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GEOPHYSICAL RESEARCH PTY. LTD.

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MICROFILMED

For
Nickelton Mining

HOLWELL, TASMANIA

E.L. 5/71

GEOLOGY

May, 1971

AMG REFERENCE POINTS ADDED

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EL 5 / 71 on behalf of Nickelton Mining Pty Ltd

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I. INTRODUCTION

This is a report on the geology of EL 5/7I held in the name of J.S.Willcox on behalf of Nickelton Mining Pty Ltd. The report is a compilation of previous literature and incorporates the results of new mapping of an additional 250 square miles at reconnaissance standard.

Previous work consists of investigations of mineral deposits at Andersons Creek by Taylor, Stephanski and Hughes, published in the Technical Reports of the Department of Mines; geological mapping to formation standard on the Beaconsfield mapsheet, published in the Geological Atlas of Tasmania (One-Mile Series); mineragraphic investigations at Andersons Creek by the C.S.I.R.O. ; aeromagnetics and surface water geochemical surveys by Broken Hill Proprietary Ltd.

The new mapping was undertaken by C.J.Maclean during March and April, 1971.

2. LOCATION and ACCESS

The area is on the north coast of Tasmania, on the western side of the Tamar River, within 20 miles of Launceston. There is a deep-water port at Bell Bay on the opposite side of the Tamar River at a road distance of 15 miles. The port is equipped with bulk loading facilities for the bauxite and ferromanganese

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smelters located at Bell Bay.

There is an abandoned tramway from Andersons Creek to Beauty Point but Beauty Point is unsuitable as a deep-water port. There is a large industrial labour market in the vicinity, at Launceston, Devonport and Georgetown. There is a surplus of field labour due to the current recession in the rural industries.

The supply of labour, proximity of engineering and industrial services and the short haul to an equipped bulk-loading, all-weather shipping terminal, would make even a small mineral deposit economically attractive.

3. CLIMATE

The climate is humid, cool temperate. Average rainfall is about 30 inches. There is a surplus of surface water between May and September. The summer variability is high and local water sources are not dependable for large supplies in the summer. Commercial and household users on the West Tamar are assured a reliable supply by trunk main from the South Esk River.

Water is not abundant due to lack of control but could be obtained economically in large quantities with relatively small capital investment.

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4. STRATIGRAPHY

4a) Precambrian: The effective basement is the Badger Head Group of sandstones, slates and phyllites. In the catchment area at the head of the Supply River the rock types observed are metasandstones, slates and chlorite schists. These rocks are strongly foliated but with no obvious lineations. The folds are younger than the predominant foliation and are crossed in places by kink bands.

4b) Cambrian: The Cambrian rocks consist mainly of slate with subordinate greywacke sandstone. A second common lithology is interbedded slate and chert. East of Salisbury Hill there is an interbedded lens of keratophyre.

South of Beaconsfield map sheet, the slate belt between Peaked Hill and Salisbury Hill continues south for about one mile but then disappears beneath Permian cover on Mt. Stewart. On the southern side of Mt. Stewart an outcrop of slate was found at low water level in the bed of the southern tributary of the Supply River. This is thought to be Cambrian. The slates are dark in colour with no visible banding and no mineralization; the cleavage trends generally north.

On the western side of the ultrabasic complex at Andersons Creek, Cambrian rocks form a narrow strip between the ultrabasics and the Precambrian basement. Baker described these rocks, and other small patches described by him as "roof pendants" in the

serpentinite, as reconstituted graphitic schists containing detrital zircon, pyrrhotite, chalcopyrite, rutile and ilmenite.

4c) Ordovician: The Ordovician rocks at Beaconsfield consist of quartz sandstone with layers of quartz conglomerate, called the Cabbage Tree Formation. In the area of new mapping to the south, the quartz sandstone of Peaked Hill continues south to Flowery Gulley, then disappears under the Permian of Mt Stewart. It reappears as a large inlier on the south side of the Supply River, surrounded by Permian rocks, and there consists of meta-quartzite with bands of granule conglomerate 9 inches thick. Another small outcrop was found on the hills north-east of Frankford as a small residual occupying a hollow in the Precambrian bedrock, and consists of an open framework conglomerate of well-rounded pebbles, markedly prolate in form. The pebble size varies from $\frac{1}{2}$ to 4 inches in diameter with an average size of 2 inches. The pebbles are pink or white quartzite. No imbricate structure or bedding is apparent.

On Beaconsfield mapsheet the Gordon Limestone occurs in a narrow strip on the eastern side of Cabbage Tree Hill. Further south, the limestone occurs on Beams's farm at Flowery Gulley where it is a dark blue limestone with a prominent north-south foliation. It has impure horizons containing siliceous material in the form of chert. The stratigraphic level is near the base of the formation and the Flowery Gulley deposit appears to be a tight

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synclinal zone which disappears under the Permian of Mt Stewart to the south.

Sinkholes on the crest of the ridge, southwest of Beams's farmhouse, show a coarse fluvial conglomerate, Permian in age, unconformably overlying the Gordon Limestone. Small caves in the vicinity have Gordon Limestone walls and a horizontal Permian roof.

4d) Permian: Permian rocks form an extensive cover throughout the area. They consist of mudstones with occasional beds of sandstone and conglomerate. The attitude is subhorizontal on the western and southern areas of the E.L., but on the eastern and northern sides a marked regular dip appears in the Permian, with the beds striking NNW and dipping north-eastwards into the Tamar fault zone.

The base of the Permian is about 300 feet above sea-level on the northern side of Mt. Stewart and at Flowery Gulley and is approximately the same at the head of the Supply River. The maximum thickness is about 1000 feet on Mt. Stewart.

The Permian rocks on the western side of the Dazzler Range, in the vicinity of Frankford, are predominantly mudstone, while on the eastern side, at Mt. Stewart and Glengarry, the rocks are predominantly sandstone.

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4e)Cainozoic: Surface deposits consist of sand, silt, clay and gravel. The gravels are being worked for roadbase.

5. IGNEOUS ROCKS

5a)Jurassic dolerite: There are large areas of Jurassic dolerite in the form of irregular sills which make up the western edge of the Tamar Valley from Rosevears to Sidmouth; and on the western side of Frankford, forming a northwesterly trending belt extending from Quamby Bend to Harford. A semicircular plug of dolerite, 3 miles south of Glengarry, at the Four Springs Plain, may be a small cone sheet.

5b)Tertiary basalt: There are basalt flows in the Tamar Valley between Hillwood and Garden Island (Georgetown). These are interstratified with the Cainozoic sediments of the Tamar Basin.

5c)Cambrian keratophyre: A lens of keratophyre outcrops on the roadside east of Salisbury Hill. It is finegrained with mafic phenocrysts and is interbedded with Cambrian slates.

5d)Cambrian basics and ultrabasics: The most important rock type in the district is the Cambrian ultrabasics of the Andersons Creek complex. According to Baker, the first intrusion was a hornblende gabbro which is confined to the northwestern end of the complex at Frenchmans Quarry. This has been intruded by

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serpentinite which makes up the bulk of the complex. The hornblende gabbro was altered by garneterizing of the plagioclase by lime metasomatism to produce grossularite, while hornblende was altered to chlorite. The resultant rock type, containing grossular, vesuvianite, diopside, prehnite and epidote, is termed rodingite. It is a typical hornfels, being white, dense, tough, finegrained with a flint-like texture. The alteration involved introduction of calcium, water, aluminium, removal of silica, potassium, sodium, iron and titanium,

6. ECONOMIC MINERAL DEPOSITS

The nickel-chromium deposits at Andersons Creek may be classified into three types--primary, secondary and residual. This classification is based on consideration of previous reports and its validity has not been tested in the field. Most of the work done on these deposits appears to be haphazard, with no systematic investigation or appraisal.

The serpentinite is predominantly antigorite with veins of chrysotile and picrolite which have been worked for asbestos. Magnetite occurs as small primary grains associated with chrysotile or an acicular secondary form. Everard examined drill core averaging 0.7% nickel and was unable to observe any garnierite, and suggested that the nickel was isomorphous with magnesium in antigorite. Baker recorded the opaques as being magnetite,

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picotite, pyrite and millerite. In 1961 the Department of Mines sank an inclined hole 159 feet through surface secondary concentrations of garnierite to intersect a rodingite band in depth and found no economic concentration of nickel or chromium in the serpentinite adjacent to the rodingite. Surface work has found chromite as primary concentrations along the intrusive contact with roof pendants of rodingite, with local concentrations up to 75%.

Secondary nickel occurs within the serpentine as garnierite, apparently concentrated near contacts with rodingite. The rodingite itself is low in nickel, but the western contact assays 0.7 to 0.8%, the eastern contact 3% nickel. A sample showing much bluish-green mineralization ran 6.7% nickel.

Lateritic cappings on the serpentinite contain residual concentrations of chromite. The nickel-chromium clays in the soil zone immediately above the serpentinite were investigated by the Ben Lomond Mining Co. in the period 1957-62 and were found to contain about 0.5% nickel and in the order of 2% chromium, King Island Scheelite, in 1967, drilled a pattern of 100-foot diamond drill holes to test the laterite. They found surface concentrations of nickel from about 1 to 1.5%, but only background levels below this. 13 holes were drilled on Barnes Hill with 4 scout holes further north. Indicated reserves were about 9 million tons averaging 1% nickel.

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Chromite occurs as a (?) Tertiary fluvial deposit southeast of Barnes Hill on serpentinite bedrock, also immediately west of the contact between serpentinite and Ordovician sediments. Grades range up to 240 lbs/yard but in limited tonnages.

6b) Gold: Gold occurs in Beaconsfield map sheet in EL 7/69, currently held by Allstate Tasmania Pty Ltd. The deposits are combinations of saddle and fissure reefs in Ordovician rocks. The Tasmania Reef is the principal occurrence and strikes 050 and dips 55 southeast. It occupies an old fault zone, averaging 8 feet wide, and is 1300 feet long with grades decreasing from 25 swt at the surface to 5 or 10 dwt at 1500 feet. The lode passes into sulphides at depth.

6c) Metallic sulphides: Sulphide mineralization, pyrite, chalcopyrite and galena, are reported from the Tasmania Reef at Beaconsfield. East of the Tamar River at Lefroy there is also stibnite and arsenopyrite associated with gold. This is post-Ordovician, presumably Devonian, mineralization.

In the serpentinite at Andersons Creek pyrite is common and millerite is reported from the northern end. Hornblende gabbro in the northwestern corner of the complex, and southwest of Mt. Vulcan, contains pyrrhotite, pentlandite and chalcopyrite. Pyroxenites within the serpentinite contain chalcopyrite and chalcocite.

Copper deposits in the Precambrian of the Asbestos Ranges

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are presumably in the form of narrow seams of chalcopyrite. Surface water sampling by B.H.P. failed to reveal any significant sources.

6d) Summary: Gold and telethermal sulphides at Beaconsfield are Devonian deposits related to the eastern granites. The nickel and copper sulphides at Andersons Creek indicate a basic mineralization during the late Cambrian. The latter assemblage has yielded base metals on the West Coast of Tasmania but the Beaconsfield assemblage is poorly known.

7. AEROMAGNETICS

The aeromagnetism shows a high of 2250 gammas located over the outcrop of ultrabasics on Barnes Hill. The source is a localized one within the serpentinite mass. Crossgradients may be due to concentrations of secondary magnetite.

The most prominent regional feature is a long linear anomaly which continues for about 16 miles. The intensity is high over Palaeozoic inliers and diminishes rapidly with increasing thickness of Permian cover. The depth to the source within the licence area is everywhere of the order of 1000 feet or more, which is too deep for ground geophysical methods to be effective in determining the nature and location of the source.

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8. TECTONICS and REGIONAL GEOLOGY

The tectonic map, profiles assembled from serial sections, and transformed aeromagnetics, show all that can be usefully inferred of the Palaeozoic geology.

Salisbury Hill is a strike-fault repetition of Cabbage Tree Hill. Peaked Hill is considered by the Geological Survey to be another such repetition but it appears to be, instead, the core of a syncline. Bedding is obscured on the eastern side of Peaked Hill by a strong cleavage which the Survey has interpreted as due to a strike fault, however it appears to be cleavage developed in a fold hinge. The syncline continues southward through the limestone at Flowery Gulley. There is a marked change of profile on the south side of Peaked Hill which is due to an east-west trending cross-structure. This is generated disharmonically at the Precambrian boundary on the west, while to the east it passes into a transverse flexure at the south end of Cabbage Tree Hill.

The Flowery Gulley-Peaked Hill syncline is separated from the Ordovician strike ridge through Dans Hill by a large fault which has very considerable throw. The fault correlates very closely with the major aeromagnetic anomaly.

The ultrabasic complex has an intrusive boundary on the west against Cambrian, and possibly Precambrian. The eastern

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boundary is a depositional contact representing Ordovician (or Tremadocian) erosion of the ultrabasics. The ultrabasic complex may extend in depth for many miles north and south of its known outcrop, however in both directions the structure of the Permian cover is such that it increases rapidly in thickness. To the south, the Permian is horizontal, but the topography rises sharply so that a thickness of 1000 feet is rapidly attained on Mt. Stewart. To the north, the topography is low but the edge of the Tamar structure runs in, with steep dips in the Permian and again, large thicknesses of cover. If there are strike extensions of the ultrabasic complex they are too deep to warrant investigation. There is no indication of lateral repetitions, either structurally or by way of a second intrusion.

9. CONCLUSIONS and RECOMMENDATIONS

The only rocks with prospects for mineralization are Precambrian, Cambrian and Ordovician rocks. There is a Devonian reef gold province centred on Beaconsfield and a Cambrian base metal province centred on Andersons Creek. The Permian cover is thick and extensive so that areas of economic interest are confined to inliers in the Permian.

The Andersons Creek-Beaconsfield inlier is wholly blocked out by E.L.s 7/69 and 26/70. The thickness of cover increases

too rapidly away from the margins of the inlier to make the surrounding area of any interest.

A smaller inlier, or group of inliers, occurs on the south side of the Supply River. However the rocks of economic interest do not outcrop and the topographic situation is such that, if present, they are covered by several hundred feet of Permian cover. Further exploration of that southern area is not warranted.

The only possibilities for extensions at shallow depth are to the north, in a thin strip along the eastern edge of the Precambrian of the Asbestos Range. The geology is obscured by Cainozoic cover. The aeromagnetics indicates a discrete source in this region at a depth of several hundred feet which would be amenable to examination with ground magnetics and electrical methods.

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REVIEW OF AN AEROMAGNETIC SURVEY

BEACONSFIELD, TASMANIA

(EL 5/71)

ON BEHALF OF

NICKELTON MINING PTY LTD

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REVIEW OF AN AEROMAGNETIC SURVEY

BEACONSFIELD, TASMANIA

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by

R.J.G. Lewis, B.Sc., M.A., Ph.D.

Mona Vale, N.S.W.

May, 1971.

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SUMMARY

Depth estimates made from an aeromagnetic survey over parts of EL 5/71 indicate that potential targets are at too great a depth for practical exploration. Acquisition of a related target is recommended.

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REVIEW OF AN AEROMAGNETIC SURVEY

BEACONSFIELD, TASMANIA

(EL 5/71)

ON BEHALF OF

NICKELTON MINING PTY LTD

INTRODUCTION

Late in 1970 EL 5/71 was pegged in the name of J.S. Willcox. This EL extends north and south of the town of Beaconsfield and surrounds the outcrop of a complex ultramafic intrusion without any actual outcrop of ultrabasics in EL 5/71. The potential exploration target is a possible extension of the ultramafics under Palaeozoic cover to both north and south of the known outcrop.

As a step in the investigations a review of the data available from Mines Department files was undertaken. Previous work on the area included a total intensity aeromagnetic survey by B.H.P. and this is reviewed here. The plans on file in the Mines Department were of such a scale as to make an overall view

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impossible. B.H.P. was accordingly approached and a map on the scale of 2 inches to the mile was obtained (Plate 1).

The survey was carried out for B.H.P. by Ameg Pty Ltd and was flown at a mean terrain clearance of 500 feet. The original report by J. Daly could not be obtained.

INTERPRETATION

Ultrabasic rocks are frequently the source of strong magnetic anomalies, well known examples being found in the eastern goldfields of Western Australia. The actual magnetic properties of such materials are, however, very variable depending strongly on the degree of serpentinization etc. (Saad, 1969). The aeromagnetic results show clearly that the Beaconsfield ultrabasics are associated with quite substantial magnetic anomalies.

The survey revealed a series of magnetic highs on a roughly northwest trend lying to the east of a large area of magnetically uniform terrain which corresponds geologically to the Precambrian rocks of the Asbestos Range. The crests of the magnetic highs form a well defined feature and correlation with a geological map of the area shows that at least in the region between profiles

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B and D the magnetic feature coincides almost exactly with a structure mapped as a fault by the Department of Mines. This indicates that the anomaly may be associated with a step-like edge on the intrusives.

The long quasilinear trend almost vanishes to the north and south. Going north a final large anomaly is situated on profile E. This is in an area shown as alluvium on the geological map and it is essentially a blind geophysical target.

The depth to the source of an aeromagnetic anomaly can be calculated by various procedures all using the shape of the magnetic profile. Depth estimates on profiles A - D had clearly been made by B.H.P. An estimate of the depth to source has been made for profile E (Plate 2).

The method used on profile E is due to Smellie (2) and it was assumed that the anomaly could be adequately represented by a line of poles approximation. The ratio $\eta : \eta' = 0.65$ (using Smellie's notation) which is close to the value expected for this case. The indicated maximum depth to source below the sensor is 1056 feet so that the depth below the surface is about 556 feet.

The depth estimates are set out in full in Table 1. The indicated depth to source in the southern parts of EL 5/71 is generally greater than the preceding estimate. These depths

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are such that geophysical methods are generally inaplicable and exploration costs are enormous. The anomaly on profile E which is outside the present EL boundary is a more favourable target.

RECOMMENDATIONS

It is recommended that after a brief geological examination the southern part of this area be relinquished and efforts be made to secure the ground containing the anomaly on profile E.

For Geophysical Research Pty Ltd

(R.J.G. Lewis)

Mona Vale, N.S.W.

May, 1971.

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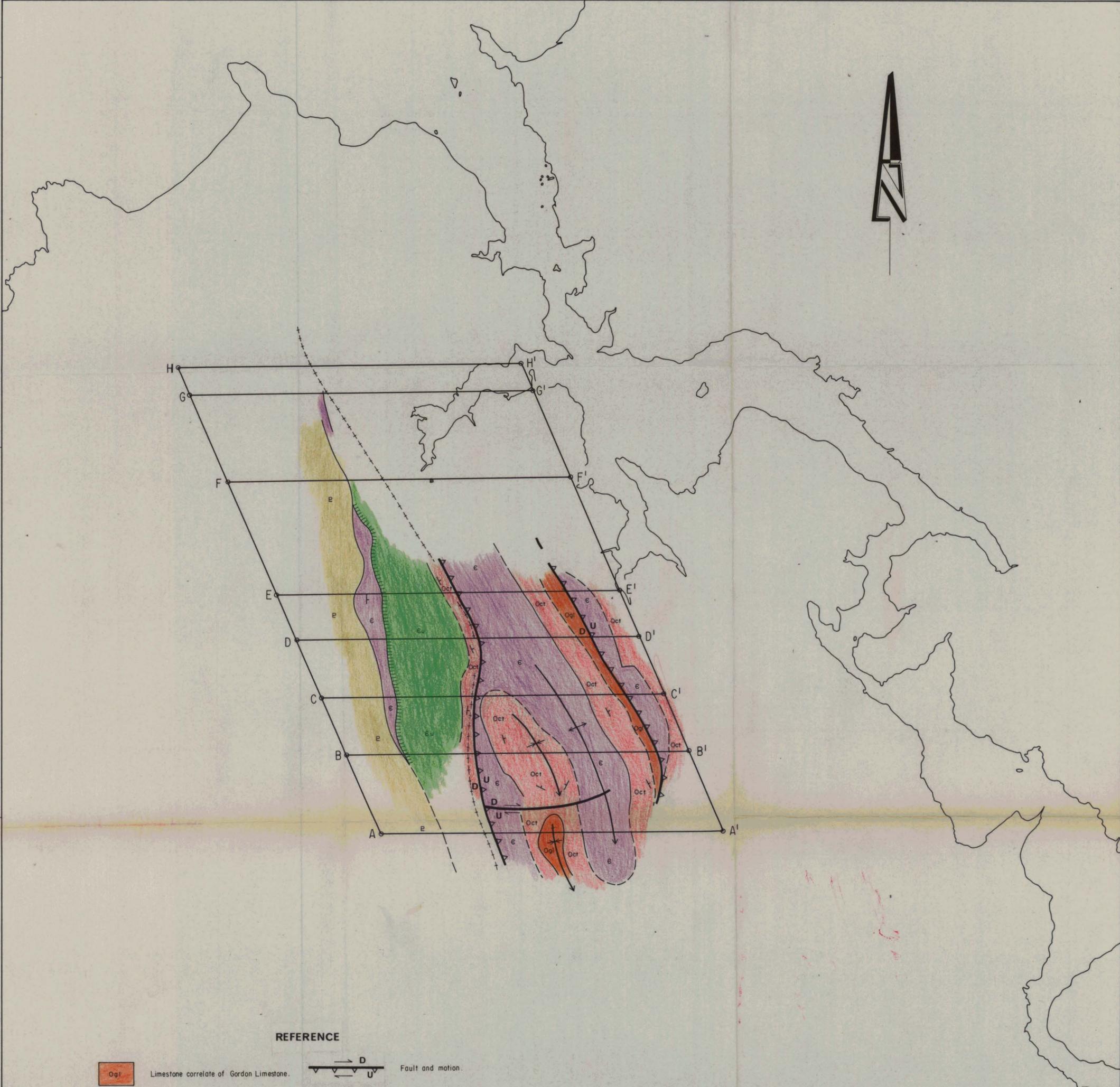
TABLE 1

<u>PROFILE</u>	<u>INDICATED DEPTH</u>
A	At least 1000 ft.
B	Probably a small body near the surface; at least 1000 ft. in general.
C	200 to 300 feet.
D	At the surface.
E	550 feet.

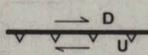
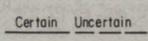
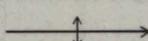
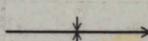
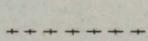
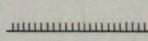
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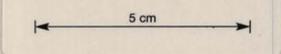
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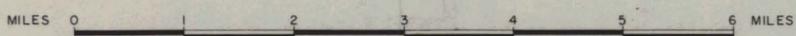


REFERENCE

- | | | | |
|---|--|---|--------------------------------|
|  | Limestone correlate of Gordon Limestone. |  | Fault and motion. |
|  | Cabbage Tree Formation. Quartz sandstone with chert and conglomerate layers. |  | Spalinspastic boundaries. |
|  | Slate |  | Anticline |
|  | Ultrabasic complex. |  | Syncline |
|  | Quartzite, slate and phyllite. |  | Generalised dip. |
| | |  | Trace of aeromagnetic anomaly. |
| | |  | Intrusive contact. |



SCALE



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HOLWELL, TASMANIA

TECTONICS & REGIONAL GEOLOGY

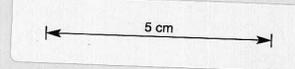
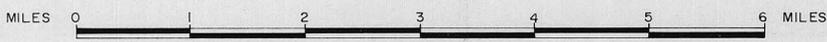
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REFERENCE

- Contour Value (Gammas) 20,000
-  Low
-  Profile
-  Flight Line
- Flight Height 500ft. MTC

SCALE



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GEOPHYSICAL RESEARCH PTY. LTD.

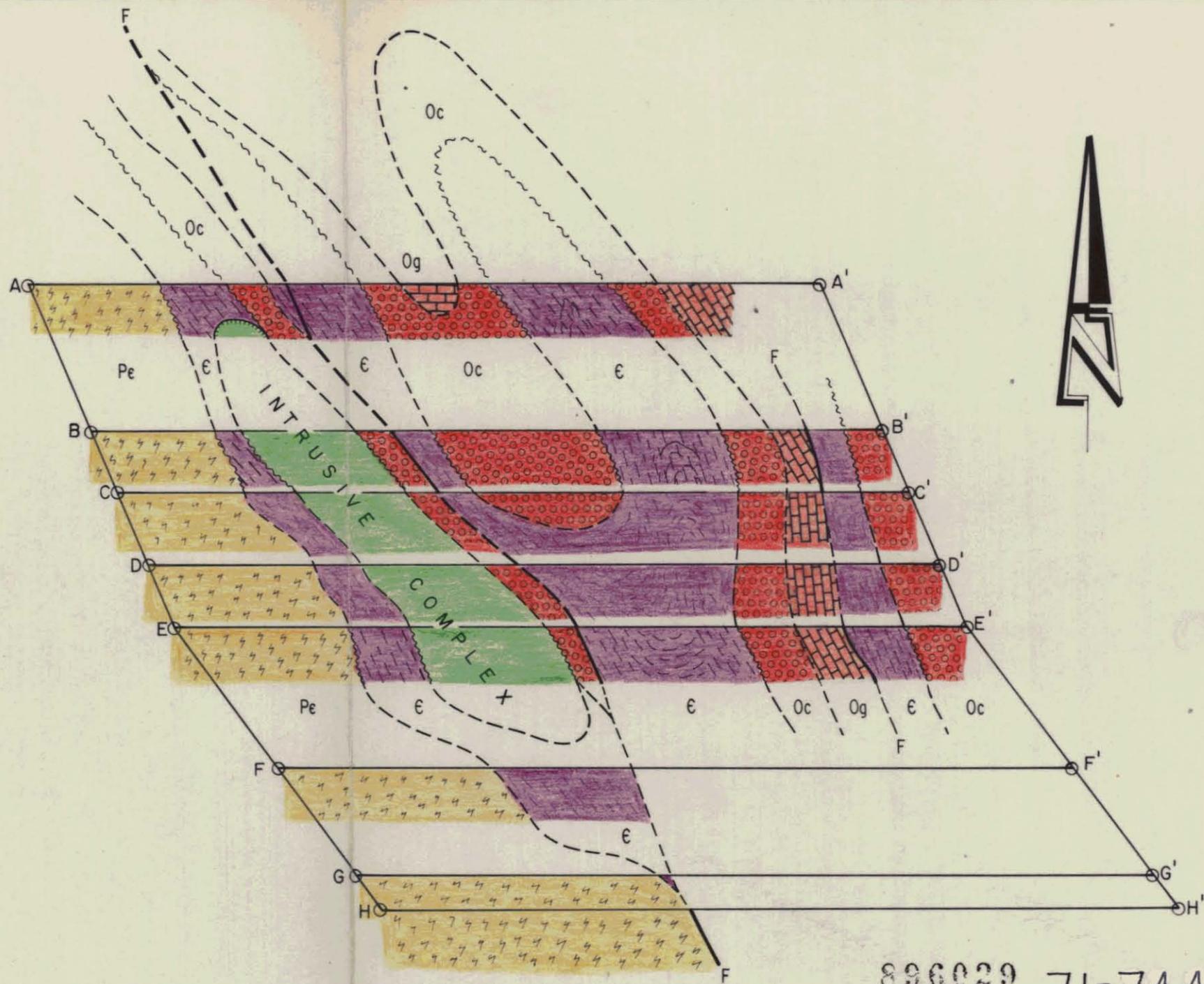
**HOLWELL, TASMANIA
AEROMAGNETIC SURVEY
TOTAL MAGNETIC INTENSITY**

DATA BY AMEG PTY LTD. FOR B.H.P. LTD.

PLATE 1

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(b)



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GEOPHYSICAL RESEARCH PTY. LTD.

HOLWELL
TASMANIA

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SERIAL PROFILE

(c)

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GEOPHYSICAL RESEARCH PTY. LTD.

HOLWELL, TASMANIA

**TOTAL FIELD
MAGNETIC PROFILE**
DATA FROM B.H.P.

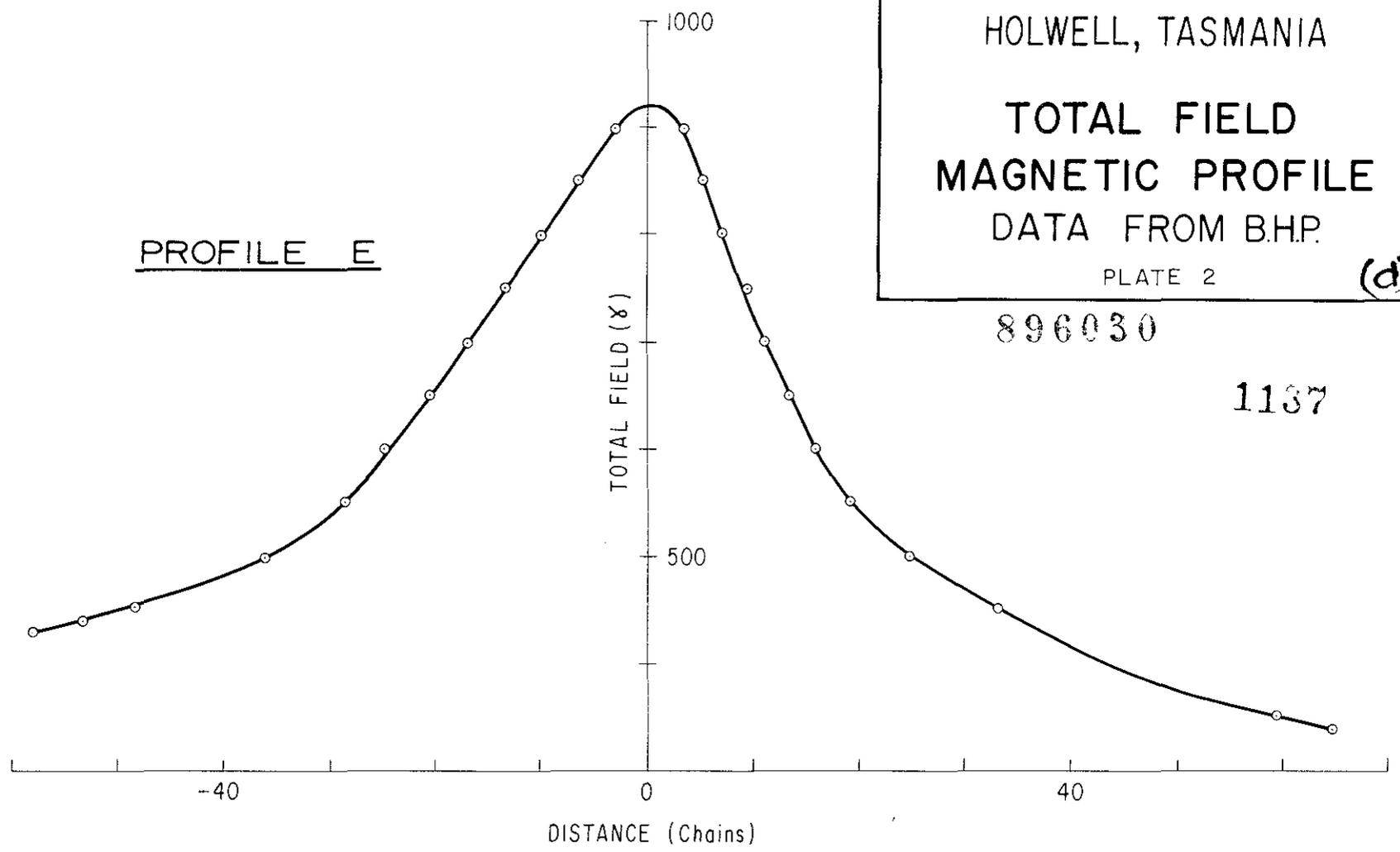
PLATE 2

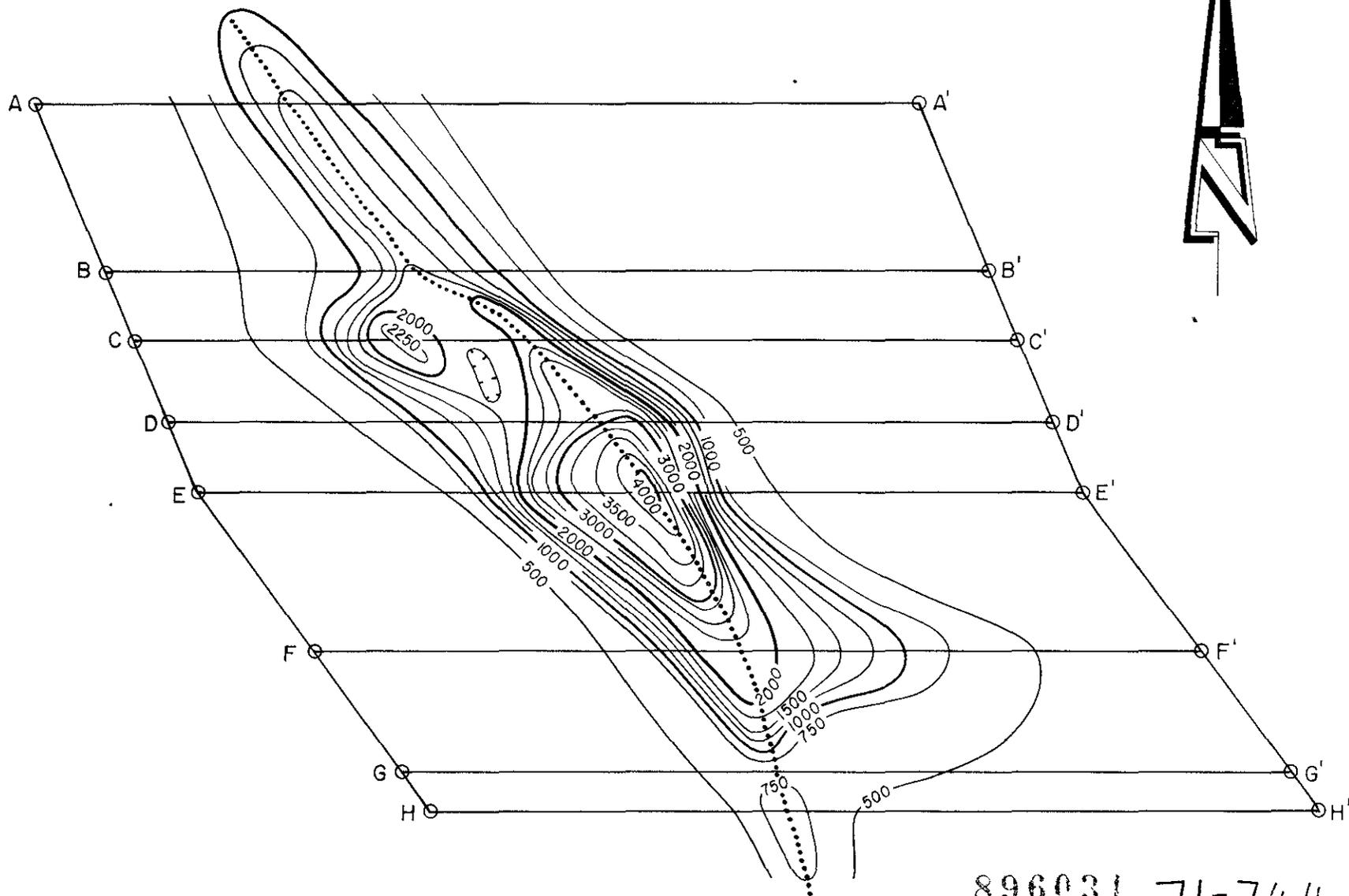
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PROFILE E





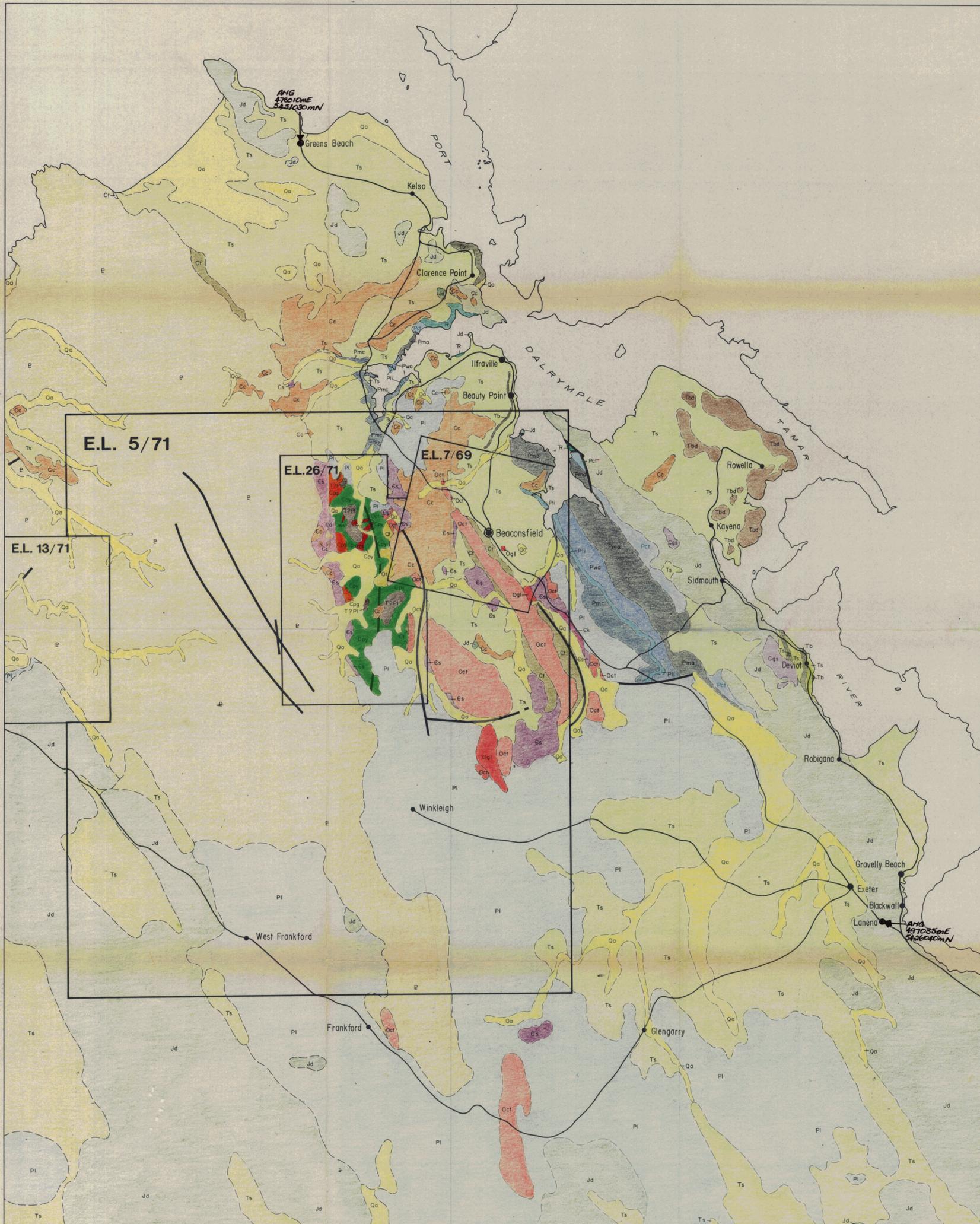
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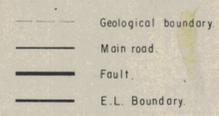
AEROMAGNETICS

(e)



REFERENCE

QUATERNARY	
Qa	River alluvium, marsh deposits and beach sand
Qf	Talus.
CAINOZOIC	
Cf	Talus Cfo - sandstone and conglomerate derived from Oct.
Cgs	Partially consolidated granule spnd.
Cc	Partially consolidated conglomerate, mainly of rounded vein quartz and quartzite.
TERTIARY	
Ts	Sand, clay and gravel.
T-Pi	Pisolithic ironstone Pre - Ts in age.
Unconformity	
MESOZOIC	
TRIASSIC	
Tr	Quartz sandstone and micaceous shale.
Pct	Clog Tom Sandstone - carbonaceous sandstone and shale.
Pma	Middle Arm Group - wormcast siltstone and sandstone, conglomerate bed indicated.
Pwa	West Arm Group - fossiliferous sandstone, siltstone and limestone.
Pii	Liffey Sandstone - carbonaceous sandstone and shale.
Pmi	Massey Creek Group - mudstone, pebbly siltstone and sandstone, clastic limestone beds.
Pmc	Massey Creek Group - mudstone, pebbly siltstone and sandstone.
PERMIAN	
Unconformity	
PALAEOZOIC	
ORDOVICIAN	
Ocl	Limestone, correlate of Gordon Limestone.
Ocr	Cabbage Tree Formation quartz sandstone with chert and quartz conglomerate layers indicated.
CAMBRIAN	
Es	Slate with impersistent units of greywacke sandstone (Csg) and interbedded slate and chert (Csc). Keratophyre lens indicated.
PRECAMBRIAN	
PROTEROZOIC	
E	Badger Head Group - sandstone slate and phyllite.
TERTIARY	
Ts	Basalt insitue.
Tbd	Basaltic dolerite.
JURASSIC	
Jd	Dolerite.
CAMBRIAN	
Cg	Layered pyroxenite and gabbro, Chg - hornblende gabbro.
Es	Included septum of metamorphic rocks.
Cx	Pyroxenite (serpentinised pyroxenite) Ca albite pegmatite Cr rodingite.
Ck	Albite - epidote - chlorite - amphibole - keratophyre.



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AMG REFERENCE POINTS ADDED

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