow (clay) laminae above 59.0m (indicate bedding dipping 10° to horizontal). Unit massive below 59.0m. Red tinge to sediment at 62.9-63.25, and 63.55-63.8m. Dull black carbonaceous mudstone interbedded at 56.98-57.04. Minor mudstone clasts at 60.93m
64.85	66.67	1.82	<u>BANDED MUDSTONE</u>	dull black carbonaceous mudstone (80% of top 0.5m) interbedded with pale red and pale green mudstone, and with minor pale green sandstone bands (as at 52.97-64.85m bands usually 1.0-30.0mm thick (except carb. mudstone. bands in top 0.5m, which are up to 200mm thick). Mainly pale green sandstone in lower 0.5m.
66.67	68.5	1.83	<u>SANDSTONE</u>	pale grey/green medium quartz arenite with 50% pale red laminae and bands up to 200mm thick. One dull black carbonaceous clay band at 67.53-67.55m
68.5	69.4	0.9	<u>CARBONACEOUS MUDSTONE</u>	dull black ?carbonaceous mudstone, massive and featureless except for green/black fine sandstone band at 68.93-68.96m. Fracture at ~70° to horiz. in top half of unit
69.4	70.0	0.6	<u>SANDSTONE/MUDSTONE</u>	. Green fine quartz arenite (40%) interbanded with 1-5mm thick dull black carbonaceous mudstone laminae (~40%) and dull red mudstone bands (~20%) up to 15mm thick.
70.0	74.17	4.17	<u>SANDSTONE</u>	pale grey/green fine well sorted quartz arenite. Laminated-laminae 1-10mm thick of darker sand (and rarely of red mudstone) define bedding at 10° to horizontal. Sediment fairly friable.
74.17	76.18	1.99	<u>SANDSTONE</u>	brown fine-medium well sorted quartz arenite with indistinct banding and laminations.

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
74.17 (cont'd)	76.18	1.99	A few irregular blotches and laminae pale grey/green (i.e., not Fe stained), and rare fracture surfaces (at ~45° to horizontal) also grey/green.	BROWN Fe-STAINED DUE TO SOLUTIONS FROM DOLERITE?
76.18	76.6	0.42	<u>MUDSTONE</u> fine red/brown banded (1-10mm thick bands) mudstone, except grey/green on some bedding planes and on a vertical fracture at 76.42-76.54m.	
76.6	76.8	0.2	<u>SANDSTONE</u> fine/medium brown hard arenite (baked)	
76.8	77.82	1.02	<u>BAKED MUDSTONE/SANDSTONE</u> fine grey/green mudstone, laminated, with dark grey/green and red laminae up to 5mm thick, and with ~40% 5-10mm thick fine grey/green quartz arenite interbeds. Vertical fracture in bottom 0.5m (cuts dolerite contact, therefore post-dolerite intrusion or penecontemporaneous).	
77.82			<u>DOLERITE CONTACT</u> 2mm thick ?quartz layer on contact.	
77.82	83.0	5.18	<u>DOLERITE</u> top 70mm dull black fine grained - a chilled margin. Rest of unit is dense grey/green medium to coarse grained dolerite, clearly showing intergrown texture of pyroxene and feldspar crystals.	
83.00			END OF HOLE	

HOLE NO: T3  
 LOCALITY: Sand River Road, Buckland Army Training Reserve CO-ORDS 147°42'45"E 42°27'31"S  
 DATE COMMENCED: 13.8.81  
 DATE COMPLETED: 17.8.81 COLLAR R.L. 310m ASL  
 DRILLED BY: Stacpoole Drilling CASING Collar 9m steel  
 DRILLER: Wayne Bald DEPRESSION Vertical  
 LOGGED BY: Chris Sharples and Kelvin Kuys BEARING -  
 RIG: Foxmobile B-80 DD rig

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
0	9.3	9.3	<u>OPEN HOLE</u> clayey materials - no recovery	
9.3	9.9	0.5	<u>WEATHERED SANDSTONE</u> grey/white medium quartzose sandstone. Clayey. Approx. 1% black carbonaceous specks, and 2% fine-medium mica grains. Tendency to be friable, despite clay content.	
9.9	12.0	2.1	<u>WEATHERED SANDSTONE/WEATHERED CARBONACEOUS MUDSTONE (20/80)</u> sandstone as at 9.3-9.9m, in a bands 10-30mm thick, interbedded with bands of slightly clayey dull grey/black fine-grained and carbonaceous mudstone. Mudstone bands 5-150mm thick, and slightly clayey.	
12.0	13.0	1.0	<u>MUDSTONE</u> pale grey to pale purple finegrained mudstone, with bedding defined by pale grey/yellow mud bands 1-10mm thick, often wispy, and constituting 20-30% of unit.	
13.0	13.82	0.82	<u>MUDSTONE</u> pale green mudstone (fine, but almost verging on fine sandstone in places) with wispy yellow bands as at 12-13m.	
13.82	14.15	0.33	<u>SANDSTONE</u> pale green fine/medium well sorted quartzose sandstone with ~5% fine/medium mica. Cement (clay?) is pale green, <10% of sediment. Banding not apparent, but breaks along planes ~10% from horizontal. Feldspar content indeterminate. Fine-mudstone - in bottom 50mm	
14.15	14.25	0.1	<u>CARBONACEOUS MUDSTONE</u> grey mudstone with 10-20% black spots <1mm dia, and minor pale grey/white laminae.	
14.25	15.0	0.75	<u>MUDSTONE</u> as at 13.0-13.82m. Slowly coarsens down-graduating into next unit below.	
15.0	16.73	1.73	<u>SANDSTONE</u> pale green medium grained quartzose sandstone with 5-10% fine/medium mica, feldspar indeterminate. Bedding obvious (~5-10% from horizontal), lighter and darker beds 2-10mm thick. Indications of crossbedding in a few places, beds mainly uniform "conformable".	
16.73	17.4	0.67	<u>CARBONACEOUS SANDSTONE</u> sandstone as at 15-16.73, with 60-80% undulating 'wisps' and bands up to 20mm thick of fine grey/black micaceous sandstone (almost a mudstone). Individual carbonaceous grains not discernable - just a carbonaceous cement.	

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
17.4	24.71	7.31	<u>SANDSTONE</u> pale green medium well sorted quartzose sandstone with ~5% fine/medium mica. Abundant darker laminations 1-5mm thick - wispy, undulating, anastomosing; approx. elongated at 5-10° from horizontal. Contorted "sedimentary roll" at 20.7m. Laminations rare, indistinct below 23.7m.  Tight quartz-lined fractures at ~60° to horizontal at 17.6m, 21.6m, 24.10m.	CORE LOSS AT 20.66 -20.8m FRACTURE AT 21.6m MAY BE A FAULT- SEDIMENT ABOVE AND BELOW SLIGHTLY DIFFERENT.
24.71	25.17	0.46	<u>INTRACLASTIC ("FLAT PEBBLE") CONGLOMERATE</u> sandstone as per above unit, with 50% intraclasts of green fine sandstone (mudstone), elongated along bedding (~5° to horizontal). Intraclasts range 1-20mm thick, and 8- >30mm long.	
25.17	26.45	1.28	<u>SANDSTONE</u> pale green medium well sorted quartzose sandstone, massive (laminated in places). About 5-10% mica.	
26.45	28.0	1.55	<u>MUDSTONE/SANDSTONE</u> grey micaceous mudstone with 30% laminae and bands up to 30mm thick of medium pale grey/green sandstone. Sandstone bands irregular, and wispy or contorted/deformed. Mudstone intraclasts present in some sandstone bands. Fracture at ~60° to horizontal at 27.4m, lined with quartz.	
28.0	31.7	3.7	<u>SANDSTONE</u> grey/green medium quartz sandstone with ~5% mica and <5% dark black shiny grains (also mica?). Laminated, with laminations commonly wispy, anastomosing. Below 29.0m, thick banding (up to 0.5m) of massive sandstone occur.  Rock shattered (fracture or fault zone) between 28.0 and 30.6m (no uniform fracture pattern obvious).	CORE LOSS AT 29.67- 29.80m. FRACTURING
31.7	33.53	2.23	<u>SANDSTONE</u> massive grey/green medium quartz sandstone with <2% mica. Irregular fracturing throughout, especially at 33.0-33.24m.	
33.53	33.83	0.3	<u>INTRACLASTIC ("FLAT PEBBLE") CONGLOMERATE</u> grey/green medium quartz sandstone with <1% mica, and 20-30% grey mudstone intraclasts up to 3mm x 15mm, elongated sub-horizontally.	
33.83	41.6	7.77	<u>SANDSTONE</u> grey/green medium quartz sandstone with <2% mica and ~2-3% dispersed shiny silvery metallic medium grains. Massive except for a few indistinct lighter bands up to 10mm thick. A few bedding plane breaks (~5° to horizontal) show slickensiding.	MINERALIZATION.

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
33.83 (cont'd)	41.6	7.77	At 36.7-37.0m, 37.55-37.98m and 40.4-41.04m, get intense shattering of rock (fracture/?fault zone breccia). Fracture surfaces coated with dark black high S.G. mineral and minor pyrite. These coatings appreciably increase S.G. of some sandstone fragments. Sandstone in & adjacent to mineralised fracture zones is appreciably darker and denser than elsewhere in unit & impregnated by mineralising solutions?	MINERALISED FRACTURE ZONES - FLUIDS FROM DOLERITE???
41.8	45.5	4.9	<u>BANDED SANDSTONE</u> Interbanded grey/green & pale grey medium quartz sandstone with 2-5% (up to 30% at 41.7-42.0m) medium irregular dispersed grains of a silvery shiny metallic mineral. Light and dark bands 5-100m thick, usually planar and sometimes crossbedded or contorted	MINERALISATION
45.5	46.8	1.3	<u>INTRACLASTIC ("FLAT PEBBLE") CONGLOMERATE</u> pale green medium quartz sandstone (no mica seen) with 1-2% dark shiny metallic grains dispersed throughout. Approx. 5% pale grey/green mudstone intraclasts up to 6 x 30mm in size, elongated sub-horizontally.	
46.8	52.0	5.2	<u>SANDSTONE</u> medium grained well sorted grey/green to (minor) pale grey green quartz sandstone (no mica seen). Planar bands (at ~3-5% to horizontal) are 2mm-200mm thick and indistinct. In lower 2m of unit, get some irregular bands and blotchy patches of darker sand (intraclasts ?) up to 20mm dia.	
52.0	57.3	5.3	<u>SANDSTONE</u> heavy dark green (mineralisation impregnated?) quartz sandstone with 2-3% dispersed fine pyrite and dark silver metallic mineral grains. No mica seen. At 53.55-53.80m, get fine dark green laminated mudstone. At 52.0-52.5m (shattered), 53.7-53.95m (shattered), 55.1-55.4m, 55.84-56.47m, 57.8-57.2m, get fractures (mostly at 60° to horizontal) lined with black mineral and minor pyrite.	MINERALISATION
57.3	64.4	7.1	<u>SANDSTONE</u> grey/green medium quartz sandstone, with indistinct planar bands 5-20mm thick, sometimes cross-bedded. Minor amounts of silvery shiny metallic mineral (up to 30% on some bedding planes). At 61.5-61.74m, get fracture at ~70° to horizontal, lined with black mineral coating which sandwiches a 4-5mm thick pyrite vein in the centre.	
64.4	65.8	1.4	<u>SANDSTONE</u> grey/green medium grained quartz sandstone similar to 57.3-64.4m except completely shattered. Shattering occurs at random rather than along bedding planes.	FRACTURING
65.8	89.2	23.4	<u>SANDSTONE</u> grey/green medium grained quartz sandstone, massive generally, minor dark bands. angle of bedding to L.C.A. ~5°. minor clay pellets at 74.3-74.8m fine grained band from 79.8-81.0	

DEPTH FROM (m)	DEPTH TO (m)	THICKNESS (m)	DESCRIPTION	COMMENTS
65.8 (Cont'd)	89.2	23.4	grades from siliceous to more argillaceous at base (green colouration due to clay minerals) little thermal metamorphism.	
89.2	98.3	9.1	<u>DOLERITE</u> grey/green fine grained dolerite (chilled margin) becoming coarser grained with depth minor calcite veining from 90.7m to 91.2m.	
98.3			END OF HOLE	

APPENDIX 2

ANALYTICAL RESULTS

Assay Results T3 Core Samples

	Cu	Pb	Zn	Ag	Mo	As	Sb	Au	Sn	W
T3-1	30	880	680	4	10	5	<4	<0.1	<5	<10
T3-2	10	560	130	3	20	220	<4	<0.1	5	<10
T3-3	70	2800	1000	9	10	10	20	<0.1	<5	<10

- analyst Aust. Lab. Services; all results in ppm
- Sn, W, Sb by method XRFIA; Cu, Pb, Zn, Ag method 1
- Mo method 2; As method 5B.

T3-1 Green sandstone with pyrite vein - 53.7-54.0m.  
T3-2 Pyrite vein with pyrolusite (?) - 61.6-61.7m.  
T3-3 Green sandstone below pyrite vein - 61.4-61.6m.

