



# Mineral Resources Tasmania

## REPORT 1993/08

### The palaeomagnetic record of selected Tasmanian rock units

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#### Abstract

A collaborative program between the then Tasmania Department of Mines and the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) was undertaken to study the feasibility of using various Palaeozoic and Mesozoic rocks for palaeomagnetic analysis. The results of our palaeomagnetic measurements have shown that the vast majority of Palaeozoic Tasmanian rocks have been exposed to at least one episode of magnetic overprint. In our opinion, the most effective overprint episode occurred at the Devonian/Carboniferous time boundary. Nevertheless, in a few cases the overprint component was successfully removed and an earlier (primary) component identified.

Our key results are:

- The Smithton Trough volcanics yielded a pole falling on the Cambrian section of the Australian Polar Wander Path but show a strong Early Carboniferous magnetic overprint.
- Cambrian gabbroic, basaltic and ultramafic rocks east of Zeehan and along the Murchison Highway give a VGP on the Ordovician segment of the polar wander path. Whether this reflects an overprint episode or drift, and subsequent collision of a crustal segment with Australia, is at this stage unclear.
- Cambrian volcanic rocks along Jukes Road have been thoroughly overprinted, during the Early Carboniferous or the Cretaceous thermal event when Australia separated from Antarctica.
- The Meredith Adamellite appears to possess its primary magnetisation and plots on the early Carboniferous segment of the Australian polar wander path.
- The Mesozoic basalts from Cape Portland possess too short a cooling history to have ever averaged out the effects of secular variation.

Note that the definition of Eocambrian and Cambrian used here precedes the recent revision of the Cambrian to a time span between 500 and 540 Ma.

Our study was successful in evaluating the suitability of various Tasmanian Palaeozoic rocks for palaeomagnetic

research. The quantity of material available and analysed is, however, insufficient to yield enough data to unequivocally establish representative VGP's for the rock units in question. It is recommended that this research be continued and additional measurements added to the ones presented in this report.

#### INTRODUCTION

This report summarises the results of a joint study between the then Tasmania Department of Mines (now Mineral Resources Tasmania) and the German BGR (Bundesanstalt für Geowissenschaften und Rohstoffe) as a complementary part of current geoscientific research carried out by the BGR in northern Victoria Land, Antarctica. The aim of this study was to determine and assess the value of undertaking further palaeomagnetic studies on lower Palaeozoic Tasmanian rocks, with a view to further investigating the past relationship between northern Victoria Land (Antarctica) and Australia.

The sampling was undertaken by R. H. Findlay (Tasmania Department of Mines) and D. Delisle (BGR) during February 1989. The palaeomagnetic measurements were completed at the Laboratory for Palaeomagnetic Research of the State Geological Survey of Lower Saxony in Grubenhagen, Germany. An internal report was prepared by G. Delisle for the BGR and this report is reproduced here.

#### PURPOSE OF STUDY

Only a few palaeomagnetic investigations have been published to date for Tasmania (see review paper by Embleton, 1981). The principal difficulty lies in the structural complexity of the island and the difficulty in finding suitable rock formations which have not been displaced or deformed, or have only been displaced or deformed to a minor degree, throughout their geological history. Prior to field work, a number of potential rock formations that might suit the above requirements were suggested by R. H. Findlay.

The aim of this study was twofold:

- to search for material suitable for palaeomagnetic investigations from selected Tasmanian rock formations.

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- to search palaeomagnetically for evidence for a suspected lateral displacement of segments of the early Palaeozoic Tasmanian sequences.

It was further hoped that the results of the project might serve as a useful guide for future palaeomagnetic investigations in the area.

## FIELD WORK

The following rock formations were selected for sampling:

- Eocambrian/Cambrian volcanic rocks from the Smithton Trough area;
- Cambrian basaltic and ultramafic rocks to the east of the Murchison Highway south of Renison Bell;
- Cambrian gabbroic rocks near Zeehan;
- Cambrian feldspar-phyric volcanic rocks along the Jukes Road south of Queenstown;
- Devonian Meredith Adamellite complex;
- Scamander Tier dyke south of St Helens; these rocks did not yield useful results, and are not discussed further;
- Cretaceous dykes and a lava flow at Cape Portland;

The intention was to collect about ten oriented hand samples from each region. Unfortunately, due to insufficient rock exposure and the high degree of weathering in the western part of the country, this aim was not always attainable. The available samples are listed below.

Sample numbers	Area
8900–8910	Smithton Trough
8911–8917	Murchison Highway
SH	Murchison Highway (unoriented samples from two vertical bore holes)
8918–8921	Gabbros near Zeehan
8930–8940	Jukes Road
8942–8947	Meredith Adamellite
8950–8959	Granodiorite S of St Helens
8960–8967	Dykes and lava flow at Cape Portland

In most cases oriented hand samples were taken in the field, but a few core specimens were drilled and their orientation marked *in situ*.

## LABORATORY WORK

A number of specimens were cored from each hand sample. For this purpose, each hand sample was put in a gravel bed before coring and re-oriented according to its orientation in the field.

The remanent magnetisation of all specimens was measured on a spinner magnetometer. Subsequently, selected core specimens were demagnetised in steps of 5–20 millitesla (mT) by the alternating field technique (af-demagnetisation), while some specimens were demagnetised with a "Schoenstedt thermal demagnetiser" in steps of 50K or less. The remaining magnetisation of the specimens was measured again on a spinner magnetometer after each demagnetisation step. Most of the sampled material turned out, as expected, to be only weakly

magnetised. For this reason we were limited in the number of subsequent demagnetisation steps. Beyond that limit, no meaningful result can be expected.

## RESULTS AND DISCUSSION

The measured magnetisation directions, as a function of demagnetisation, are discussed below for each rock formation. The table below gives the average declination and inclination values for the number of specimens (N) from the location #, from where, in each case, one hand sample was taken. The  $a_{95}$  value represents the 95% angle of confidence, which is a measure of the quality of the measured values given. The precision parameter K is also listed. K is a measure of the scatter of the vector directions measured from the samples of one site.

### Smithton Trough

The data for this region are tabulated below.

#	N	Decl.	Incl.	$a_{95}$	K
8900	4	65.3	-66.1	65.6	2.9
8901	7	12.9	-68.1	26.2	6.3
8903*	10	3.7	-75.2	5.8	71.4
8903a	10	288.3	-69.8	7.3	44.7
8903b	8	259.5	-48.5	8.9	39.4
8904	4	28.7	-53.5	34.7	8.0
8905	4	355.3	-15.1	13.1	50.3
8906	4	64.7	-68.0	12.9	51.3
8907	4	346.3	-48.6	14.7	39.9
8908	4	17.2	-60.8	6.3	213.9
8909	9	273.0	-19.2	27.1	4.6
8910	4	5.7	-58.1	5.1	324.7

\* 10 mT field

9803a 20 mT field (see text for discussion)

8903b 60 mT field (see text for discussion)

With exception of locations 8905 and 8909, all measured inclinations are rather steep. The expected inclination for Tasmanian Cambrian rocks is shallower, as Tasmania was then near the equator according to the various available Gondwana configurations. The large number of sites with rather steep I-values may have been exposed to a magnetic overprint, of which the mean declination ( $D_m$ ) and mean inclination ( $I_m$ ) was calculated by excluding 8905 and 8909 (see below). Location 8903 represents a special case. During af-demagnetisation in fields up to 10 mT, a stable magnetisation direction around  $d = 4^\circ$ ,  $I = -75^\circ$  was observed. In higher af-fields, the D values turned towards W and the I values became more shallow. It would appear that in af-fields of 15 and 20 mT a magnetisation component was partly removed and a second magnetisation direction started to emerge. For calculating  $D_m$  and  $I_m$  below, we have used the 10 mT field value.

Mean directions	$D_m$	$I_m$
all except 8905, 8909	20.1	-64.9

Successive demagnetisation of 8903 in steps up to 100 mT gave the following results:

af-field (mT)	N	D <sub>m</sub>	I <sub>m</sub>	a95	K
30	8	266.9	-65.8	17.9	10.5
40	8	268.8	-57.0	8.3	45.1
60	8	259.5	-48.5	8.9	39.4
80	8	251.3	-42.9	13.0	19.2
100	8	251.6	-41.9	18.4	10.0

The remaining magnetisation of the samples beyond 100 mT is too weak to give meaningful results.

A virtual geomagnetic pole position at 84.0°E, 74.4°S for samples 8900–8910 (D<sub>m</sub> = 20.1°; I<sub>m</sub> = 64.9°) has been calculated based on a mean position<sup>m</sup> for all<sup>m</sup> location sites at 145.12°E, 41.00°S. The calculation of a VGP from one site (e.g. 8903 at high af-fields) would not be meaningful.

It should be noted that apart from the prevalent magnetisation direction (see above), two more components appear to have survived in some samples. One component is characterised by I values around -42° (palaeolatitude = 24°; see 8903) and the other by I = -15° to -19° (sites 8905, 8909), being equivalent to a palaeolatitude of 8°–10°.

### Dundas Tram

These locations, to the east of the Murchison Highway, are located along the old North East Dundas Tramway. The outcrops in the area, with the exception of 8917 (fresh roadcut), suffer from deep weathering. The sampling was undertaken to test if meaningful results could be obtained. The measured results by af-demagnetisation are shown below.

#	N	Decl.	Incl	a95	K
8911	2	348.4	-67.5		
8912	2	336.0	-2.1		
8913	2	23.2	-66.1		
8915*	3	6.8	-46.0	29.7	18.3
8916	2	242.5	-5.6		
8917*	3	230.2	-6.3	24.0	27.4

\* 8915 was stable in af-fields up to 100 mT. 8917 remained stable in af-fields up to 40 mT and then showed a systematic shift in higher fields toward D<sub>m</sub> = 105° and I<sub>m</sub> = 69° at 100 mT.

In addition, two specimens from each location were thermally demagnetised in successive temperature steps up to 680°C. The treatment had to be discontinued for 8911 at a temperature level of 400°C because of insufficient remaining magnetisation of the specimens. The results obtained were:

#	N	Decl.	Incl.	Temperature Range
8911	2	53.9	-67.2	0 – 250
8911	2	113.6	68.9	– 350
8912	2	329.3	19.1	– 680*
8913	2	25.3	-56.7	– 250
8915	2	28.3	-54.4	– 590
8915	2	52.8	-45.5	– 650
8917	2	235.9	3.6	– 620

\* a secondary magnetisation component was apparently removed at a temperature > 600°C.

The results obtained by af- and thermal demagnetisation are in reasonable agreement. Thermal demagnetisation in the temperature range of 300–400°C did reveal, in the case of 8911, a second component of magnetisation, the significance of which is not clear. As the sample, because of its weak magnetisation, cannot be demagnetised above 400°C, it is not possible to confirm the true direction of this magnetisation component.

The results of the af- and thermal demagnetisation for each sample were combined. The following mean orientations were obtained:

#	N	Decl.	Incl.	a95	K
8911	4	17.8	-69.9	19.6	23.0
8912	4	332.6	8.4	17.6	28.2
8913	4	24.3	-61.5	9.5	94.9
8915*	5	15.9	-49.6	16.1	23.4
8916**	2	242.5	-5.6	37.8	45.8
8917	4	232.5	-2.4	12.7	37.3

\* data taken for T = 560°C

\*\* no thermal demagnetisation data available

Two main magnetisation directions can be observed:

- (a) 8911, 8913, 8915  
(b) 8912, 8916, 8917

For both sets the following mean directions can be calculated:

	D <sub>m</sub>	I <sub>m</sub>	a95	dp	dm
Mean directions for a):	19.1	-60.4	15.7	11.3	29.3
Mean directions for b):	265.0	0.0	***	***	***

(\*\*\* angle of confidence >90°; not defined)

Sample 8912 appears to have been rotated in the horizontal plane. The calculated mean direction (b) is probably not representative.

Virtual pole positions, based on a mean position of the location sites at 145.5°E, 41.8°S, are calculated for (a) as 60.1°E, 75.7°S. The palaeolatitude for (b) is at the equator.

In addition, core from two vertical drill holes was available for analysis. The core from one hole, consisting of serpentinite, proved to be too weakly magnetised to yield meaningful results. The other core, consisting of basalt, gave the following inclination values:

Sample	NRM	2.5 mT	5 mT	7.5 mT	10 mT
SH1	20.0		1.5		-4.5
SH2	-15.9	-11.1	09.3	-8.5	-5.8

Declination values remained stable throughout the successive demagnetisation steps. The basaltic layer in question (Cambrian age), being drilled from below the weathering layer, appears to be suitable for palaeomagnetic investigations. A palaeolatitude of 3° is suggested from the obtained I values, although we have not considered the effects of rotation during the drilling operation.

### Trial Harbour

The result of the af-demagnetisation measurements up to 40 mT are shown below:

#	N	Decl.	Incl.	a95	K	dp	dm
8918	4	49.6	24.6	18.0	26.9	9.3	20.0
8919	4	6.4	-77.4	10.5	77.0	7.0	17.3
8920	3	173.1	4.6	40.1	10.5	23.0	79.3
8921	4	217.5	-1.3	11.2	68.3	7.7	19.7

All samples, with the exception of 8919, show the expected low inclination of Cambrian material. The anomalously high inclination of 8919 is indicative of an overprint, which we were unable to remove. As the measured orientation is typical for Devonian material, we suspect that a Devonian intrusion near the collecting site has caused this overprint.

The declination value of 8918 deviates significantly from the expected southerly direction. In addition the polarity of the samples are reversed. Therefore thermal demagnetisation was also carried out.

#	N	Decl.	Incl.	a95	Temperature
8918	2	294.7	5.6	42.1	650°C

The specimens showed unstable behaviour during the demagnetisation. The orientation, as obtained by af-demagnetisation, was never obtained. For this reason this sample has been excluded from further discussion.

We were then left with four samples which show shallow magnetic inclination:

#	N	Decl.	Incl.
8920	3	173.1	4.6
8921	4	217.5	-1.3

and in addition from the NE Dundas Tramway locations

8916	2	242.5	-5.6
8917	5	232.5	-2.4

From these four samples a mean direction is obtained at:

$$\begin{aligned}
 D_m &= 217.1 \\
 I_m &= -1.1 \\
 a_{95} &= 36.8 \\
 dp &= 46.5 \\
 dm &= 25.98
 \end{aligned}$$

from which a virtual geomagnetic pole position (mean position of sampling locations at 145.33°E, 41.83°S) at 193.5°E, 36.0°N is obtained.

### Jukes Road

Cambrian volcanic rocks, showing evidence of folding and flattening, were collected along Jukes Road. It was expected that the primary magnetisation in the material, assuming it had survived later deformational and tectonic phases, should scatter significantly. The measured orientations are summed up below:

#	N	Decl.	Incl.	a95	K
8930	4	316.3	-78.2	9.8	89.4
8931	4	277.7	-41.7	28.9	11.1
8932	4	202.1	-85.1	11.5	65.3
8934	4	206.7	-74.9	11.3	67.1
8935	4	15.4	-83.5	15.1	37.8
8936	4	61.6	-80.2	8.1	128.4
8937	4	43.9	-84.5	4.8	368.5
8938	4	260.2	-80.2	9.4	97.1
8939	4	8.6	-66.9	15.8	35.0
8940	4	77.3	-81.9	8.6	116.4

The data can be further summarised as follows:

N	Decl.	Incl.	a95	K	dp	dm
10	308.9	-84.9	11.4	19.0	6.0	13.1

From this result, the virtual geomagnetic pole (based on a mean position of sampling locations at 145.5°E, 42.2°S) can be calculated as 157.3°E, 48.0°S.

Selected specimens were also thermally demagnetised. The results are in good agreement with the available data from the af-demagnetisation:

#	N	Decl.	Incl.	Temperature
8930	2	350.1	-70.4	-350
8932	2	353.0	-86.3	-350
8932	2	247.7	-3.0	-650
8936*	2	64.1	-78.9	-400

\* The steep rise in susceptibility in both specimens at temperatures above 400°C (mineral phase change?)

In the case of 8932 it appears that the overprint was removed at temperatures above 350°C. The then obtained magnetisation direction appears to reflect the orientation expected for Cambrian material. In that case, little or no deformation has affected the sample after imprint of this magnetisation component, which seems surprising.

### Meredith Adamellite

This complex has been dated by the Rb-Sr method at 353±7 Ma (Department of Mines, base map of Tasmania, 1976). Steep inclination values were therefore expected:

#	N	Decl.	Incl.	a95	K
8942	4	265.1	9.4	14.4	41.6
8943	4	308.2	-76.9	7.4	155.3
8945	11	35.7	-81.5	5.2	77.8
8946	4	265.7	-80.4	13.1	50.5
8947	6	22.8	-70.1	15.4	19.8

Sample 8942 appears to be anomalous in comparison with the rest of the samples. The specimen was possibly not *in situ*. Based on the rest of the samples, the following mean declination and inclination values were obtained:

Decl.	Incl.	a95	K	dp	dm
347.6	-81.5	14.2	42.7	7.1	14.4

A virtual geomagnetic pole (based on a mean position of sampling locations at 145.07°E, 40.5°S) was calculated as 151.5°E, 56.6°S.

**Cape Portland**

Lamprophyre dykes and andesitic flows were emplaced during the Cretaceous in the Cape Portland area (Jennings and Sutherland, 1969). Hornblende minerals of both suites have yielded K/Ar ages between 101 and 102 Ma (McClenaghan *et al.*, 1982). Several dykes (#8960–#8964) and one flow (#8965–#8967) near the NE tip of Tasmania have been sampled and analysed.

#	N	Decl.	Incl.	a95	K
8960	4	47.8	-55.0	14.6	40.6
8961	4	15.6	-65.6	5.6	274.8
8962	4	18.7	-79.1	2.6	1211.6
8963	4	34.0	-72.8	3.1	882.1
8964	4	301.9	-76.3	7.3	160.7
8965	4	260.5	+16.1	42.9	5.5
8966	4	23.8	-72.9	13.4	48.2
8967	4	7.1	-68.3	6.1	224.6

With the exception of two sites, a tight grouping of the measured remanent magnetisation directions of each site is observed as expected for this type of material. Sample 8965 shows large internal scatter in the magnetisation directions. The resultant D and I values are altogether unrealistic. The sample was thus excluded from further consideration. Sample 8960 appears to be affected by an unremoved secondary component, as can be seen from the (for this type of material) rather low K value and the surprisingly low inclination angle.

Combining the remaining sites we arrive at:

N	D <sub>m</sub>	I <sub>m</sub>	a95	K	dp	dm
6	10.6	-74.3	8.2	68.1	10.2	21.4

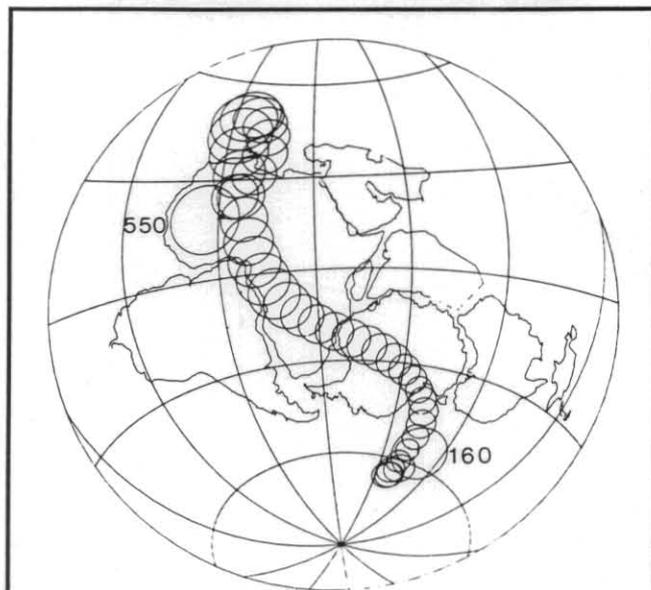
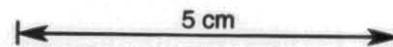
**INTERPRETATION**

The correlation between the calculated VGP's and the apparent polar wander path (APWP) of Australia is considered first. The VGP's available from this study are summarised below:

Locality	VGP
Smithton Trough:	84.0°E, 74.4°S
Trial Harbour:	193.5°E, 36.0°N (13.5°E, 36.0°S)
Jukes Road:	157.3°E, 48.0°S
Meredith Adamellite:	151.5°E, 56.6°S

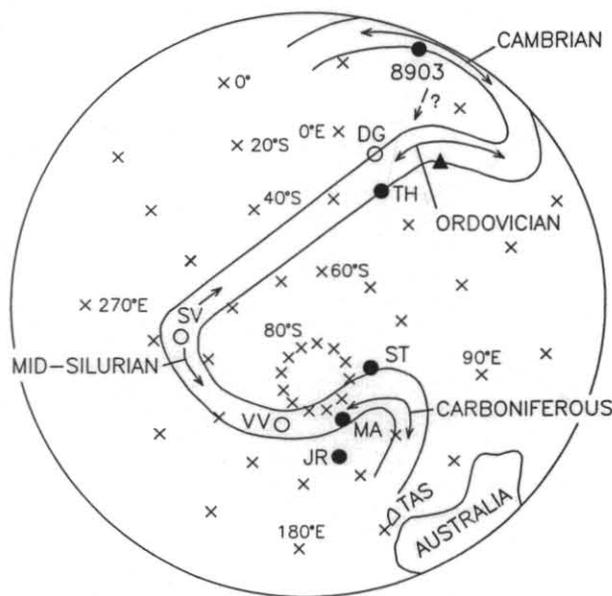
The Australian APWP (or alternatively of Gondwana) for the Palaeozoic has been a matter of debate for some time. Principally, two alternative paths have been proposed:

- (a) direct migration of the pole from Northern Africa (Ordovician position) to Central Antarctica (Devonian position). This path (fig. 1) was proposed in detail, among others, by Thompson and Clark (1982).
- (b) a large excursion of the pole from North Africa via South America (Silurian position) to Central Antarctica. Convincing evidence supporting the latter path (fig. 2, adapted from Embleton, 1981) was presented by van der Voo (1988). We have chosen the latter path as the basis for interpretation of our data.



**Figure 1**

95% confidence limits for the APWP path of Gondwana at 10 Ma intervals (taken from Thompson and Clark, 1982).



**Figure 2**

APWP for Australia, modified after Embleton (1981) and van der Voo (1988).

- DG = Dundas Group
- TH = Trial Harbour
- MA = Meredith Adamellite
- JR = Jukes Road
- ST = Smithton Trough
- VV = Visean Volcanics
- SV = Silurian Volcanics

The above listed VGP from the Cambrian **Smithton Trough Volcanics** corresponds well with the published VGP of the Devonian (374 Ma) Housotop Granite (Briden, 1967) at 94°E, 67°S, indicating a magnetic overprint of the Smithton Volcanics during a Devonian event involving high heat flow.

Specimens from two sites in the Smithton Trough (8905, 8909) gave low inclination values, but differed substantially in their declination values. This could be due to a number of possible factors (site not *in situ*, several inseparable magnetisation components present). No further interpretation for these anomalous sites is offered.

Site 8903 (Smithton Trough) shows a strong secondary component stable up to high af-fields. No other sites with a comparable magnetisation direction have been found. Nevertheless, this one site has yielded:

- (a) the overprint signal (in af-fields up to 20 mT), and
- (b) the expected D- and I-values for Cambrian material.

A VGP calculated from this one site (16.1°E, 11.7°N) lies exactly on the Cambrian portion of the Australian APWP. Whether this is a fortuitous coincidence or not is not clear. We take this result as a likely indication that the primary magnetisation has survived in a small portion of the Smithton Volcanics exposed today. **If this interpretation is correct, then there is little room for any speculation about the Smithton Volcanics being part of an allochthonous crustal segment.**

Two **NE Dundas Tramway** sites and two **Trial Harbour** sites show consistently low  $I_m$  values and  $D_m$  values of S to SW directions. The calculated VGP based on these four sites compares rather well with the VGP of the Upper Cambrian Dundas Group at 13°E, 23°S (Giddings and Embleton, 1974). It must be stressed, however, that the available number of sites is insufficient to clearly establish a representative VGP for the sites in question.

The rest of the investigated NE Dundas Tramway and Trial Harbour sites were clearly affected by a mid-Palaeozoic magnetic overprint. The material from site 8918 behaved in an odd fashion. The results obtained by successive af- and thermal demagnetisation differed substantially for unknown reasons. The site was excluded from further consideration.

Our preliminary VGP for the Trial Harbour material, as well as the published VGP by Giddings and Embleton (1974), lies on the Ordovician portion of the APWP. Whether this is evidence of continental drift of the Cambrian basement of Tasmania versus Australia, or the result of incomplete averaging of the palaeomagnetic record, is not clear at this stage. Theoretically, a drift episode would imply movement of Tasmanian basement roughly along the coast of Victoria Land/Antarctica and eventually collision with Australia (see Figure 2). If we accept the concept by Dalziel (1991) of an Eocambrian supercontinent juxtaposing North America next to Victoria Land/Antarctica and Australia until Late Cambrian times, than any drift episode would have to occur during the Early Ordovician.

As already discussed, the material from the **Jukes Road** site has been magnetically overprinted after a phase of deformation. The VGP we obtained, on the basis of ten sites, represents therefore the episode of overprint. Our VGP lies near the Cretaceous or Upper Carboniferous segment of the Australian APWP (see Figure 3; the Australian APWP for both geologic periods overlaps.) In

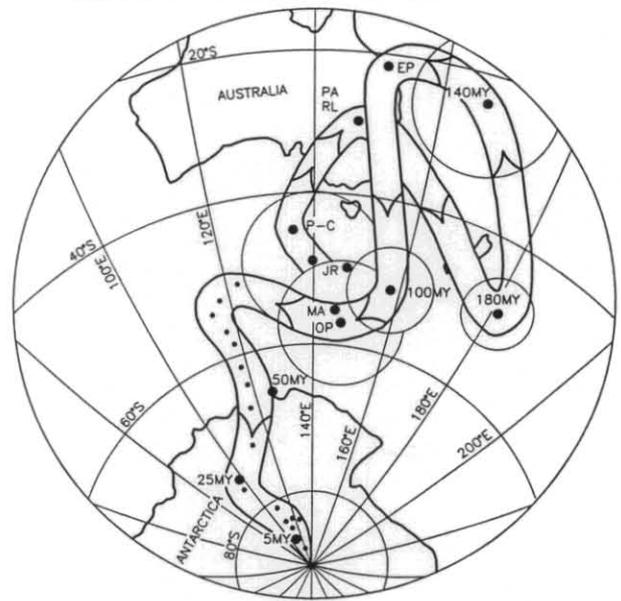
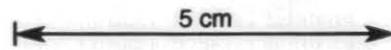


Figure 3

Mesozoic and Cenozoic South Pole track for Australia. MA = Meredith Adamellite, JR = Jukes Road (from Embleton, 1981)

which time period the overprint occurred cannot be resolved on the basis of our data.

The VGP of the 350 Ma old (early Carboniferous, according to Harland *et al.*, 1990) **Meredith Adamellite** is located on the Lower Carboniferous portion of the Australian APWP (fig. 2). The VGP obtained by this study could theoretically also represent a Cretaceous overprint event (fig. 3). The presence of the primary magnetisation component is, however, considered more likely, as no obvious evidence for an overprint was found. The available number of sites is insufficient to define a truly representative VGP for this adamellite complex. Additional suitable material is needed to establish that position.

Various Devonian granites from North Victoria Land/Antarctica have been analysed in the past by the BGR. The resulting VGP, based on few sites, fell on the Carboniferous section of the Antarctic APWP. This result was not understood at the time but appears now to be reasonable on the basis of our new results from Tasmania.

The palaeomagnetic record of the material from **Cape Portland**, taken from narrow dykes and one rather thin flow, should reflect the geomagnetic field orientation from only a very short time span to be measured in hours or days. An averaging out of the secular variation of the geomagnetic field is not to be expected. The tight grouping of all measured D- and I-values around the mean might actually be an indication that the andesitic flow and the dykes were emplaced within a very short time span, or maybe even at the same time.

Correspondingly, the VGP that follows from the above data (133.3°E and 69.1°S, assuming a common sampling location at 147°55'E and 40°45'S) is located far off the

accepted pole position for the Cretaceous period and most likely reflects incomplete averaging.

## RECOMMENDATIONS

A complex magnetic overprint history masks the primary magnetisation of most selected Tasmanian Palaeozoic rock units, as this survey has again shown. The most influential overprint event seems to have occurred during Devonian to Carboniferous times. A second difficulty in obtaining the primary magnetisation lies in the lack of availability of sufficiently unweathered material in the field.

The determination of the primary components of Cambrian rock units is a prerequisite to obtaining soundly based palaeomagnetic data on the character of the Tasmanian basement and its tectonic evolution. To overcome the existing obstacles in identifying these components, two principle approaches are available:

- (1) The systematic sampling of a very large number of sites might yield sufficient material which still carries a sufficiently strong primary magnetisation component, such as 8903. The availability of enough suitable surface exposures in the field is, however, questionable.
- (2) Probably more promising would be a drilling program to recover **oriented** drill cores from below the weathering zone. A drilling program would firstly alleviate the surface exposure problem. In addition, the question of the site being *in situ* or not can be resolved on the basis of a 10–20 m long core more easily than by mere judgement of the visible surface exposure. Based on the results of the Trial Harbour sites and SH1/SH2, the Cambrian gabbros and associated rock units are, in our judgement, the most promising target area in this respect.

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