Section

Rept. Bk. No. 716
G.S. No. 3196
S.R. 11/5/202

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

PETROLEUM SECTION

ATTITUDES OF PRE-PERMIAN ROCKS IN OIL EXPLORATION WELLS, NORTH AND NORTH-EAST SOUTH AUSTRALIA

by

B. G. Forbes
Assistant Senior Geologist

19th July, 1965

S.R. 11/5/202

Pre-Perm. rocks - Forbes

WARBURTON 65/19 July

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ABSTRACT

Twenty-one oil exploration wells in north and north-east South Australia and nearby Queensland penetrate basement rocks ranging in age from Precambrian to probable Devonian. Known and suspected Ordovician rocks are steeply dipping. The Cambrian and ?Devonian beds of the Gidgealpa-Merrimelia area have average dips of between 10 and 36 degrees.

INTRODUCTION

This is a brief, introductory study of continuous dipmeter records mainly from Cambrian and Devonian rocks in well bores of the Gidgealpa and Merrimelia areas west of Innamincka. Although at present the chief drilling target in the north-east of South Australia is the Permian sand, attention is also being paid by exploration companies to the Pre-Permian sequence. In fact, initially the main target in this region was the older Palaeozoic. This policy has been shown to be justified by the discovery of excellent reservoir rocks and good reservoir fluids in the Cambrian of Gidgealpa Nos. 1 and 5 and the success of Mereenie No. 1 in producing gas from the Ordovician of the Amadeus Trough south-west of Alice Springs.

Sources of Information

The Gidgealpa-Merrimelia wells have so far been the most fruitful sources of information in the area considered here, as may be inferred from Table 1 below. Schlumberger and Welex dipmeter records have been lodged with the S.A. Department of Mines by Delhi Australian Petroleum Ltd. and the French Petroleum Company (Aust.) Pty. Ltd.

TABLE 1: List of Wells and Information on the Pre-Permian

Well	Dipmeter record	Pre-Permian
Gidgealpa 1.	Yes	Cambrian limestone and shale below 9110'.
" 2.	Yes	?Cambrian volcanics below 6868'.
" 3.	Yes	?Cambrian breccia and limestone below 7692'.
" 4.	No	?Cambrian volcanics below 7245'.
" 5.	Yes	Cambrian limestone below 7930'.
" 6.	No	?Precambrian volcanics below 7567'.
" 7.	Yes	Cambrian limestone and shale below 7609'.
Merrimelia 1.	Yes	?Devonian sandstone and shale below 9663'.
" 2	Yes	?Devonian sandstone and shale below 7762'.
" 3	Yes	?Devonian sandstone and shale below 8145'.
Innamincka 1.	Yes	?Devonian siltstone, sandstone below 7185'.
Betoota 1	Yes	?Devonian greywacke below 5757'.
Fortville 3.	No	Precambrian Willyama schist, phyllite below 3495'.
Dullingari 1.	Not in pre-Perm.	Ordovician shale below 9050'; steep dip.
Orientos 1.	Yes - poor	Ordovician shale below 7288'; steep dip.
Poonarunna 1	Yes - poor	?Ordovician or ?Proterozoic siltstone below 5349'; steep dip.
Naryilco 1.	No	?Ordovician quartzite and slate below 4739'; steep dip.
Pandieburra 1.	No	Ordovician quartzite below 6970'; steep dip.
Putamurdie 1.	No	?Ordovician quartzite below 6130'.
Purni 1	No	?Proterozoic shale below 5860'; dip 55°.
Witcherrie 1	No	?Devonian shale and sand below 2150'.

Figure 1, derived from the Tectonic Map of Australia, shows the positions of these wells in relation to basement outcrops. Information on marginal outcrops is obtained from articles and papers listed under References.

MARGINAL OUTCROPS OF PRE-PERMIAN ROCKS

The south-west end of the outcropping Georgina Basin may be seen near the top of Figure 1. Wopfner (1965) notes here a Precambrian tillite, likened to the Sturt Tillite of the South Australian Proterozoic, overlain by shallow- to flat-dipping shale, limestone and sandstone of Cambrian and Ordovician age.

In the Alice Springs region older Precambrian high-grade metamorphic rocks of the Arunta complex are overlain by folded sedimentary rocks of the Amadeus Trough of upper Proterozoic, Cambrian, Ordovician and upper Palaeozoic ages. Some similar rocks occur north-west of Oodnadatta. It is of interest that as well as the Mereenie Ordovician gas production, non-commercial methane was produced from a dolomitic limestone of the upper Proterozoic Pertatataka Formation in Ooraminna No. 1 Well (Murray, 1965).

In the southern and south-western part of Figure 1 most of the basement area is occupied by folded upper Proterozoic rocks of the Adelaide System; there is some flat-lying and folded Cambrian about the latitude of Lake Torrens.

Proterozoic and moderately-dipping Cambrian, Ordovician and Devonian sedimentary rocks are known in the Mootwingee - Gnalta region and at Mt. Arrowsmith (Fletcher, 1964; Opik, 1961). Upper Devonian granite occurs at Tibooburra.

Freeman (1964) provides a useful summary of the then-available bore-hole and surface information on the pre-Permian in particular.

Structural trends within the area of Figure 1 are various. The southern Georgina Basin shows a south-easterly strike; the Amadeus Trough is east-west; the Oodnadatta-Marree basement trends south-easterly; east of Leigh Creek the trend is north-easterly and in the Mootwingee area south-easterly.

DIPS IN THE INNAMINCKA REGION

Dips of pre-Permian rocks from the Betoota - Gidgealpa sub-surface have been plotted stereographically as in Figure 2; the results, as average dips, are also summarized in Figure 1. There is not enough information to show whether the Gidgealpa structure is closed. If it is open to the north-west, the hypothetical anticlinal axis would pitch about 10° to the south-south-east, as indicated by the intercepts of the curves in Figure 2.

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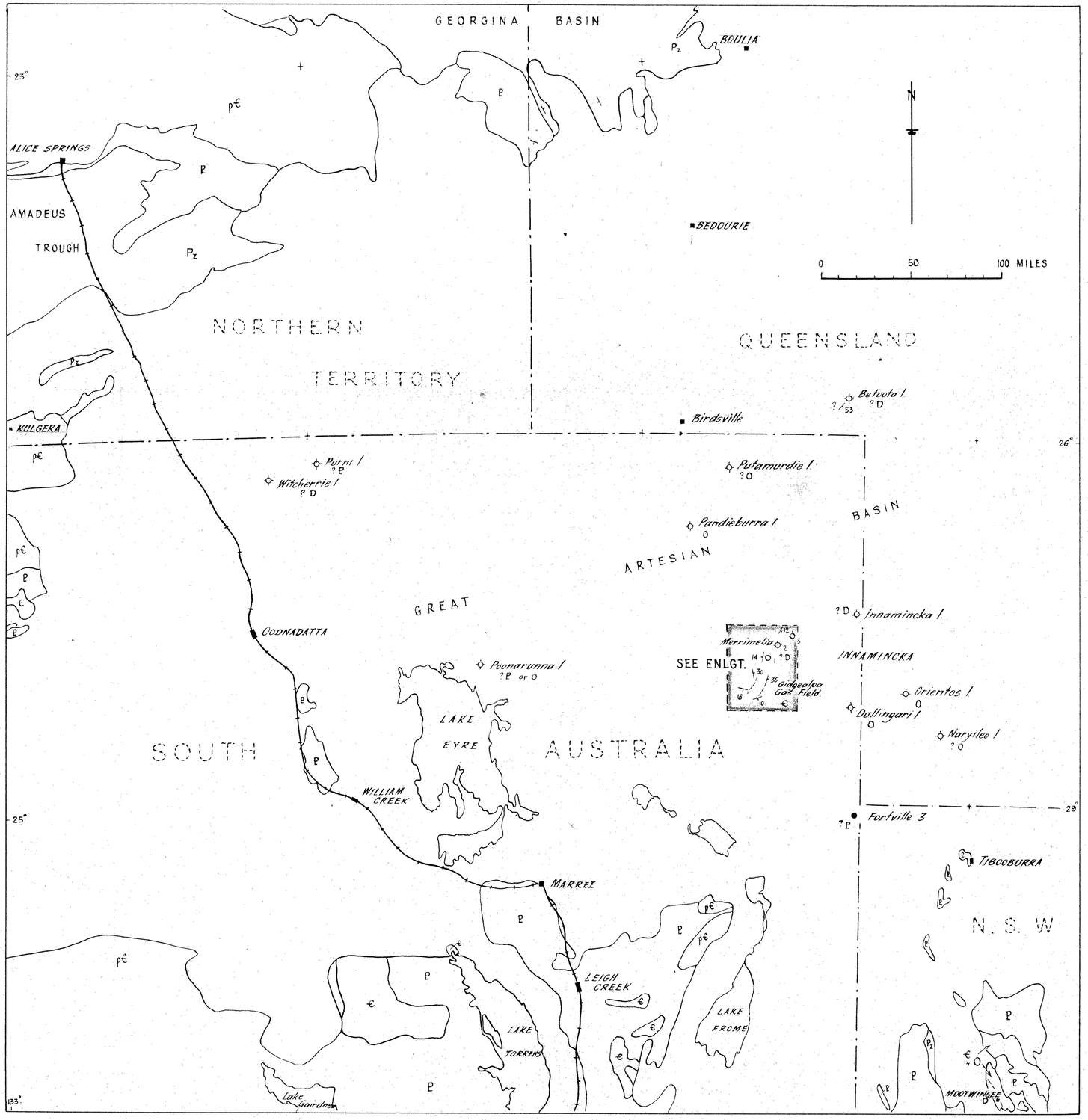
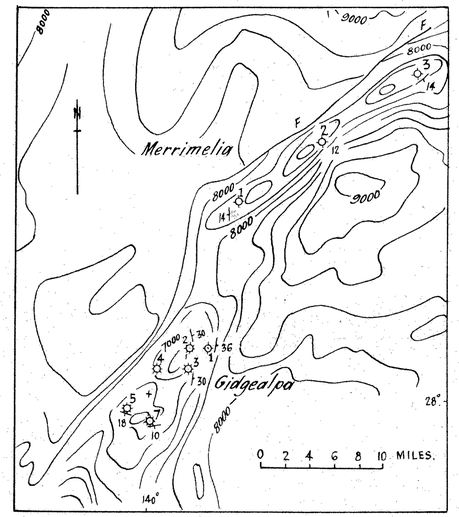




Attitudes of pre-Permian rocks compared with contours of top of Permian. GIDGEALPA - MERRIMELIA AREA

LEGEGND

1/2 Dip of pre-Permian in well.
D . . . Devonian.
O . . . Ordovician
€ . . . Cambrian
Pz . . . Palaeozoic
P . . . Upper Proterozoic
p€ . . . Older Proterozoic or Archaean.

To accompany report by B.G. Forbes.

FIGURE 1

S.A. DEPT. OF MINES

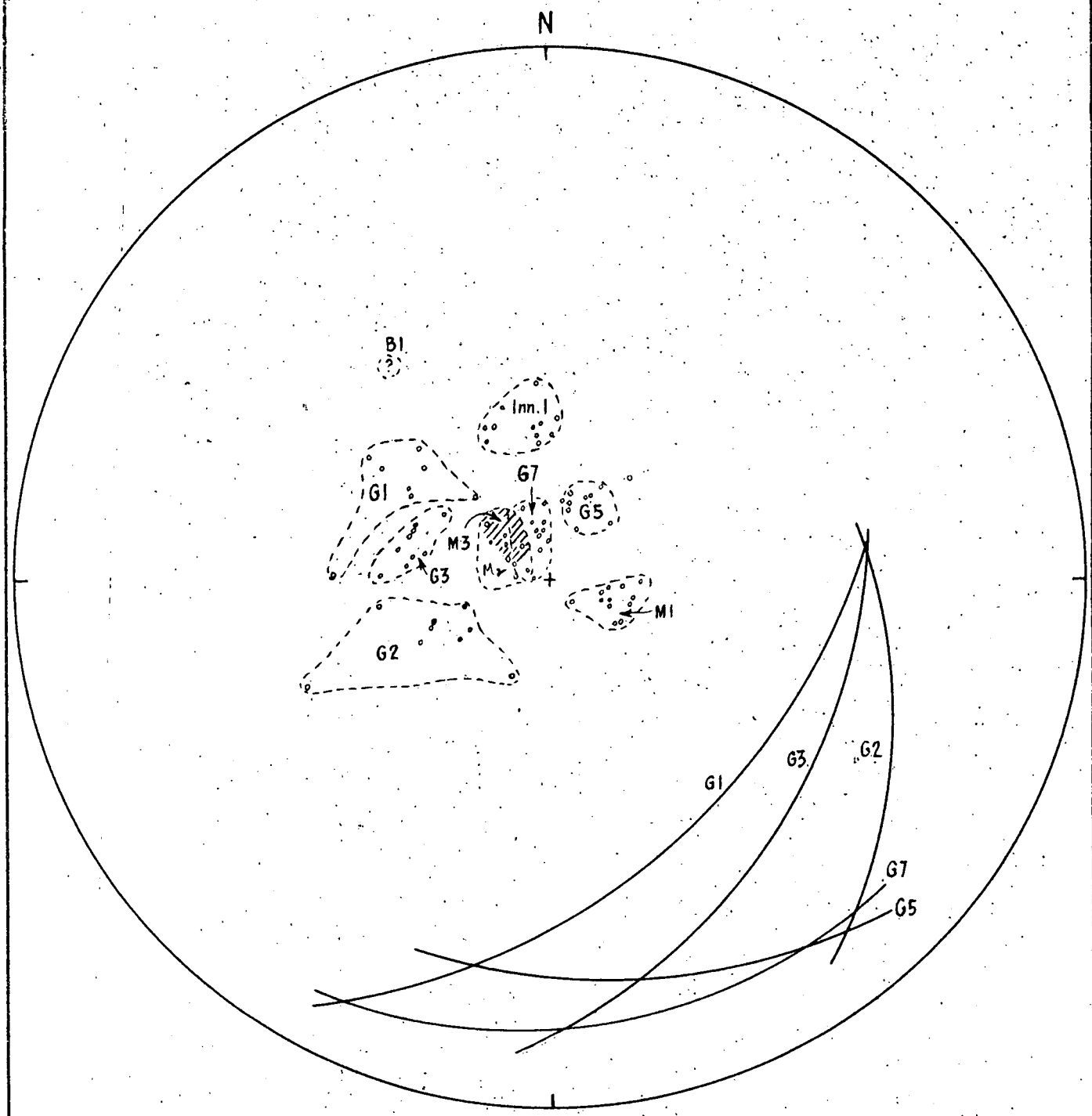
DISTRIBUTION OF PRE-PERMIAN ROCKS
AROUND MARGINS OF PART OF GREAT ARTESIAN BASIN
AND IN SOME BORE-HOLES

Associated Drawing	No.	No.	Amendment	Exd.	Date

Req. No.
D.M.
Compiled from

Approved	Passed		Scale :
	-	Drn.	65 - 762
		Tcd.	894-2/4+81
Director of Mines		Ckd.	
		Exd.	Date 20. 7. 65.

200—2 61 5605



Lower hemisphere stereographic plot of dips of sub surface pre-Permian Points are bedding poles, curves are intercepts of average dip planes derived from fields of points

B: Betoota, G: Gidgealpa, Inn: Innamincka, M: Merrimelia.

AVERAGE DIPS & AZIMUTHS.

B1.	?53°	140°
G1.	36°	126°
2	30°	065°
3	30°	105°
5	18°	204°
7	10°	159°
Inn.1.	34°	170°
M1	14°	283°
M2	12°	131°
M3	14°	136°

Hypothetical anticlinal axis near G2-7 pitches 9-12°
Brg. 139°-188°

To accompany report by B. G. Forbes.

S.A. DEPARTMENT OF MINES

Approved	Passed	Drn.	FIGURE 2	D.M.	Scale
		Tcd.	*Stereographic plot of subsurface pre-Permian dips.*	Req.	S 4446
		Ckd.			Bc.
Director		Exd.			Date 20. 7. 65

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