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DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS:

RECORDS 1966/46

THE ILLAMURTA STRUCTURE OF CENTRAL AUSTRALIA ITS DEVELOPMENT AND RELATIONSHIP TO A MAJOR FRACTURE ZONE.

by

P.J. Cook

THE ILLAMURTA STRUCTURE OF CENTRAL AUSTRALIA. ITS DEVELOPMENT AND RELATIONSHIP TO A MAJOR FRACTURE ZONE

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Record 1966/46

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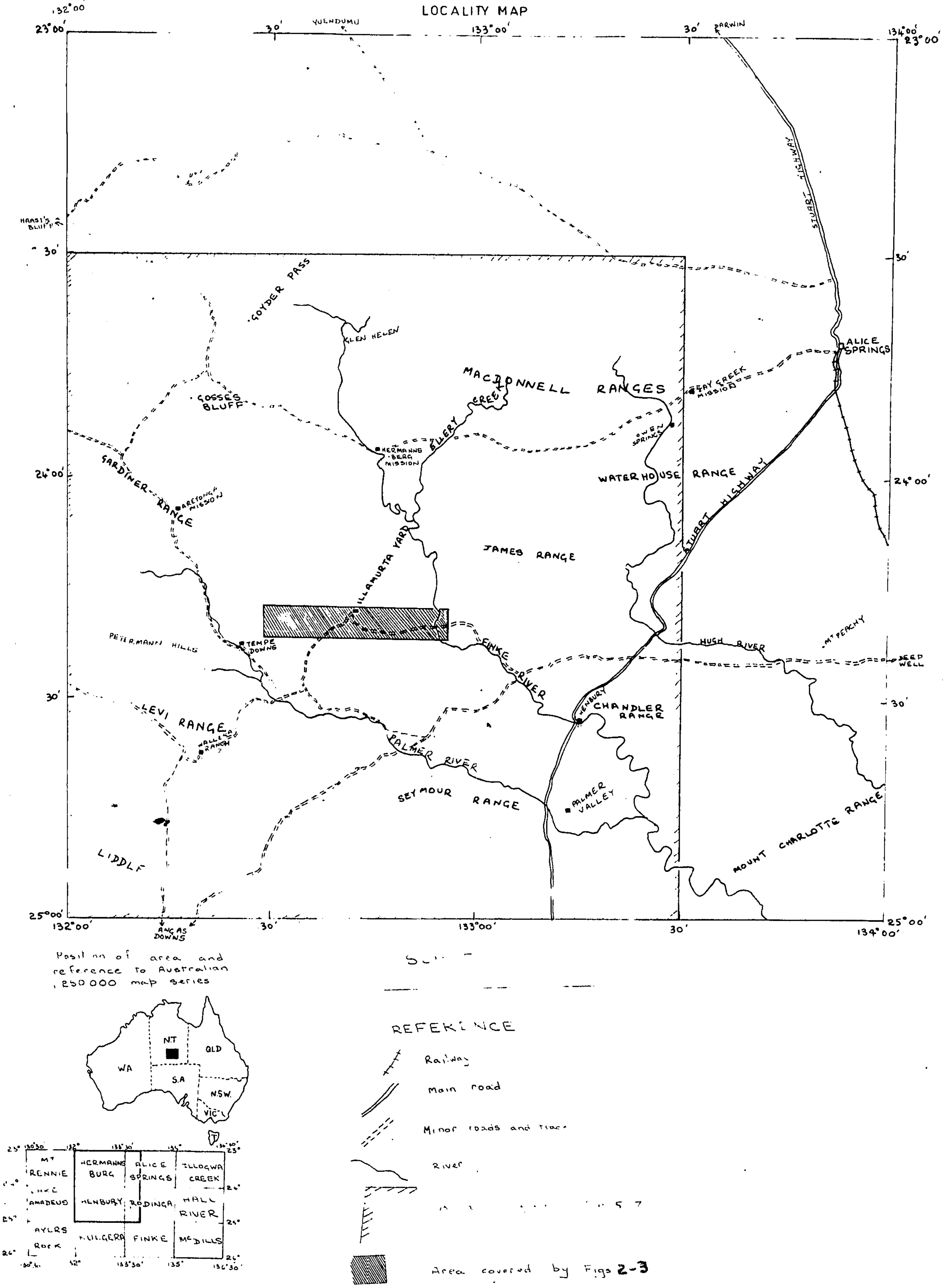

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ABSTRACT

The Illamurta Structure is a complex anticlinal structure which grew whilst Amadeus Basin sedimentation proceeded. Aeromagnetic and gravity data suggests that the movement producing the structure resulted from folding and thrusting in the Archean basement and diapirism of the Bitter Springs Formation. There may have been gravity sliding on the flanks of the diapir.

It is postulated that the Illamurta Structure together with three other similar structures lies on a zone which trends approximately north-north-west across the basin. The zone probably formed a topographic high over which thinning of stratigraphic units occurred and which effected facies distribution at times throughout the late Upper Proterozoic and the Palaeozoic.

By reference to both geology and geophysics this north-north-west structural trend can be traced to Lake Eyre in South Australia, from where it continues through the zone of Flinders Range diapirs and south into the complex structural zone in and around Spencer Gulf.

It is postulated that the zone also continues north-west from the Amadeus Basin into the Fitzroy Basin, where it is probably parallel to the Fenton Fault. The Frome Rocks diapir, the Fitzroy lamproites and the Mount Abbott crypto-volcanic structure are all geological expressions of this same zone. The name Fitzroy-Spencer Gulf Fracture Zone is suggested for this important structural feature of the Australian continent.

INTRODUCTION

The writer mapped the Illamurta Structure on a scale of 1:46,500 as part of a Bureau of Mineral Resources programme in the Amadeus Basin, central Australia.

The structure is situated in the northern half of the Henbury 1:250,000 sheet area, about 16 miles east-north-east of Tempe Downs Homestead and about 90 miles south-west of the town of Alice Springs (Fig.1).

It lies in the central part of the Amadeus Basin (Ranford, et.al., 1966), where there are between 12.000 and 30,000 feet of Upper Proterozoic and Palaeozoic sediments. The oldest unit exposed is the Upper Proterozoic Bitter Springs Formation. The youngest unit exposed (excluding thin superficial Tertiary and Quaternary), is the Devonian-Carboniferous Pertnjara Formation. The stratigraphy of the Illamurta Structure is basically that established by Prichard and Quinlan (1962) from the northern margin of the Amadeus Basin, with modifications by Ranford, et.al., (1966), and is summarized in Table 1.

The area has been affected by two major orogenies - the Upper Proterozoic to Lower-Cambrian Petermann Ranges Orogeny (Forman, 1966) and the Devonian-Carboniferous Alice Springs Orogeny (Forman, et.al., 1966). Both orogenies produced folding and faulting, with an approximately east-west trend (see Fig.5). However, the older orogeny had little effect on the Illamurta Spring area and most of the folding here resulted from the younger orogeny. In many areas the style of the folds (characterized by broad synclines and sharp anticlines) is controlled by disharmonic folding in the Bitter Springs Formation which is known to contain salt at depth; diapiric structures are also common in some areas.

DESCRIPTION OF THE ILLAMURTA STRUCTURE

Stratigraphy

The stratigraphy of the Illamurta Structure is summarized in Table 1. There are approximately 20,000 feet of Amadeus Basin sediments ranging in age from Upper Proterozoic to Upper Palaeozoic involved in the structure. Thin superficial deposits of Tertiary and Quaternary sediments are present in some areas (Fig.2). It is immediately apparent on examining the air photograph (Fig.2) of the structure that there is a considerable stratigraphic hiatus as the Illamurta Springs area is approached from either east or west. This thinning is confirmed by field work and involves many units, including all formations of the Pertaoorrta and Larapinta Groups, the lower unit of the Mereenie Sandstone (Pzm(1)), the siltstone

ILLAMURTA STRUCTURE

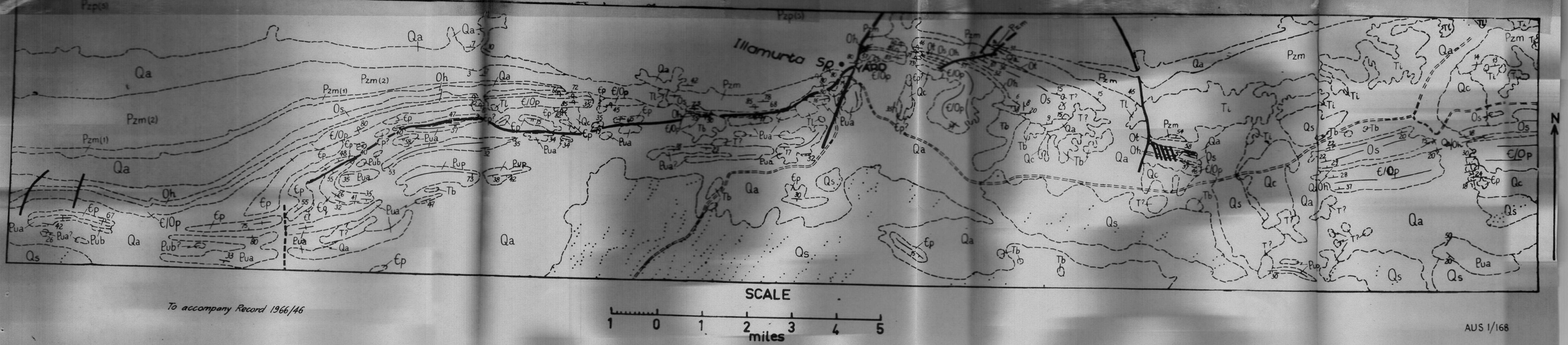

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TABLE 1

STRATIGRAPHY OF THE ILLAMURTA STRUCTURE

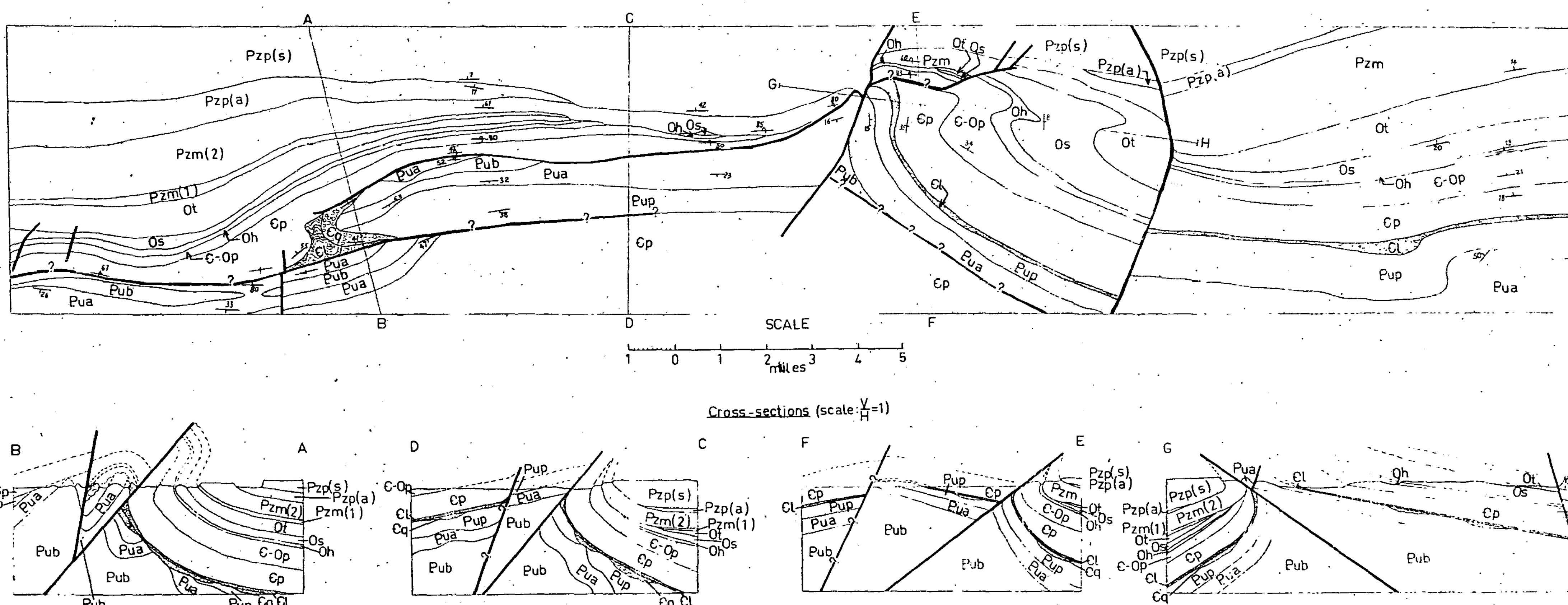
AGE	FORMATION ✗		LITHOLOGY	EST.MAX. THICKNESS (feet)
Quaternary	(Qa)		Alluvium & river gravel	50
	(Qs)		Aeolian sand	50
	(Qc)		Conglomerate	20
	(T)		Undiff.calc.siltstone & sandstone	20
Tertiary	(Tl)		Freshwater limestone	10
	(Tc)		Conglomerate	10
	(Tb)		"Grey Billy" - strongly silicifed sediments.	10
	(Ta)		Laterite & ferricrete.	20
Devonian-Carboniferous	Pertnjara Fm	(Pzp(s))	Sandstone & pebbly sandstone	4000 +
		(Pzp(a))	Siltstone & minor sandstone	1000
Ordovician-Devonian	Mereenie Sandstone	(Pzm)	Undiff.sandstone & silty sandstone	2000
		(Pzm(2))	Well sorted cross-bedded sandstone	
		(Pzm(1))	Red-brown silty sandstone	200
Ordovician	Larapinta Group	Stokes Fm(Ot)	Siltstone,claystone & limestone	1000
		Stairway Sandstone (Os)	Sandstone & siltstone	800
		Horn Valley Siltstone(Oh)	Siltstone,claystone & limestone	400
		Pacoota Sandstone(Ꞓ/Op)	Massive sandstone & minor siltstone	2000
Cambrian	Pertaoorrta Group	Undiff.(Ꞓp)	Sandstone,siltstone, claystone & limestone	2000
		Tempe Fm(Ꞓt)	Siltstone & Glauconitic limestone	300
		Chandler Lst (Ꞓl)	Limestone,dolomite, chert & probably salt subsurface	200 + (?)
		Quandong Con. (Ꞓq)	Conglomerate & conglom. sandstone	200
Upper Proterozoic	Pertatataka Fm.(P̲up)		Siltstone,claystone & minor sandstone & limestone	1000
	Areyonga Fm.(P̲ua)		Tillites,siltstone, claystone,sandstone & minor limestone.	1000
	Bitter Springs Fm (P̲ub)		Dolomite,limestone, siltstone & prob. salt surface.	2000 + (?)

✗ The formation symbol in brackets is used in figs 2, 3 and 4.

Fig 3

THE ILLAMURTA STRUCTURE

Interpretation of the solid geology



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unit of the Pertnjara Formation (Pzp(a)), and possibly the Pertatataka Formation (Pup). In a distance of 10 miles about 10,000 feet of section is lost. There is no detectable thinning of the upper part of the Mereenie Sandstone (Pzm(2)) or the sandstone unit of the Pertnjara Sandstone (Pzp(5)). The thinning-out of formations is particularly well developed on the western flank of the structure (Fig.2). On traversing from west to east it is found that the siltier units of the Pertnjara Formation (Pzp(a), the Mereenie Sandstone (Pzm(1)), and the Stokes Formation (Ot), are the first units to disappear, and all three units disappear at approximately the same position. Further east the Stairway Sandstone (Os) the Horn Valley Siltstone (Oh), the Pacoota Sandstone (ЄOp) and perhaps also the Pertaoorrta Group sediments (Єp, Єl and Єq) and the Pertatataka Formation (Pup) (though this is difficult to establish because of the faulting) also disappear beneath the Mereenie Sandstone (Pzm(2)). On the east side of the Illamurta Structure the formations reappear in much the same order as they disappeared.

Structure

The Illamurta Structure has a predominantly east-west trend. It is about 25 miles long and five miles wide and is severely folded and faulted.

The actual field data is given in Fig.2 and from this it is possible to construct a map of the "solid" geology (i.e. contacts beneath the superficial Tertiary and Quaternary are interpolated - Fig.3). The western half of the Illamurta Structure consists of a sharp anticline with an overturned northern flank; this overturned limb has been subsequently displaced by a fault or high angle thrust (see cross-section A-B, Fig.3). The western end of this structure, where the Cambrian Quandong Conglomerate overlies the Areyonga Formation to give an "anchor-like" form to the outcrop, is somewhat problematical. In the field the junction appears to be unconformable although the contact is not actually visible. However, the form of the outcrop strongly suggests by analogy with the Mount Burrell Anticline in the eastern part of the Amadeus

Basin (Wells, et.al., 1967), that the contact should equally well be a folded fault plane. In this same area it is also apparent that the Chandler Limestone is a highly incompetent unit, probably due to salt which though not exposed at the surface is known to be present subsurface in other areas.

The structure of the area east of Illamurta Spring is somewhat less complicated and a normal stratigraphic sequence from Areyonga Formation to Pertnjara Formation dips to the north. Here, an easterly plunging anticline is terminated by a north-south normal fault. In this same area there is a marked change in profile shape down the axial plane. A fault shown south-east of Illamurta Spring separating Upper Proterozoic Areyonga Formation from Cambrian Pertaoorrta Group (Fig.3) is rather speculative and it is possible to also explain the outcrop arrangement by an unconformity between the Areyonga Formation and the Pertaoorrta Group.

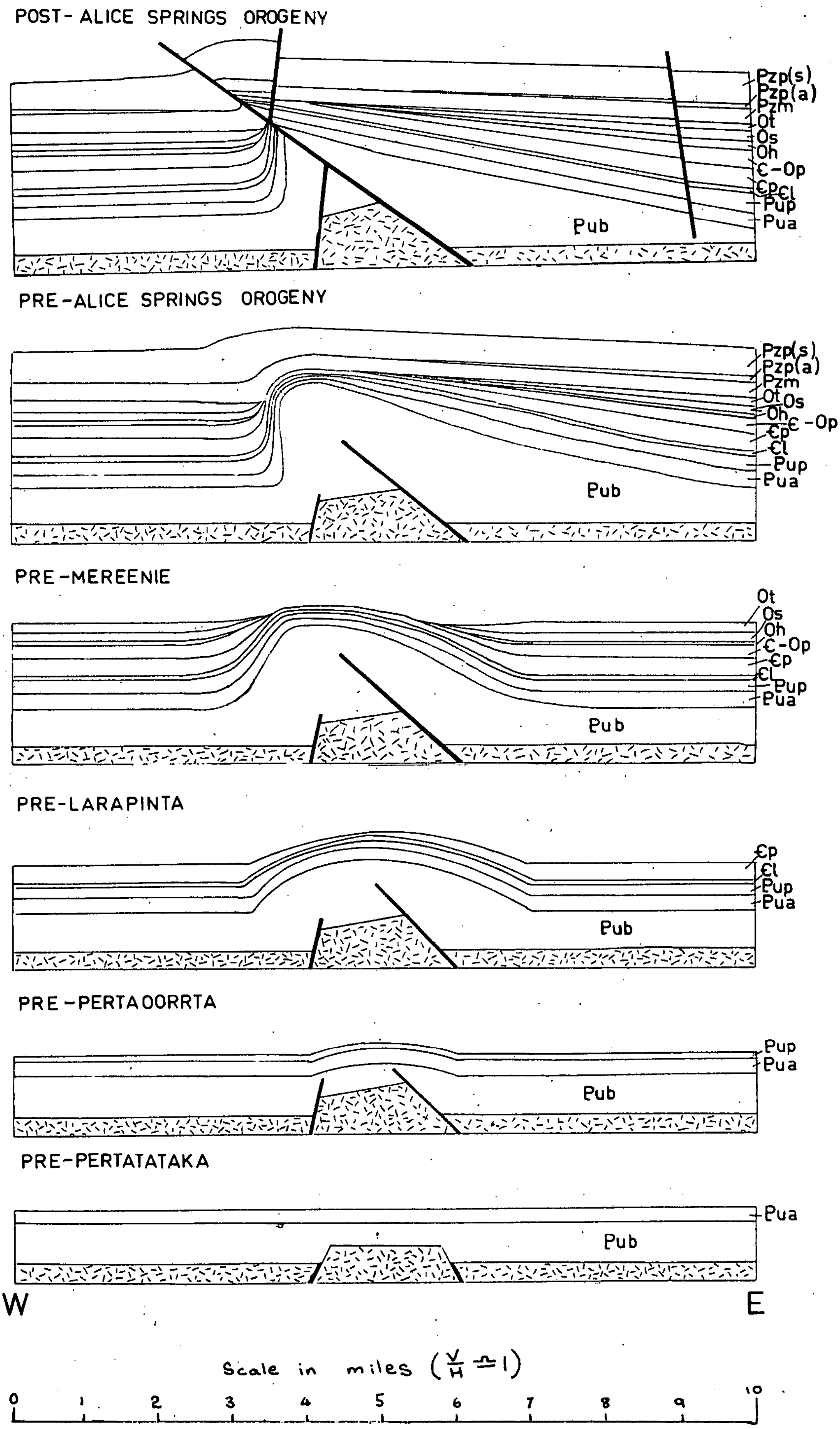
At Illamurta Spring itself the rocks are strongly disturbed with, for instance, gently dipping Upper Proterozoic Areyonga Formation thrust over vertically dipping Palaeozoic Mereenie Sandstone (see cross-section G-H, Fig.3). It is here that the south-dipping east-west fault (thrust) is itself intersected by a north-north-east trending fault which cuts through the core of the Illamurta Structure.

THE DEVELOPMENT OF THE ILLAMURTA STRUCTURE

The most important problem in the Illamurta Structure is whether the disappearance of rock units can be attributed to stratigraphic or structural thinning. Probably the most likely reason for stratigraphic thinning occurring over such a restricted area and at various times throughout the Upper Proterozoic and Palaeozoic is that the area was subject to anticlinal or diapiric growth during sedimentation. There is also considerable folding, and faulting which probably influenced the growth of the structure. Fault movements may have "triggered-off" and terminated the growth of the Illamurta Structure. Numerous examples of diapiric structures and salt anticlines with Bitter Springs Formation in the core are known from other parts of the Amadeus Basin. In particular the

fig 4

DEVELOPMENT OF THE ILLAMURTA STRUCTURE



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Goyder Pass Diapir (McNaughton et.al., 1966) on the northern margin of the Amadeus Basin, has a form remarkably like that of the Illamurta Structure and this has undoubted Bitter Springs Formation in the core. McNaughton et.al. (1966) postulate a "trapdoor" type diapiric structure with the lifting of a lid of sediments about a hinge-line. The present writer considers that the structure can be explained by more conventional cross-sections across a faulted and folded diapir as in Fig.3. By analogy with Goyder Pass and because of its salt and dolomite content the Bitter Springs Dolomite is/the most likely cause of diapirism in the Illamurta Structure. This is supported by the depth to magnetic basement below the structure, which is estimated from aeromagnetic work (Young & Shelley, 1966, unpubl.) to be approximately 18,000 feet, whereas the maximum possible thickness of sediments in a normal, undisturbed succession, below the Areyonga Formation (which is exposed in the core of the structure,)is about 5,000 feet. The extra 13,000 feet of section can be explained either by the basement being non-magnetic (unlikely in view of what is known of the basement in other parts of the Amadeus Basin), or more likely, by thickening due to incompetent folding of the Bitter Springs Formation in the core of a diapir or anticline.

The simple picture of the structure developing entirely because of diapiric growth of Bitter Springs Formation, is however not entirely compatible with the geophysical picture, for it does not correspond to a negative bouguer anomaly. It is possible that any anomaly is obscured by the strong regional gravity gradient. The structure does however correspond to a very definite basement high which strongly suggest that basement was involved in the development of Illamurta Structure as well as the Bitter Springs Formation.

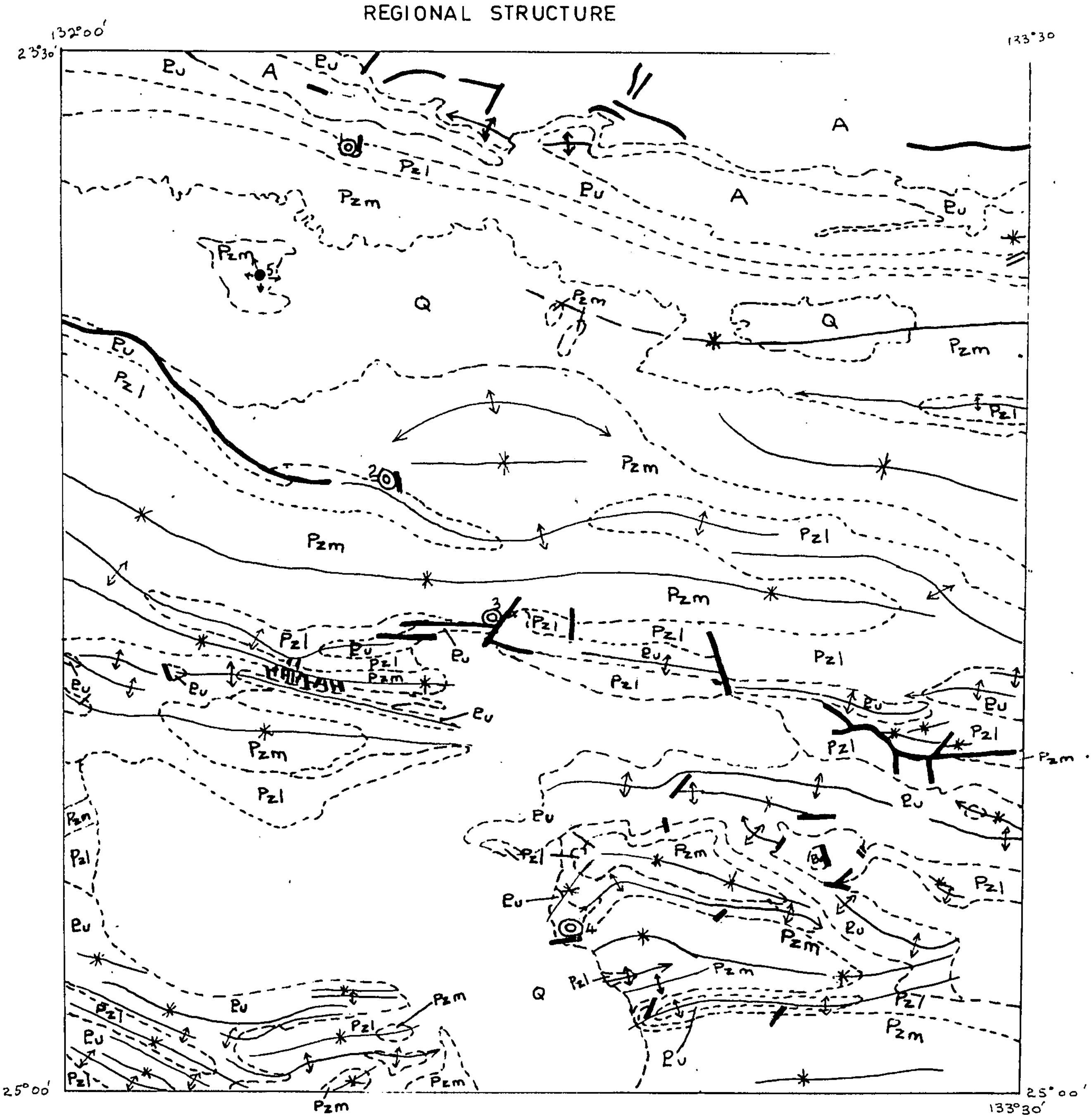
Fig.4 attempts to show qualitatively the development of the Illamurta Structure. The section shown is an east-west section across the structure so that the final (post Alice Springs Orogeny) section corresponds to section G-H of Fig.3. It is postulated that throughout the development of the structure, movement in the basement has played an important role in initiating and possibly continually modifying the movement of the Bitter Springs Formation.

Initially the structure was probably a symmetrical anticline with a core of Bitter Springs Formation. By Mereenie Sandstone times the structure had become somewhat assymmetrical perhaps due to epeirogenic movements which occurred prior to Upper Mereenie Sandstone (Pzm(2)) sedimentation. The assymmetry of the structure was accentuated during the Alice Springs Orogeny and in addition the east flank of the structure was thrust over the west flank. There was also some normal faulting at this time. The severe movement of the Alice Springs Orogeny finally terminated the growth of the structure.

It is apparent from Figs.2 or 3, that the silty formations thin out more rapidly than the sandy formations. The reason for this may be that the rate of growth of the structure varied. Alternatively, during silt sedimentation, the rate of deposition was probably fairly slow so that the growth of the structure easily kept pace with sedimentation. However, during for instance Mereenie Sandstone (Pzm(2)) times, the thick sequence of strongly cross-bedded orthoquartzites was probably deposited relatively rapidly, so that growth was now no longer able to keep pace with the rate of sedimentation. Consequently there was little or no thinning of the Mereenie Sandstone over the Illamurta Structure. Whilst it is possible to rationalise most of the features of the Illamurta Structure to fit in with a diapiric origin, the possibility that gravitational sliding tectonics (de Sitter, 1956) may have also played an important part should not be ignored. The change in profile shape down the axial plane mentioned previously, is regarded by Cummings & Shackleton (1955) as a characteristic feature of structures involved in gravity sliding. There are many cases known of the thinning of rock units by "shearing-out" during gravity sliding. In particular van der Fliert (1953) has described a case of gravitational sliding on the flanks of the Djebel Friktia diapir of eastern Algeria along gliding planes lubricated by plastic shales. It is possible that the shales for instance of the Pertnjara Formation and the Stokes Formation may have acted in a similar fashion. If this had happened in the Illamurta Structure it would probably be impossible to detect as there would be no indications such as a mylonite on the slip plane.

Fig 5

REGIONAL STRUCTURE



SCALE

0 10 20 30 40 50 miles

0 10 20 30 40 50 60 70 kilometers

REFERENCE

Fault

Anticline

Syncline

Structure of the Illamurta type

1 - Goyder Pass Diapir

2 - Gardiner Range "pinch-out"

3 - Illamurta Structure

4 - Seymour Range "pinch-out"

•5 - Gosses Bluff

Q - Superficial Quaternary deposits

Pzm - Middle Palaeozoic (Pertnjara Formation plus Mereenie Sstn).

Pzl - Lower Palaeozoic (Larapinta plus Pertaoorrta Groups)

Pu - Upper Proterozoic (Pertatataka Formation, Areyonga Formation, Bitter Springs Formation and Heavitree Quartzite

A - Archean - crystalline basement

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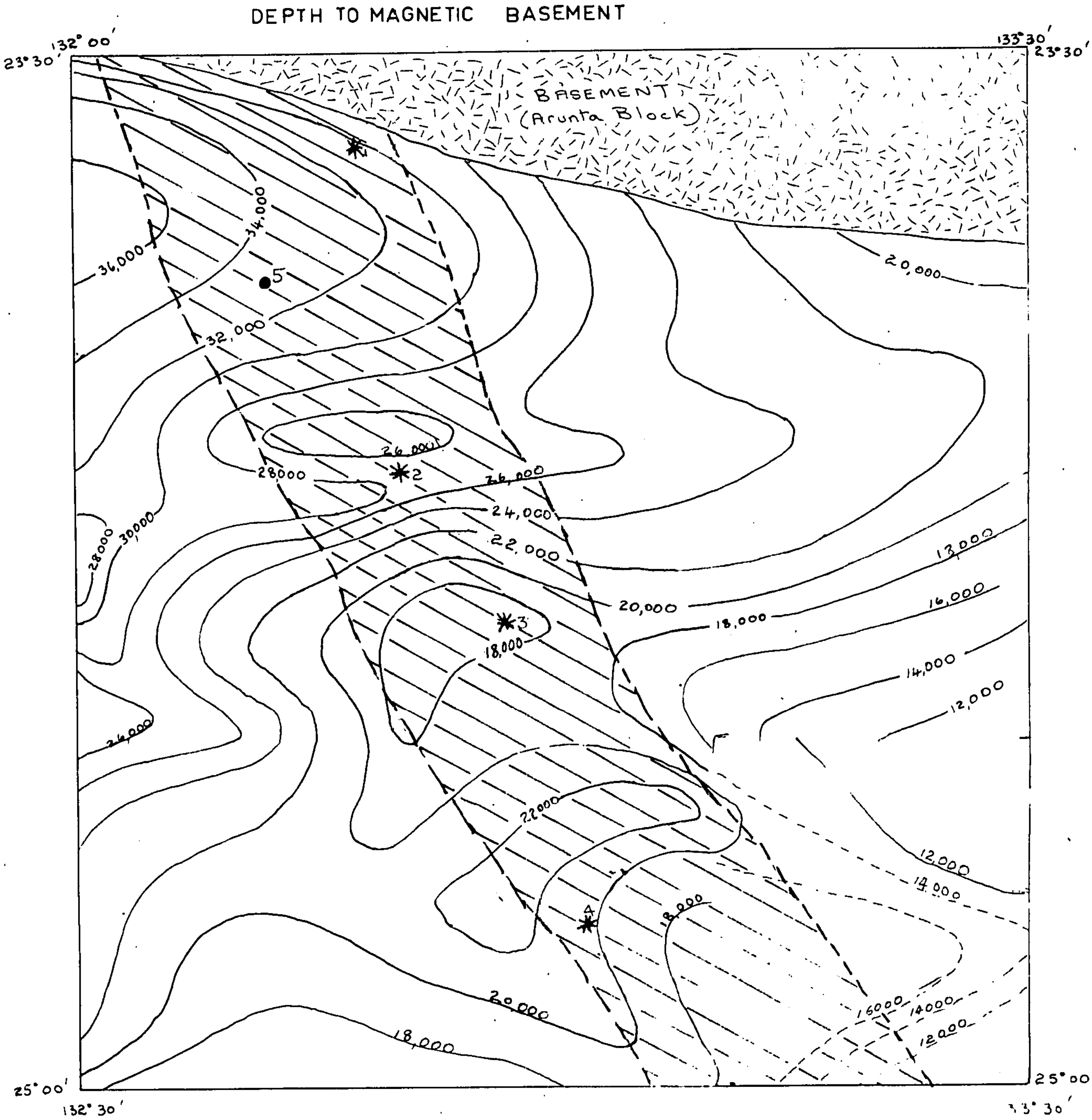
Fig 6

DEPTH TO MAGNETIC BASEMENT



SCALE

0 10 20 30 40 50

0 10 20 30 40 50 60 70

REFERENCE

20,000 contours on depth to magnetic basement (interval 2,000 feet)

* Structure of the Illamurta type

1 - Goyder Pass Diapir

2 - Gardiner Range "pinch-out"

3 - Illamurta Structure

4 - Seymour Range "pinch-out"

5 - G[illegible] Bluff

Postulated zone of structural disturbance and stratigraphic thinning

Survey by the Geophysical Branch of the Bureau of Mineral Resources (Young & Shelley, 1966)

Survey by Aeroservice Ltd (Hartman, 1963)

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Therefore whilst it is suspected that the Illamurta Structure is diapiric in character, it is possible that gravity sliding on the flanks of the rising diapir may have played a major part in the thinning of some formations. The siltstone intervals in particular show significantly greater thinning than the sandstone units, perhaps due to their more plastic character rather than the differential rate of growth or the slower rate of sedimentation as was suggested earlier.

REGIONAL IMPLICATIONS

Amadeus Basin

In addition to the Goyder Pass Diapir (McNaughton et.al., 1966) which has been previously mentioned, the writer also recognises two further structures of the Illamurta type, in the central part of the Amadeus Basin (see Ranford et.al., 1966). These are here informally referred to as the Gardiner Range "pinch-out" and the Seymour Range "pinch-out". These four structures lie on an approximately north-north-west trending belt with cuts across the trend of most of the major visible structures in the area (Fig.5). Though somewhat more problematical in origin, and rather different in form, the Gosses Bluff crypto-explosion structure (Crook and Cook, 1966), is almost certainly situated on the same broad trend.

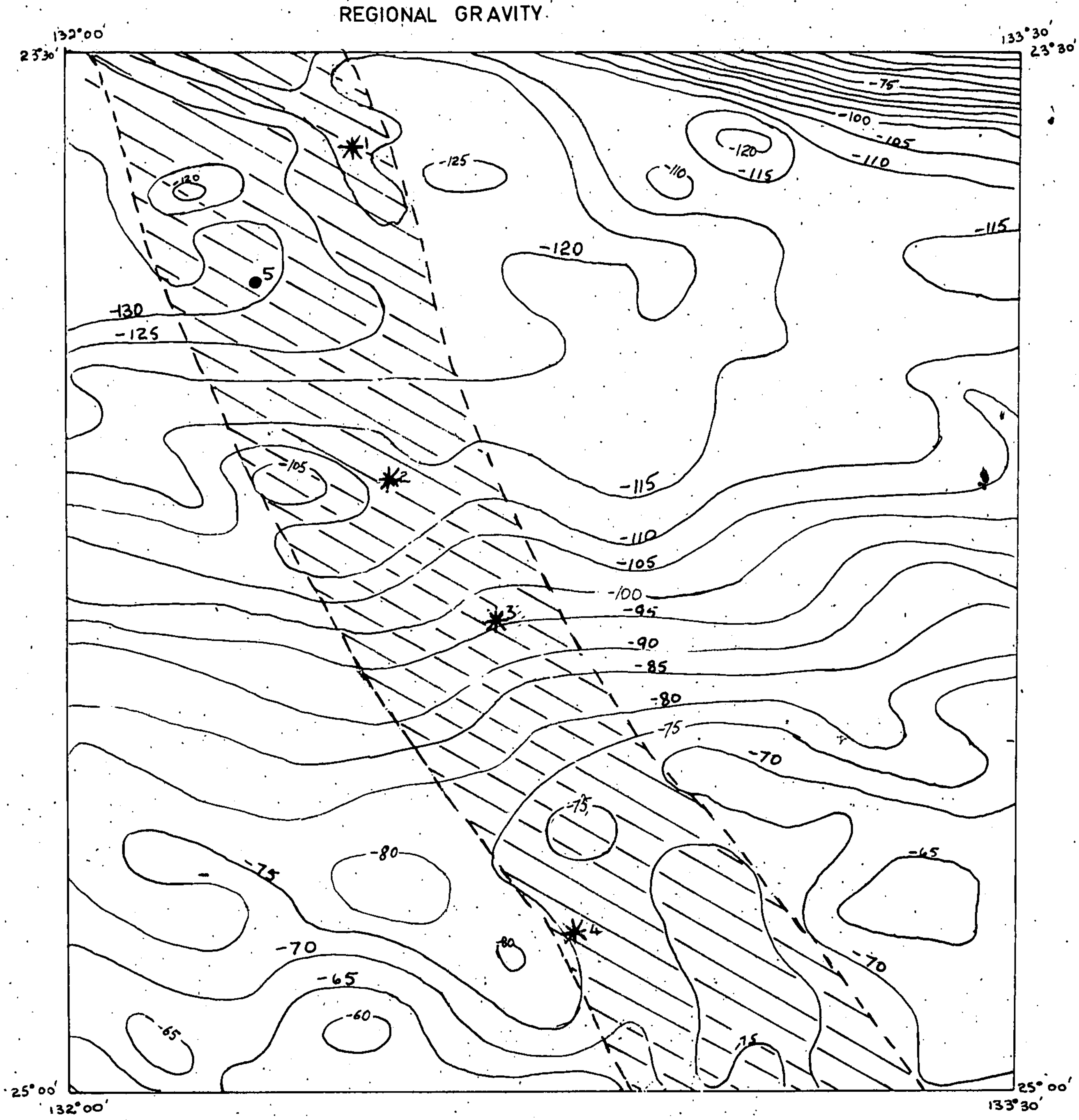
Regional magnetic work by Young and Shelley (1965) has shown that with the exception of the Goyder Pass Diapir (which is probably too close to the Arunta Block for a small local aeromagnetic anomaly to be apparent) the Illamurta-type structures are located on basement highs (see Fig.6). At all these highs there is thinning of individual units. However, as mentioned earlier for the Illamurta Structure, the thickness of the underlying sedimentary pile is greater than would be the case in the normal stratigraphic sequence, again probably due to the incompetent folding of the Bitter Springs Formation. The bouguer anomaly map fails to show any clear correlation between gravity anomalies and the Illamurta type of structure (Fig.7). It is considered that this is largely due to the steep regional gravity gradient and the strong east-west trends produced by the Alice Springs Orogeny which cut across the older Illamurta trend. There is however strong evidence for suggesting that the 130 mile long belt running across the Amadeus Basin was probably active throughout the history of the basin, and during at least part of this time constituted a topographic high. It may have influenced palaeocurrent direction. In the Stairway Sandstone the normal palaeocurrent direction is from the east or south-east except for an elongate area just to the west of and parallel to the Illamurta structural zone. Here the palaeocurrents flow north-south (see palaeocurrent map in Cook, 1967). During the Cambrian Pertaoorrta Group times the Illamurta structural zone strongly influenced the distribution of lithologies, forming the western limit of carbonate sedimentation. This is best seen in the Seymour Range where a wholly sandstone sequence of the Cambrian Pertaoorrta Group grades very rapidly (over a lateral distance of only a few hundred yards) into a wholly carbonate-shale sequence. This transition does not take place exactly at the Seymour Range "pinch-out" but it occurs only 6 miles to the east of it. It may well be that the "summit" of the structure migrated west (as is shown in Fig.4) throughout the Palaeozoic. In the same way the Pertaoorrta Group shows a marked thinning along the zone with a very noticeable kinking of the isopachs along its length (see isopachous map for the Pertaoorrta Group, Ranford, 1967).

Australia

The zone on which the Illamurta Structure lies can be followed south into the St.Vincents Gulf area and north-west into the Fitzroy Basin. The name Fitzroy-Spencer Gulf Fracture Zone is suggested for the feature. It will just be referred to as the Fracture Zone from hereon. The existence of an extension of the Illamurta structural zone was first suggested to the writer by Dr.G.Neumann (pers.comm.) of the Geophysical Branch of the Bureau of Mineral Resources. He pointed out that the Illamurta structural zone forms a "gap" (i.e. a negative anomaly) between the Angas Downs Gravity Ridge (Lonsdale & Flavelle, 1963, unpubl.), and the Rodinga Gravity Ridge (Fig.8). There is a similar gravity low separating the Alberga Gravity High from the McDills Gravity Platform. The two gravity troughs though separated by the Ayers Rock Gravity Depression nevertheless are in line (Fig.8). Neumann (pers.comm.) has further pointed out that this gravity trough extends to the south-east forming a large gravity depression in the western half of the Dalhousie sheet area and a further trough near the north-west corner of Lake Eyre. Therefore

Fig 7

REGIONAL GRAVITY



0 10 20 30 40 50 miles

0 10 20 30 40 50 60 70 kilometers

REFERENCE

-75 gravity contours (interval 5 milligals)

✱ Structures of the Illamurta type

1 - Goyder Pass Diapir

2 - Gardiner Range "pinch-out"

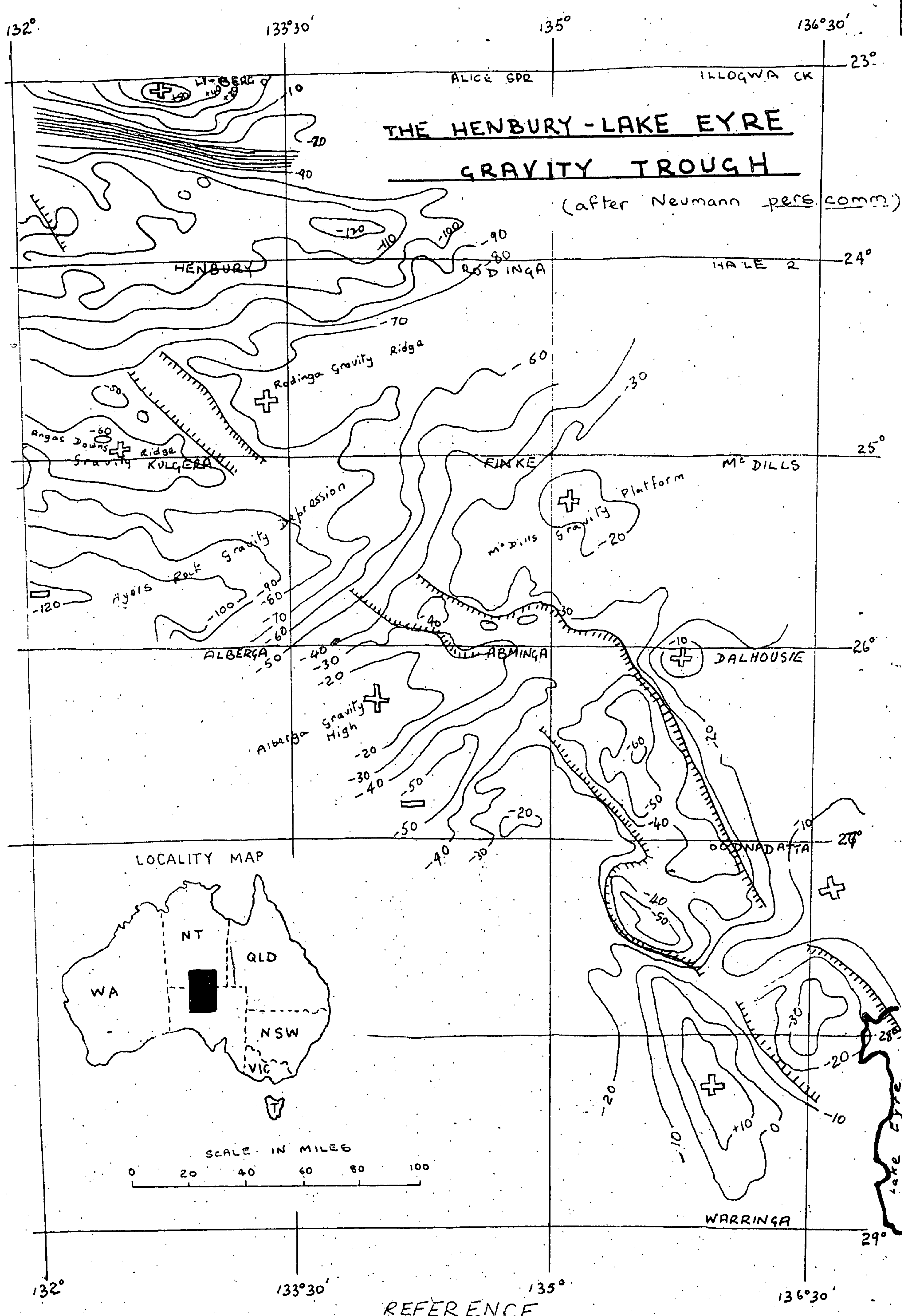
3 - Illamurta Structure

4 - Seymour Range "pinchout"

●5 - Gosses Bluff

Postulated zone of structural disturbance and stratigraphic thinning

Fig 8



REFERENCE

'Low' gravity anomaly trend

'High' gravity anomaly

'Low' gravity anomaly

-20 Bouguer anomaly contour in mgals (interval of 10 mgals.

FINKE - name refers the 1:250,000 Australia map series

BMR To accompany Record 1966/46 AUS1/173 the extension of the Illamurta structural zone can be followed for at least 400 miles along the Henbury-Lake Eyre Gravity Trough in spite of the disruption of the zone by younger basins.

By recourse to geology it is possible to suggest a further extension of the Fracture Zone south along a broad zone of diapiric activity. The most northerly diapir described by Coats (1965) is the Witchelina Diapir which is situated near the south-east corner of Lake Eyre. The most southerly one, the Wirreanda Diapir lies about 170 miles to the south, near the head of Spencer Gulf. Within this 170 miles Coats (1965) has recognized 26 separate diapiric structures. Whilst the structures are diapiric in that they have broken through the overlying strata the cores of the structures are composed of brecciated Callanna Beds and there is no salt evident although Webb (1961) has suggested that it may be present sub-surface. Blocks of crystalline basement and basic volcanics are fairly common. Whilst diapirixm is the accepted origin for the Flinders Range structures at the present time, the possibility that some are in fact crypto-explosion structures (perhaps formed in a similar manner to the Gosses Bluff crypto-explosion structure) should not be ignored. Whatever their origin, they are however yet another expression of the Fracture Zone.

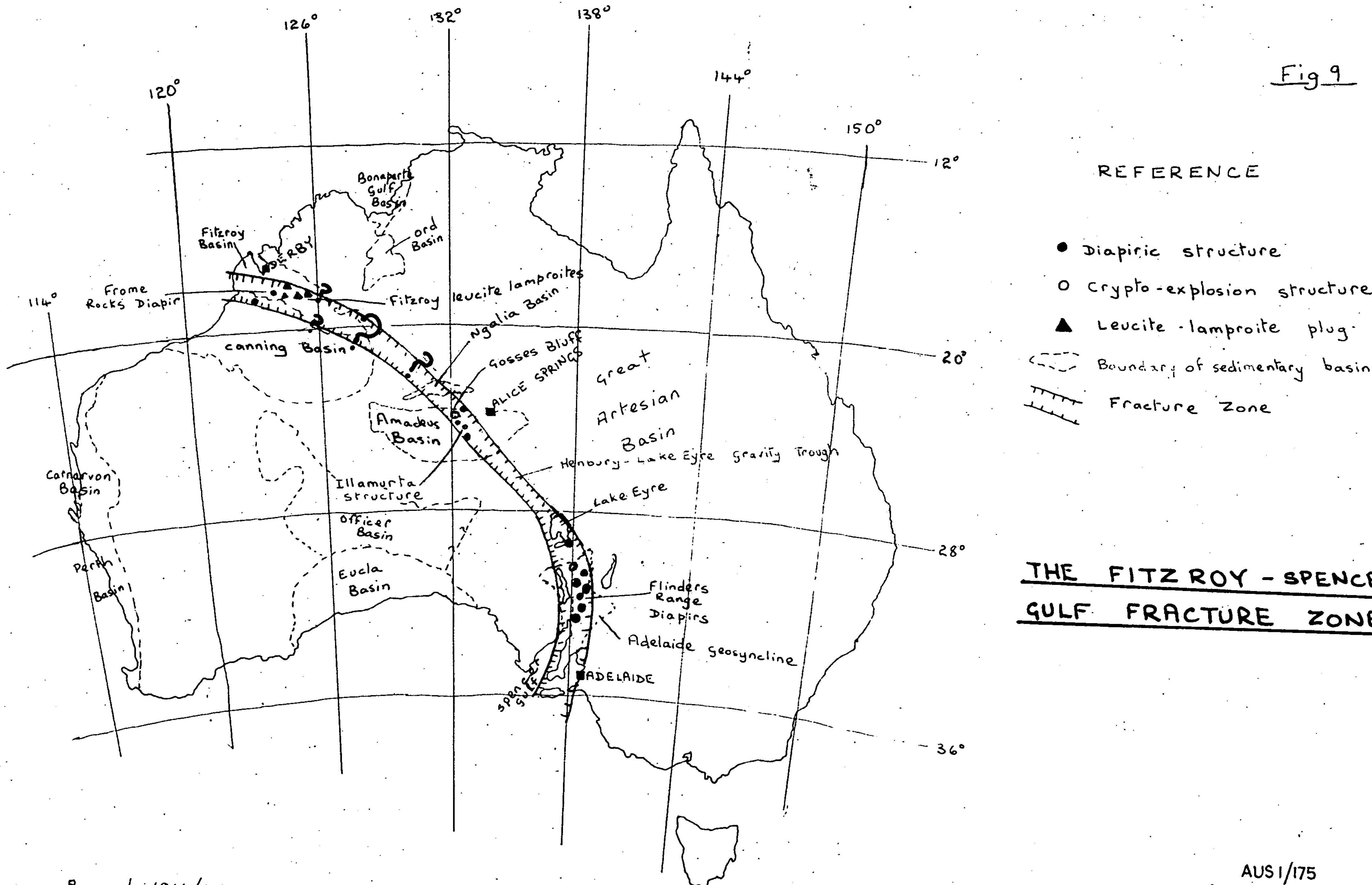
The Fracture Zone then continues south through the complex structural zone in the St.Vincents Gulf-Spencer Gulf area, referred to by Fairbridge (1950) as the Great Shatter Belt. South of Spencer Gulf the Fracture Zone finally disappears below the southern Indian Ocean. North and north-west of the Amadeus Basin, there is little geophysical or geological data available on which to base any continuation of the Fracture Zone. Geological photo-interpretation of the Ngalia Basin by Rivereau (1965, unpubl.), does suggest some north-trending structures in the region where the Fracture Zone would be expected to cut across the east-west trending Ngalia Basin. Further to the north-west in the Lucas Sheet area and then in the Fitzroy Basin gravity information suggests a gravity trough similar to that south of the Amadeus and also affected by younger trends at right angles to the older gravity trough. The geological expression of the Fracture Zone are even more obvious and significant. The north-west trending Fenton Fault (Guppy et.al., 1958) is part of the Fracture Zone. The Frome Rocks Diapir also lies within the same north-west trend, as do the leucite - lamproite plugs of the Fitzroy Basin. Significantly, Prider (1960) describes the lamproite plugs as "occupying diatremes" (gas drilled pipes) and also consider the structure at Mount Abbott to be a crypto-volcanic structure. Therefore it appears from the geophysical and geological information that the Fracture Zone continues north-west through the Fitzroy Basin. The Fitzroy-Spencer Gulf Fracture Zone is therefore about 2,000 miles long and from 30 to 100 miles plus wide. For much of its length it follows the boundary originally suggested by Fairbridge (1950) between "Eo-Australia" and "Palaeo-Australia". The Fitzroy-Spencer Gulf Fracture Zone is undoubtedly a very ancient feature dating back to the Proterozoic. It was also a very "strong" tectonic zone for in spite of many Proterozoic and Palaeozoic structural trends cutting across, it was nevertheless able to retain its identity along most of its length. The Fracture Zone was also active over a very considerable period of time ranging from Proterozoic (the Flinders Range diapirs) to Tertiary (the Fitzroy Basin lamproites).

The Fracture Zone may have had a graben-like form in some area (e.g. Spencers Gulf) but in other areas it may have been more horst-like (e.g. across theAmadeus Basin). In many ways it bears a marked similarity to the Rhine Graben which is not in fact a simple graben and stretches from eastern Spain to Southern Norway - a distance of about 1,500 miles. Along its length the Rhine Graben has the same association of diapiric structures, crypto-volcanic (explosion) structures and volcanic plugs which are also found in the Fitzroy-Spencers Gulf Fracture Zone.

SUMMARY

1) The Illamurta Structure is a complex diapiric structure which involves both the Bitter Springs Formation and crystalline basement in the movement. The thinning out of formations may be due to either thinning over a diapir or gravity sliding on the flanks of the uprising diapir,

Fig 9



THE FITZROY - SPENCER GULF FRACTURE ZONE

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or possibly both.

2) Three other structures of the Illamurta type lie on a broad structural zone which runs north-north-west across the Amadeus Basin.

3) The Gosses Bluff crypto-explosion structure lies on the same broad structural zone and is probably a function of the same tectonic processes which produced the Illamurta Structure and other similar structures.

4) The structural zone which crosses the Amadeus Basin profoundly affected sedimentation at times.

5) The structural zone crossing the Amadeus Basin can be extended across the Australian continent. It is given the name of the Fitzroy-Spencers Gulf Fracture Zone.

6) The Fitzroy-Spencers Gulf Fracture Zone is characterized by negative bouguer anomalies in many areas. Dispiric structures, crypto-volcanic (and crypto-explosion) structures and volcanic plugs (diatremes) are also a feature of it.

7) The Fitzroy-Spencers Gulf Fracture Zone may be compared with the Rhine Graben in extent, in structural style, and in the presence of diapirs and volcanic plugs.

ACKNOWLEDGEMENTS

The writer wishes to thank Dr.G.Neumann of the Geophysical Branch for his assistance in the geophysical matters discussed in this report and for his advice on many aspects of the work. His help is greatly appreciated. Dr.M.Rickard of the Australian National University kindly read this paper and offered many helpful suggestions.

REFERENCES

COATES, R., 1965 Diapirism in the Adelaide Geosyncline. Jour.Aust.Pet.Explor.Assoc.p.98-102

COOK, P.J., 1967 The Larapinta Group In Wells, A.T., Forman, D.J., Ranford, L.C., and Cook., P.J. The Geology of the Amadeus Basin. Bur.Min.Resour.Aust.Bull. (in prep.).

CROOK, K.A.W., & COOK, P.J., 1966 Gosses Bluff. Diapir or astrobleme. Jour.Geol.Soc.Aust. (in prep.)

CUMMINGS, W.A., & SHACKLETON, R.M., 1955 The Ben Liu Recumbent Syncline (S.W. Highlands) Geol.Mag., v.92, No.5 p.353-363

de SITTER., L.U., 1956 Structural Geology. McGraw Hill, London 552 pp.

FAIRBRIDGE, R.W., 1950 Problems of Australian geotectonics. Scope (Jour.Sci.Union.Uni.West.Aust.) v.1., No.5.

FORMAN, D.J., 1966 The geology of the south-western margin of the Amadeus Basin, central Australia. Bur.Min.Resour.Aust.Rep.87 (in press)

FORMAN, D.J., MILLIGAN, E.N., & McCARTHY, W.R., 1966 Regional geology and structure of the north-eastern margin of the Amadeus Basin, Northern Territory. Bur.Min.Resour.Aust.Rep. (in press)

GUPPY, D.J., LINDNER, A.W., RATTIGAN, J.H., & CASEY, J.N., 1958 The geology of the Fitzroy Basin, Western Australia. Bur.Min.Resour.Aust.Bull.36, 116 pp.

HARTMAN, R.R., 1963 Interpretation report of airborne magnetometer survey over Oil Permit No.72 and portion of Oil Permit No.78 (Amadeus Trough, N.T.) Report forExoil by Aeroservice (unpubl.)

LONSDALE, G., & FLAVELLE, A. Amadeus Basin and South Canning Basin - Results of reconnaissance gravity survey using helicopters, N.T. and W.A. (Bur.Min. Resour.Aust.Geophys.Prog.Rep.1963064 (unpubl.)

McNAUGHTON, D.A., QUINLAN, T., HOPKINS, R.M., & WELLS, A.T., 1966 Diapiric Structures in the Amadeus Basin Geol.Soc. Amer.Spec.Publ. (in press)

PRICHARD, E., & QUINLAN, T., 1962 The geology of the southern half of the Hermannsberg 1:250,000 sheet. Bur.Min. Resour.Aust.Rep.,61

PRIDER, R.J., 1960 The leucite lamproites of the Fitzroy Basin, Western Australia. Jour.Geol.Soc.Aust., v.6, No.2, p.71-118

RANFORD, L.C., 1967 The Pertaoorrta Group In Wells, A.T., Forman, D.J., Ranford, L.C., and Cook, P.J. The Geology of the Amadeus Basin. Bur.Min. Resour.Aust.Bull. (in prep.)

RANFORD, L.C., COOK, P.J., and WELLS, A.T., 1966 The geology of the central part of the Amadeus Basin, Northern Territory. Bur.Min.Resour.Aust.Rep.86

RIVEREAU, J.C., 1965 Report on photo-interpretation of the Ngalia Basin, Northern Territory. Bur.Min.Resour. Aust.Rec.1965/255 (unpubl.)

VAN DER FLIERT, J.E., 1953 Tectonique d'ecoulement et Trias diapir au Chettaaba sud-ouest de Constantine (Algerie) 19e. Cong.Geol.Internat.Compte rendue v.3, No.3, p.63-80

WEBB, B.P., 1961 The geological structure of the Blinman Dome. Trans.Roy.Soc.S.Aust.v.85, p.1-6

WELLS, A.T., RANFORD, L.C., STEWART, A.J., COOK, P.J., AND SHAW, R.D., 1966 The geology of the north-eastern part of the Amadeus Basin, Northern Territory. Bur.Min.Resour.Aust.Rep. (in press)

YOUNG, G.A., & SHELLEY, E.P., 1966 Amadeus Basin Airborne magnetic and radiometric survey N.T. 1965 Bur.Min. Resour.Aust. Rec.1966/ (unpubl.)