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PRELIMINARY RESULTS OF GEOLOGICAL MAPPING IN THE OFFICER BASIN, WESTERN AUSTRALIA, 1971

by

D.C. Lowry[x], M.J. Jackson*, W.J.E. van de Graaff[+] and P.J. Kennewell*

* Bureau of Mineral Resources, Geology and Geophysics

[+] Geological Survey of Western Australia

[x] Geological Survey of Western Australia, presently with West Australian Petroleum Pty Ltd

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SUMMARY

This report describes the results of the joint Geological Survey of Western Australia - Bureau of Mineral Resources 1971 Officer Basin mapping project. The Officer Basin, which extends from South Australia into Western Australia, contains a poorly known sedimentary sequence of Proterozoic and Phanerozoic age. The following boundaries have been provisionally adopted for the Western Australian part of the basin:

1. The Warri Gravity Ridge in the north,
2. The base of the Townsend Quartzite in the northeast,
3. The northern limit of the Tertiary deposits of the Eucla Basin in the south, and
4. The extent of the Permian fluvio-glacial deposits in the west and southwest.

The following new stratigraphic names are defined: Lefroy Beds, Lupton Beds, Clutterbuck Beds (Proterozoic), Babbagoola Beds, Browne Beds (Proterozoic or Palaeozoic), Wanna Beds (Palaeozoic), Samuel Formation (Cretaceous), Lampe Beds (Cretaceous to Cainozoic) and Plumridge Beds (Cainozoic). The Townsend Quartzite is redefined to exclude the Lefroy Beds (old name: Brown Range Siltstone). Babbagoola Beds and Browne Beds are names amended from previous unpublished usage, and Bejah Claystone is an amendment of Bejah Beds. The name Paterson Formation is used in preference to Wilkinson Range Beds or Yowalga Sandstone, names that were previously used for the Permian glacial and fluvioglacial deposits in the Officer Basin.

Permian and Cretaceous deposits have been traced from the Canning Basin southwards into the Officer Basin. Permian fluvioglacial and lacustrine deposits were mapped over most of the basin. Fossiliferous marine Cretaceous strata are confined to the northern part of the Officer Basin (north of 27° 45'S), and unfossiliferous siliciclastics and tholeiitic basalt of probable Lower Palaeozoic age crop out near the South Australian border.

INTRODUCTION

The Western Australian part of the Officer Basin underlies much of the area known as the Gibson and Great Victoria Deserts (Plate 1). It has an area of about 240000 km^2 and is the last major sedimentary basin in Western Australia containing Phanerozoic rocks to be systematically geologically mapped.

The Gibson Desert was mapped by Wells (1963), but only a few geological traverses were made over the remainder before 1970 (Talbot & Clarke, 1917; Forman, 1933; Utting, 1955; Leslie, 1961; Daniels, 1969). The Hunt Oil-Placid Oil Company made aeromagnetic, photogeological, gravity, and seismic surveys over part of the basin, culminating in stratigraphic drilling in 1966. However, little attention was paid to surface exposures and little information was collected on the distribution of marine Cretaceous rocks in the north (Wells, 1963), fluvial and glacial Permian deposits in the south (Talbot & Clarke, 1917), and Lower Palaeozoic sequences near the South Australian border.

A geological reconnaissance by the Bureau of Mineral Resources and Geological Survey of Western Australia in 1970 resulted in a preliminary re-appraisal of the geology of the basin (M.J. Jackson, 1971; Lowry, 1971). This was followed by systematic mapping by helicopter in 1971, the results of which will be recorded on eighteen 1:250,000 geological maps and accompanying notes and in a bulletin synthesizing the geology of the basin. The aims of this record are to systematize the stratigraphic nomenclature and to make available rapidly the main results of the 1971 mapping. Rock unit names which do not conform to the principles set out in the Australian Code of Stratigraphic Nomenclature (Geol. Soc. Aust., 1964) have been used in previous literature on the basin. To avoid confusion and to systematize the stratigraphy of the basin all the rock names used have been examined and modified where necessary to bring them into accord with the code. The intention of this report is to supplement, amend, and comment on the existing literature (see M.J. Jackson, 1971) not to summarize it. Owing mainly to lack of exposure the geology of the area is still poorly known and there is every likelihood that some terms will need further revision at a later date.

BASIN DEFINITION

The name Officer Basin has been used in Western Australia for the geological unit situated between the Bangemall Basin, the Yilgarn Block, the Eucla Basin, the Musgrave Block, and the Canning Basin. This basin contains a Proterozoic and Phanerozoic sequence and is the extension of the Officer Basin in South Australia, where the name Officer Basin originated (BMR, 1960, p.39). Geophysical evidence indicates that a sedimentary sequence up to 5500 m thick is present in parts of the area (P. Jackson, 1966b; Turpie, 1967). Owing to the flat-lying attitude of the surface strata, exposures give little information on the nature of this thick sedimentary sequence.

Ideally, a sedimentary basin, that is, an area characterized by long continued subsidence and more or less concommitant sedimentation, should be defined in genetically meaningful terms. That is, the boundaries chosen should preferably be of structural and/or palaeogeographic significance. In the present state of knowledge it is impossible to give more than a provisional definition of the Officer Basin.

The limits of the Officer Basin (W.A.) as described here are the Warri Gravity Ridge in the north, the extent of the continuously preserved Permian in the west and southwest, the Tertiary cover of the Eucla Basin in the south, and the outcrop of the base of the Townsend Quartzite in the northeast. The first three of these limits were used by Playford & Cope (1970, Fig 3) and the fourth is in accordance with South Australian usage (Johnson, 1963; Parkin, 1969). Two of these boundaries, the extent of the Permian deposits and the extent of the Tertiary cover of the Eucla Basin, are merely convenient limits. The Warri Gravity Ridge probably corresponds with a basement high, and is a convenient boundary with the Canning Basin. The base of the Townsend Quartzite is chosen as a boundary as it is the first, major, well exposed, angular unconformity of regional significance beneath the Phanerozoic strata that crop out over much of the basin. Although in the overlying sequence some low-angle unconformities do occur, none of these seem to be of the same magnitude and extent as the one at the base of the Townsend Quartzite, which marks the beginning of a widespread although spasmodic depositional phase.

Two of these other unconformities underlie the Kulyong, Table Hill, and Officer Volcanics, and the Paterson Formation. Neither is adopted as the boundary of the Officer Basin in the eastern part of the surveyed area, because it would not conform to South Australian usage, where the Officer Basin was first named and described.

The subsurface extent of the Townsend Quartzite and the overlying Proterozoic units is unknown. Also unknown is the relationship of the Proterozoic sequence in the Musgrave Block to the Babbagoola Beds and Browne Beds intersected by Hunt Oil-Placid Oil wells Yowalga No. 2 and Browne Nos. 1 & 2; and to the southeasterly striking, evaporite-bearing clastic and carbonate sequences on the western edge of the basin (Trainor, Stanley, and Kingston Sheets). Mack & Herrmann (1965) estimated the sequence on the western side of the basin, which is probably equivalent to the Bangemall Group, to be 9000 m thick. Owing to this lack of stratigraphic information two interpretations of the subsurface structure of the basin, along a line running from Warburton Mission to Cosmo Newberry Mission, are shown in Plate 2. In Plate 2B the Townsend Quartzite and overlying units are interpreted as being considerably younger than the Proterozoic on the western side of the basin; in Plate 2C the Townsend Quartzite and overlying units are interpreted as approximate time equivalents of the Proterozoic on the western side of the basin. Accurate dating of the Proterozoic units is required before the structure of the basin can be more fully understood.

STRATIGRAPHY

TOWNSEND QUARTZITE

The Townsend Quartzite has been mapped on the Talbot and Cooper 1:250,000 sheets (Daniels, 1971a,b) and a section near Lilian Gorge has been described by Farbridge (see Daniels, 1971a). A lower unit, 85 m thick, of thin to thick-bedded, flaggy, feldspathic, micaceous sandstone with sparse pebble beds and shale-flake horizons is overlain by a unit of coarse to very coarse-grained, thick to very thick-bedded sandstone, 170 m thick, with large-scale cross-bedding and cobble and pebble horizons.

Daniels' mapping shows the Townsend Quartzite to be unconformable on older formations along the southern side of the Musgrave Block. He describes the quartzite as conformable on the Mission Group near Warburton but lying with angular unconformity on that group farther east. At longitude 127°30'E it is unconformable on the Tollu Group and other units underlying the Mission Group and farther east at the South Australian border, it rests nonconformably on gneiss that forms part of the Musgrave Block.

In the Barrow Range region the strike and dip of the Townsend Quartzite and underlying Mission group are similar and Daniels suggests that they are conformable. The upper part of the Mission Group also contains lenses of quartzite which resemble the Townsend Quartzite and Daniels includes the Townsend Quartzite with the Mission Group in the Bentley Supergroup to emphasize its possible relationship to other older groups and formations of the region.

The South Australian equivalent of the Townsend Quartzite is probably the Pindyin Sandstone on the Birksgate Sheet (Major, 1968). The Pindyin Sandstone commonly has a basal quartz-pebble conglomerate that rests nonconformably on granite and gneiss of the Musgrave Block.

The base of the Townsend Quartzite/Pindyin Sandstone is a widespread, angular unconformity of regional significance, except near Warburton Mission where Daniels interprets it as conformable on older rocks; it appears to mark the beginning of a widespread depositional phase, and we therefore tentatively use it as the basal unit of the Officer Basin along the southern margin of the Musgrave Block. The Townsend Quartzite appears to be significantly younger than the 1060 ± 140 million year old Tollu Group.

LEFROY BEDS

Proposed Name: Lefroy Beds.

Status of Name: New name.

Derivation of name: Point Lefroy, Lat. 26°16'S, Long. 126°44'E, Talbot 1:250000 Sheet SG/52-9.

Discussion: The Lefroy Formation has previously been referred to informally as the 'Brown Range Siltstone' (Daniels, 1971a). Because of lack of information on its regional character and significance Daniels included it with the Townsend Quartzite.

Lithology: Siltstone, grading to very fine-grained sandstone, laminated to thinly bedded, weathers white to purple.

Distribution: The Lefroy Beds are poorly exposed in a southeasterly trending belt to the southwest of the Brown Range and Townsend Ridges on the Talbot Sheet (Plate 1); their easterly extent is unknown.

Type Section: Near Ainslie Gorge, Lat. 26°14'S, Long. 126°38'E, Talbot 1:250000 Sheet SG/52-9.

Stratigraphic Relationships: Conformable between the Townsend Quartzite and the Lupton Beds; unconformably overlain by the Paterson Formation.

Diagnostic Features: Mainly siltstone.

Environment of Deposition: Probably quiet water shallow marine.

Thickness: Difficult to determine owing to poor exposure, but probably at least 200 m at Ainslie Gorge (Daniels, 1969b).

Fossils: None recorded.

Age: Late Proterozoic to Ordovician, probably Adelaidean.

LUPTON BEDS

Proposed Name: Lupton Beds

Status of Name: New name

Derivation of Name: Lupton Hills, Lat. 26°32'S, Long. 128°03'E, Cooper 1:250000 Sheet SG/52-10.

Discussion: Referred to as 'Upper Proterozoic Glacial Deposits' by Daniels (1971a).

Lithology: Two units are recognized in the Lupton Beds at Lupton Hills. An upper sequence, 65 m exposed, of medium to fine-grained, well sorted, medium to thick-bedded quartz arenite with interbeds of siltstone and conglomerate overlies, with an erosional contact, a lower sequence, approximately 176 m exposed, of unbedded, very poorly sorted, pebble to boulder conglomerate with a siltstone to fine-grained sandstone matrix. The conglomerate clasts are mainly quartzite and various volcanic rocks, and the deposit is interpreted as a tillite.

Distribution: In a poorly exposed belt extending from near Warburton Mission in the West to Lupton Hills in the East (Plate 1).

Type Section: At Lupton Hills, Lat. 26°31'S, Long. 128°01'E. Cooper 1:250000 Sheet SG/52-10 (see Appendix 1, fig 1, for detailed description).

Stratigraphic Relationships: The regional distribution of the beds and sparse dip readings suggest that they conformably overly the Lefroy Beds (cf. Daniels, 1971a p. 14 - who interprets this contact as a disconformity) and are overlain with angular unconformity by the Table Hill Volcanics and Paterson Formation.

Diagnostic Features: Conglomerate - high proportion of quartzite and volcanic rock clasts up to 80 cm across, fine-grained matrix, lack of bedding. Sandstone - red-brown weathering, well lithified, medium and thick beds exhibit decimetre-scale cross-stratification or internal parallel lamination.

Environment of Deposition: Glacial followed by fluvioglacial and/or littoral.

Thickness: Undetermined, but at least 240 m is exposed at the type section. The regional distribution and several steep dip measurements suggest the sequence may be considerably thicker.

Fossils: None recorded.

Age: Late Proterozoic to Ordovician?, most probably Adelaidean.

CLUTTERBUCK BEDS

Proposed Name: Clutterbuck Beds.

Status of Name: New name.

Derivation of Name: Clutterbuck Hills, Lat. 24°35'S, Long. 126°15'E, Cobb 1:250000 Sheet SG/52-1. Leslie (1961), Wells (1963), and Brown, Campbell, & Crook (1968) use the name Iragana Hills for this range, but we adopt the name Clutterbuck, which appears on the Cobb 1:250000 topographic map sheet; Iragana does not appear on the map.

Discussion: The Clutterbuck Beds occur northeast of the Warri Gravity Ridge and are, therefore, outside the Officer Basin as defined in this report; they are likely to be related to the late Proterozoic of the Amadeus Basin rather than that of the Officer Basin. Wells (1963) records lithological similarities between them and sediments in the Amadeus Basin.

Lithology: Red-brown and purple-brown, fine to coarse-grained, well-sorted, medium to thick-bedded, feldspathic arenites with thin interbeds of laminated siltstone or very fine-grained sandstone. Low-angle cross-stratification in sets less than 1 m thick and beds with clay-clast impressions are common in the lower part of the sequence. Scattered well-rounded quartzite pebbles, quartzite and quartz pebble-beds, less than 1 m thick, and festoon cross-stratification, in sets up to 10 m thick, are common in the upper 1 000 m.

Distribution: Throughout the Clutterbuck Hills.

Type Section: Clutterbuck Hills, Lat. 24°35'S, Long. 126°15'E; Cobb 1:250000 Sheet SG/52-1 (see Appendix 1, fig 2, for description).

Stratigraphic Relationships: The Clutterbuck Beds are exposed in a steeply dipping, partly fault-bounded inlier, which is surrounded by Mesozoic and later superficial deposits. The upper and lower contacts of the sequence are not exposed so the stratigraphic relationship to other units is uncertain. However, Wells (1963) notes lithological similarity to the Carnegie Formation, Maurice Formation, and Ellis Sandstone of the Amadeus Basin (all probably Adelaidean in age).

Diagnostic Features: Thick sandstone sequence with uniform lithology.

Environment of Deposition: Shallow marine.

Thickness: 4 260 m at the type section.

Fossils: None recorded.

Age: Probably late Proterozoic.

BABBAGOOLA BEDS

Proposed Name: Babbagoola Beds

Status of Name: The name 'Babbagoola Formation' was published by Peers & Trendall (1968) and Peers (1969) without adequate definition. We propose to introduce and define the more informal term Babbagoola Beds.

Derivation of Name: Babbagoola Rock Hole, Talbot 1:250000 Sheet, SG/52-9, Lat. 26°26'S, Long. 126°11'E.

Discussion: The name Babbagoola Formation was first used by Jackson (1966a, p.13) in the well completion report of Hunt Oil-Placid Oil well Yowalga No. 2, and was reserved with the Central Register of Australian Stratigraphic Names in Canberra on 8 December 1966. The name was published by Peers in 1968 and 1969, but Article 28 of the Australian Code of Stratigraphic Nomenclature, Fourth Edition, 1964, states 'It is desirable that formal names should not be given to formations on the basis of identification in one borehole'; therefore we propose that the more informal name Babbagoola Beds be used.

Lithology: Jackson (1966b) recognizes three separate units within the Babbagoola Beds, in Yowalga No. 2.

Unit 'A' - 846 to 887 m: Interbedded sandstone - hard, buff to dark brown, fine to very coarse-grained, poorly sorted, subrounded to well rounded, pebbly, micaceous, silty, and argillaceous, with scattered lithic fragments, and shale - moderately hard, dark red-brown, slightly fissile, micaceous. The entire unit contains fracture fillings and thin veins of light brown to flesh coloured crystalline to powdery anhydrite and gypsum.

Unit 'B' - 887 to 893 m: dolomite - very hard, dark grey to brown, silicified and anhydritic, very fine-grained to cryptocrystalline. Dark fine banding in places and some microbrecciation in upper part. Gypsum and anhydrite fracture fillings and veins present.

Unit 'C' - 893 to 989 m: Interbedded shale - moderately soft to firm, light grey-green and maroon in upper part grading to dark grey, micaceous and silty, fissile, and siltstone - soft to firm, light grey to white, micaceous and slightly sandy.

Distribution: The only known occurrence of the Babbagoola Beds is in Yowalga No. 2 between 846 and 989 m (T.D.).

Type Section: Hunt Oil-Placid Oil well Yowalga No. 2, 846-989 m (see Appendix I, fig 3, for detailed description).

Stratigraphic Relationships: In Yowalga No. 2 the Babbagoola Beds lie with angular unconformity below the Officer Volcanics. This was confirmed by dipmeter results from the borehole and by seismic profiles near the well site. The base of the formation is not known.

The Babbagoola Beds are lithologically similar to the Proterozoic evaporite-bearing deposits described by Mack & Herrmann (1965) from the western edge of the basin, and to the Silurian? carbonate-shale sequences of the southern Canning Basin. However, without reliable datings no correlations can be established.

<u>Environment of Deposition</u>: Glover (<u>in</u> Jackson, 1966a, Appendix I) suggests an oxidizing, evaporite environment of deposition from the examination of cores taken from the three units.

<u>Thickness</u>: Yowalga No. 2 penetrated 143 m, but seismic evidence shows no major break in the section below the Officer Volcanics, so the Babbagoola Beds may be considerably thicker.

<u>Fossils</u>: Primitive microfossils (leiospheres) were recovered from cores taken in units 'B' and 'C'. Balme (<u>in</u> Jackson, 1966a, Appendix II) infers similarity to Sinian (Proterozoic to Early Cambrian) forms from the U.S.S.R.

<u>Age</u>: Probably Adelaidean

<u>BROWNE BEDS</u>

<u>Proposed Name</u>: Browne Beds

<u>Status of Name</u>: New name

<u>Derivation of Name</u>: From Hunt Oil-Placid Oil Browne No. 1 stratigraphic well

<u>Discussion</u>: The name 'Browne Evaporites' was used by P.R. Jackson (1966b, p.37), and reserved by him with the Central Register of Australian Stratigraphic Names in Canberra, to describe a sequence of lutites and evaporites intersected by Hunt Oil-Placid Oil stratigraphic wells Browne No. 1 and No. 2. The 'Browne Evaporites' have not been recognized on the surface and the age, thickness, and stratigraphic relationships are unknown; so the more informal term Browne Beds is preferred.

<u>Lithology</u>: P.R. Jackson (1966b, p.37) describes the Browne Beds as follows: 'interbedded dolomitic limestones, calcareous shale, anhydrite and salt. The limestones are light grey to brown, hard, fine-grained with poor to well-developed vuggy and fracture porosity. Abundant clear to pink calcite and dolomite in the vugs and fractures suggests partial secondary crystallization. The shales are soft to firm, waxy to earthy, and contain occasional anhydrite inclusions. The anhydrite, gypsum and salt occur as thin beds or as secondary fracture fillings. It is hard to soft, white to pink, and opaque to translucent'.

<u>Distribution</u>: The rock unit has been identified only in two drill holes, Hunt Oil-Placid Oil Browne Nos 1 and 2, which are on the Browne 1:250000 Sheet SG/51-8 at Lat. 25°51'15"S, Long. 125°48'58"E and Lat. 25°56'00"S, Long. 125°57'45"E respectively. The unit is not known to crop out, but evaporites have been mapped at the surface in the Woolnough Hills and Madley diapirs.

<u>Type Section</u>: Hunt Oil-Placid Oil well Browne No. 1 133-387 m

<u>Stratigraphic Relationships</u>: The stratigraphic position of the Browne Beds in the Officer Basin sequence is unknown since Browne Nos 1 & 2 were drilled on structures of diapiric origin and the evaporites have most probably been displaced vertically from their original position. In both wells the Browne Beds are unconformably overlain by the Paterson Formation.

Diagnostic features: Contains evaporites

Environment of Deposition: Evaporitic

Thickness: The base of the sequence has not been penetrated and the maximum known thickness is 251 m.

Fossils: None recorded.

Age: Probably Adelaidean

TABLE HILL VOLCANICS

The name Table Hill Volcanics was first published by Peers (1969) to describe a sequence of fine-grained massive and vesicular basalts cropping out at Table Hill (Talbot Sheet SG/52-9, Lat. 26°28'S, Long. 126°53'E). Daniels (1969b, p.18) describes the Table Hill lavas as reddish, maroon, and blue-green tholeiitic basalts unconformably overlying Upper Proterozoic glacial deposits and unconformably overlain by Permian beds.

We examined a section at Table Hill and measured 26 m of finely crystalline, greyish-green to dark grey basalt with approximately 2 m of poorly exposed, very fine-grained to medium-grained, micaceous sandstone in the middle of the sequence. The basalt was overlain unconformably by 4 to 5 m of highly ferruginized conglomeratic sandstone of the Paterson Formation. A detailed petrography of the basalts and a discussion of their age is given by Peers (1969).

The Table Hill Volcanics are regarded as equivalent to the Officer Volcanics and Kulyong Volcanics (see below).

OFFICER VOLCANICS

Proposed Name: Officer Volcanics

Status of Name: Name published by Peers & Trendall (1968) without adequate description. We proposed to formalize and validate the name.

Derivation of Name: Name derived from Officer Basin

Discussion: The name Officer Volcanics was first used by P.R. Jackson (1966a, p.13) in the well completion report of Hunt Oil-Placid Oil well Yowalga No. 2. The choice of the term 'Officer' was unfortunate, as the nearest geographic feature with this name is the Officer River (Woodroffe 1:250000 Sheet, SG/52-12 S.A.) about 600 km east of the drillhole, but as Peers & Trendall have published the name Officer Volcanics it is thought that confusion will be avoided by continuing with this name rather than introducing a new name. It is considered a mappable formation as it has been intersected in two widely spaced drillholes and traced by seismic methods throughout a considerable area of the Officer Basin.

Lithology: P.R. Jackson (1966b) describes the section in Yowalga No. 2 as: 'basalt-altered to fresh, hard to very hard, dark greenish grey to purple and brown, amygdaloidal with fillings of zeolites, chlorite, and iron minerals. Pyroxene and feldspar phenocrysts abundant, aphanitic dark groundmass, fracturing is common with well developed chlorite infillings. The section grades from a fine-grained dense basalt at the base to an amygdaloidal basalt at the top'. Peers (1969) provides detailed petrographic descriptions of seven samples taken from cores from Yowalga No. 2 and classifies them as tholeiitic basalts.

Distribution: Hunt Oil-Placid Oil Yowalga No. 2, depths 728 - 848 m; Hunt Oil-Placid Oil Lennis No. 1, depths 612-615 m (T.D.). The Officer Volcanics have been correlated with a subsurface high velocity layer which allows a reasonable estimate of their areal extent. The reflection believed to be the Officer Volcanics has been recognized at Lake Keene (Madley Sheet), along the Gunbarrel Highway (Browne Sheet), in the northeast of the Yowalga Sheet, in the western half of the Talbot Sheet and in the north and west of the Lennis Sheet. P.R. Jackson (1966b, p.35) concludes that the volcanics are present throughout most of the deeper part of the Basin. No definite surface correlations are as yet established, but the Kulyong Volcanics in South Australia, basalt at Table Hill, Herbert Wash, an unnamed locality on the Cooper Sheet, and an unnamed locality on the Waigen Sheet are regarded as being surface equivalents of the Officer Volcanics.

Type Section: Hunt Oil-Placid Oil well Yowalga No. 2 (Yowalga Sheet SG/51-12, lat. 26°10'12"S, long. 125°58'00"E). A detailed description of the type section is contained in Appendix I (Fig 3).

Stratigraphic Relationships: The Officer Volcanics lie with angular unconformity on the Babbagoola Beds in Yowalga No. 2. In Yowalga No. 2 and Lennis No. 1 wells the Lennis Sandstone lies with erosional contact on the Officer Volcanics.

Diagnostic features: Tholeiitic composition of the basalt. Individual flows are apparently amygdaloidal and vesicular in upper part, finer grained and non-vesicular in lower part.

Environment of deposition: Terrestrial

Thickness: At the type section the basalt is 117 m thick.

Fossils: None.

Age: Proterozoic or Lower Palaeozoic. Isotopic dating of the Officer Volcanics gave ages of 1000 and 1143 m.y. and of 331, 357, 445, 446, and 447 m.y. (P.R. Jackson, 1966a). Samples of the Kulyong Volcanics have been dated as 475 and 485 m.y. old (Major & Teluk, 1967). The Table Hill Volcanics have not been dated. P.R. Jackson (1966b) interpreted the Officer Volcanics datings as indicating a Proterozoic age, and considered the younger ages as being due to subsequent metamorphism. Peers (1969), however, argued that the Proterozoic dates are based on the assumption of an unlikely initial Sr^{87}/Sr^{86} value, and concluded that the 445 m.y. date is the more reliable. This age is comparable to the datings of the Kulyong Volcanics and Peers (1969) therefore considers the Kulyong, Table Hill, and Officer Volcanics to be Ordovician.

This is in accord with the fact that at least at Table Hill and on the Kulyong Sheet these volcanic rocks overlie the Proterozoic Townsend Quartzite, Lefroy Beds, and Lupton Beds (Daniels, 1971a). Considering that these units unconformably overlie the Tollu Group, which has been dated as 1 060 ± 140 m.y. (Daniels, 1971a), it is unlikely that the 1000 and 1143 m.y. datings of the Officer Volcanics are correct.

Though there is strong evidence that the Kulyong, Table Hill, and Officer Volcanics are one stratigraphic unit, we prefer to await the results of additional isotopic dating on samples from several localities before proposing to discard two of the three names, and before adopting an age for the basalts.

LENNIS SANDSTONE

Proposed Name: Lennis Sandstone

Status of Name: Name published by Peers (1969) without adequate description. We propose to formalize and validate the name.

Derivation of Name: Lennis Hills (Lennis 1:250000 Sheet SG/52-13, Lat. 27°13'S, Long. 126°50'E).

Discussion: The name Lennis Sandstone was first used by Jackson (1966a, p.13) in the completion report of Hunt Oil-Placid Oil well Yowalga No. 2. Although the name was probably derived from the Sheet area on which the well was drilled, a geographic feature, the Lennis Hills (Lat. 27°13'S, Long. 126°50'E) lie only 47 km east-northeast of drillhole Lennis No. 1 which also intersected the unit. It is proposed that the name be regarded as derived from the hills. The unit is considered a mappable formation as it has been intersected in three drillholes and mapped on the Talbot, Cooper, Lennis, and Waigen 1:250000 Sheets.

Lithology: The dominant lithology is red and reddish brown, fine to medium-grained, subangular to subrounded, moderate to well-sorted, feldspathic, micaceous sandstone. Red, fine to very fine-grained, micaceous siltstone beds up to 3 m thick are interbedded with the sandstone at several localities. Bedding ranges from laminated and fissile to very thick parallel-bedded, but medium to thick-bedding is dominant. The medium to thick beds are commonly internally laminated or cross-laminated. Trough cross-stratification, in sets 20 cm to 1 m thick, indicate current directions from the southeast. Tabular red siltstone or shale intraclasts 1 to 2 cm across are common in the unit. Irregularly contorted beds of siltstone are present at outcrops in the northeast of the Lennis Sheet.

Distribution: Hunt Oil-Placid Oil Lennis No. 1, depth 187 to 612 m; Yowalga No. 1, depth 458 to 613 m (T.D.); and Yowalga No. 2, depth 407 to 729 m. The Lennis Sandstone crops out as isolated mesas and buttes in a discontinuous belt stretching from near Lake Kadgo (Talbot Sheet), southeasterly to Waigen Lakes (Waigen Sheet) and into South Australia (Plate 1).

Type Section: Hunt Oil-Placid Oil well Yowalga No. 2 (see Appendix 1, Fig 3, for detailed description).

Reference section: Unnamed exposures on Lennis Sheet SG/52-13 (Co-ords 552623). (See Appendix I, Fig 4 for detailed description).

Stratigraphic Relationships: The Lennis Sandstone unconformably overlies the Officer Volcanics in Yowalga No. 2 and Lennis No. 1 and disconformably overlies the Kulynong Volcanics on the Cooper 1:250000 sheet. It is unconformably overlain by Paterson Formation in these drillholes. Near Sulphur Knob on the Lennis sheet (Co-ords 537623) fluvial sandstone of the Paterson Formation unconformably overlies Lennis Sandstone.

Continental Oil Company's Birksgate No. 1 well (Lat. 27°56'20"S Long. 129°48'10"E) which was drilled 70 km east of the nearest mapped outcrop of Lennis Sandstone (Birksgate Sheet, co-ords: 195546) intersected red, micaceous, feldspathic very fine to medium-grained sandstone and red, micaceous, plastic shale between 159 and 501 m, unconformably overlying Upper Proterozoic sediments (Henderson & Tauer, 1967). We tentatively correlate the red sandstone and shale with the Lennis Sandstone. Major (1968 p.11) describes red sandstone and white sandstone on the western side of the Birksgate 1:250000 Sheet which are probably Lennis Sandstone and Wanna Beds respectively.

Diagnostic Features: The red colour, high mica and feldspar content, cross-stratification, red-brown siltstone and shale intraclasts, and irregularly contorted beds of siltstone are distinctive features.

Environment of Deposition: Neritic or non-marine.

Thickness: The Lennis Sandstone is 425 m thick in Lennis No. 1; 322 m thick in Yowalga No. 2; and 342 m thick in Birksgate No. 1. The maximum thickness measured in the field is 30 m.

Age: Unknown (younger than Officer Volcanics)

Fossils: None found

WANNA BEDS

Proposed Name: Wanna Beds

Status of Name: New name

Derivation of Name: From Wanna Lakes, Lat. 28°40'S, Long. 128°25'E, Wanna 1:250000 Sheet SH/52-2.

Lithology: White to pale green, fine to very fine-grained, well sorted, slightly micaceous quartz arenite. Thinly laminated to thick bedded, commonly cross-stratified with sets up to 7 m thick. White claystone clasts occur at the base of some of the cross-stratified units.

Distribution: In a southeasterly trending belt about 100 km wide extending from eastern Lennis across the Waigen, Wanna and northern Mason 1:250000 Sheets to the S.A. border (Pl. 1). The beds also crop out along Serpentine Lakes in the southwest corner of the Noorina Sheet (S.A.).

Type Section: Wanna Lakes Lat. 28°49'S, Long. 128°16'E; Wanna 1:250000 Sheet SH/52-2.

Stratigraphic Relationships: The regional distribution of the Wanna Beds (Pl. 1) suggests that they unconformably overlie the Lennis Sandstone. Coarse-grained detritus characteristic of the Paterson Formation has not been observed in the Wanna Beds although they were deposited in a high-energy shallow marine environment. Therefore, it is unlikely that the Wanna Beds are lateraly equivalent to the Paterson Formation and they are tentatively regarded as pre-Permian.

Diagnostic Features: The fine-grained well sorted texture, presence of white claystone intraclasts and large scale cross-stratification are the most characteristic features.

Environment of Deposition: Shallow marine (van de Graaff, 1972)

Thickness: Unknown, estimated to be in the order of tens of metres

Age: Unknown

PATERSON FORMATION

Glacial, fluvial, lacustrine and possibly marine deposits of Lower Permian age form extensive but discontinuous outcrops throughout the Officer Basin (WA). The name Paterson Formation was used for Lower Permian fluvioglacial deposits in the Canning Basin (Traves, Casey, & Wells, 1956). As the deposits in the Officer Basin are continuous with those in the southern Canning Basin and are lithologically similar the name Paterson Formation is preferred to either Wilkinson Range Series (Talbot & Clarke, 1917, p.105) or 'Yowalga Sandstone' (P.R. Jackson, 1966b, p.39). In most outcrops only a few metres of flat-lying beds are exposed, but Hunt Oil-Placid Oil wells Yowalga No. 1 and No. 2 penetrated 366 m and 312 m of Permian rocks respectively. Detailed descriptions of the Permian of the Officer Basin are given by Wells (1963) P.R. Jackson (1966), M.J. Jackson (1971), and Lowry (1971).

The Paterson Formation unconformably overlies Precambrian granite and gneisse, folded Proterozoic sediments, Table Hill Volcanics, Lennis Sandstone, and Browne Beds. It is overlain by the Cretaceous Samuel Formation, but the contact has not been observed.

In the northern part of the Gibson Desert Wells (1963) recognized undifferentiated Mesozoic sediments and Wilson (1964) distinguished Jurassic deposits. These rocks are unfossiliferous and lithologically indistinguishable from the Paterson Formation and have been included in the latter.

SAMUEL FORMATION

Proposed Name: Samuel Formation

Status of Name: New name

Derivation of Name: Mount Samuel, Gunbarrel Highway (Browne 1:250000 Sheet, SG/51-8, Lat. 25°46'S, Long. 125°56'E).

Discussion: The Samuel Formation corresponds in part to the 'Undifferentiated Cretaceous' of Wells (1963, p.24) and the 'Undifferentiated Lower Cretaceous' of Jackson (1966, p.44).

Lithology: Laminated to thin-bedded, fine to medium-grained sandstone, siltstone and claystone. Moderate to well sorted, moderate to well rounded, indistinctly cross-bedded in part. The fine and medium sandstones are grey to brown and commonly bioturbated. The siltstones and claystones are purple, red, green and brown, indistinctly laminated and contain discontinuous laminae of micaceous, fine-grained sandstone.

Distribution: The Samuel Formation crops out on the Madley, Warri, Cobb, Herbert, Browne, Bentley, Yowalga, Talbot, and Westwood 1:250000 sheets (Pl. 1).

Type Section: Mount Charles, Gunbarrel Highway, Bentley 1:250000 Sheet, Lat. 25°45'S Long. 126°11'E (see Appendix I, Fig 5 for detailed description).

Stratigraphic Relationship: The base of the formation is exposed at the Browne diapir (25°51'S, 125°48'E), where it disconformably overlies the Paterson Formation. The Samuel Formation is overlain by the Bejah Claystone apparently conformably.

Diagnostic features: The formation is mainly fine-grained and well sorted and more distinctly bedded than the Permian in the Officer Basin. It commonly crops out as lateritized or deeply weathered breakaways.

Thickness: 20 m at type section; seismic and drilling information indicates a thickness of about 300 m along much of the Gunbarrel Highway.

Age: Lower Cretaceous (Aptian).

Fossils: Pelecypods and gastropods of Aptian age (Skwarko, 1967).

BEJAH CLAYSTONE

Proposed Name: Bejah Claystone.

Status of Name: New name, replaces Bejah Beds (Veevers & Wells, 1961, p.166)

Derivation of Name: Bejah Hill (Runton 1:250000 Sheet SF/51-15, Lat. 23°45'S, Long. 124°10'E.

Discussion: The distribution, age, and stratigraphic relationships of the Bejah Beds are now more fully understood than when the name was first introduced, so modification of the name to Bejah Claystone is proposed.

Lithology: White claystone and shale with thin beds of medium to coarse-grained sandstone north of 25°S; white claystone with minor fine sandstone and siltstone south of 25°S.

Distribution: The Bejah Claystone crops out as isolated mesas or as discontinuous escarpments on the Runton, Morris, Ryan, Madley, Warri, Cobb, Herbert, Browne, Robert, and Bentley 1:250000 sheets (Pl. 1).

Type Section: Bejah Hill (Runton 1:250000 Sheet SF/51-5) in the Canning Basin (see Veevers & Wells, 1961 p.166 for description).

Reference Section: Unnamed locality (Browne 1:250000 Sheet SG/51-8), Lat. 25°28'S, Long. 125°06'E. (See Appendix 1, Fig. 6 for detailed description)

Stratigraphic Relationships: The Bejah Claystone conformably overlies the Samuel Formation, and disconformably overlies the Paterson Formation on the western side of the basin; it is overlain by the Lampe Beds except where the top is eroded.

Diagnostic Features: The white colour, fine to very fine grained, and indistinct bedding are most characteristic. The upper section of most exposures is silicified to a white, hard, splintery rock with a concloidal fracture (porcellanite). Where porcellanized the Bejah Claystone usually forms flat-topped mesas with near-vertical cliff faces, surrounded by steep scree slopes. A detailed description of the outcrop pattern of the Bejah Claystone is given by Veevers & Wells (1961).

Environment of Deposition: Very quite water shallow marine.

Thickness: No complete section has been measured, but 26 m is exposed at the reference section and Leslie (1961) reports 27 m of exposed Bejah Claystone at Mount Johnson (Herbert Sheet). The type section is 15 m thick.

Age: Lower Cretaceous (Aptian)

Fossils: Pelecypods and gastropods of Aptian age (Skwarko, 1967), and radiolarians.

LAMPE BEDS

Proposed Name: Lampe Beds.

Status of Name: New name.

Derivation of Name: From Mount Lampe, Lat. 25°16'S, Long. 124°27'E, Herbert 1:250000 Sheet SG/51-7.

Lithology: Coarse to very coarse-grained, very poorly sorted angular quartz sandstone grading to quartz pebble conglomerate. Bedding generally indistinct or absent but in places medium to thick. Usually highly silicified, hard and tough.

Distribution: Generally occurs as a capping on mesas and small rises. Widespread throughout the Gibson and Western Great Victoria Deserts. Prominent on the Madley, Warri, Herbert, and Browne 1:250000 Sheets.

Type Section: At Mount Johnson, Lat. 25°24'S, Long. 124°25'E, Herbert 1:250000 Sheet SG/51-7.

Stratigraphic Relationships: Unconformably overlies Bejah Claystone, Samuel Formation, Wanna Beds, and Lennis Sandstone; probably also unconformably overlies fluvial sandstone of the Paterson Formation and some Proterozoic sediments, but silicification of these rocks can produce a lithology indistinguishable from that of the Lampe Beds. The top of the Lampe Beds is everywhere an erosion surface.

Diagnostic Features: The coarseness, poor sorting, and angularity of the constituent grains, the lack of bedding, the silicification, and a poorly developed hexagonal jointing pattern are diagnostic features in outcrop. On air-photographs the Lampe Beds produce a medium-grey mottled photopattern along the crests of mesas of Cretaceous sediments in the Gibson Desert.

Environment of Deposition: Fluviatile.

Thickness: Maximum observed thickness 3 metres.

Age: Post-Aptian.

Fossils: None recorded.

PLUMRIDGE BEDS

Proposed Name: Plumridge Beds.

Status of Name: New name.

Derivation of Name: Plumridge Lakes, Lat. 29°30'S, Long. 125°15'E, Plumridge 1:250000 Sheet SH/51-8.

Lithology: Fine-grained sandstone, siltstone, and claystone, with some intercalations of poorly sorted conglomeratic sandstone.

Distribution: In a poorly defined band along the northern boundary of the Eucla Basin on the Mason, Jubilee and Plumridge Sheets.

Type Section: Unnamed outcrop at Lat. 29°43'S, Long. 125°4'E, Plumridge 1:250000 Sheet SH/51-8.

Stratigraphic Relationships: The distribution of the Plumridge Beds suggests that they disconformably to unconformably overlie the Wanna Beds and the Paterson Formation. A kankar soil overlies the Plumridge Beds. The Plumridge Beds are considered to be a lateral equivalent of the Colville Sandstone (Lowry, 1970).

Environment of Deposition: Fluviatile to paralic.

Thickness: Maximum observed thickness is 10 m. The unit is estimated to be a few tens of metres thick.

Age: Early Miocene (lateral equivalent to Colville Sandstone, which is early Miocene).

Fossils: None recorded.

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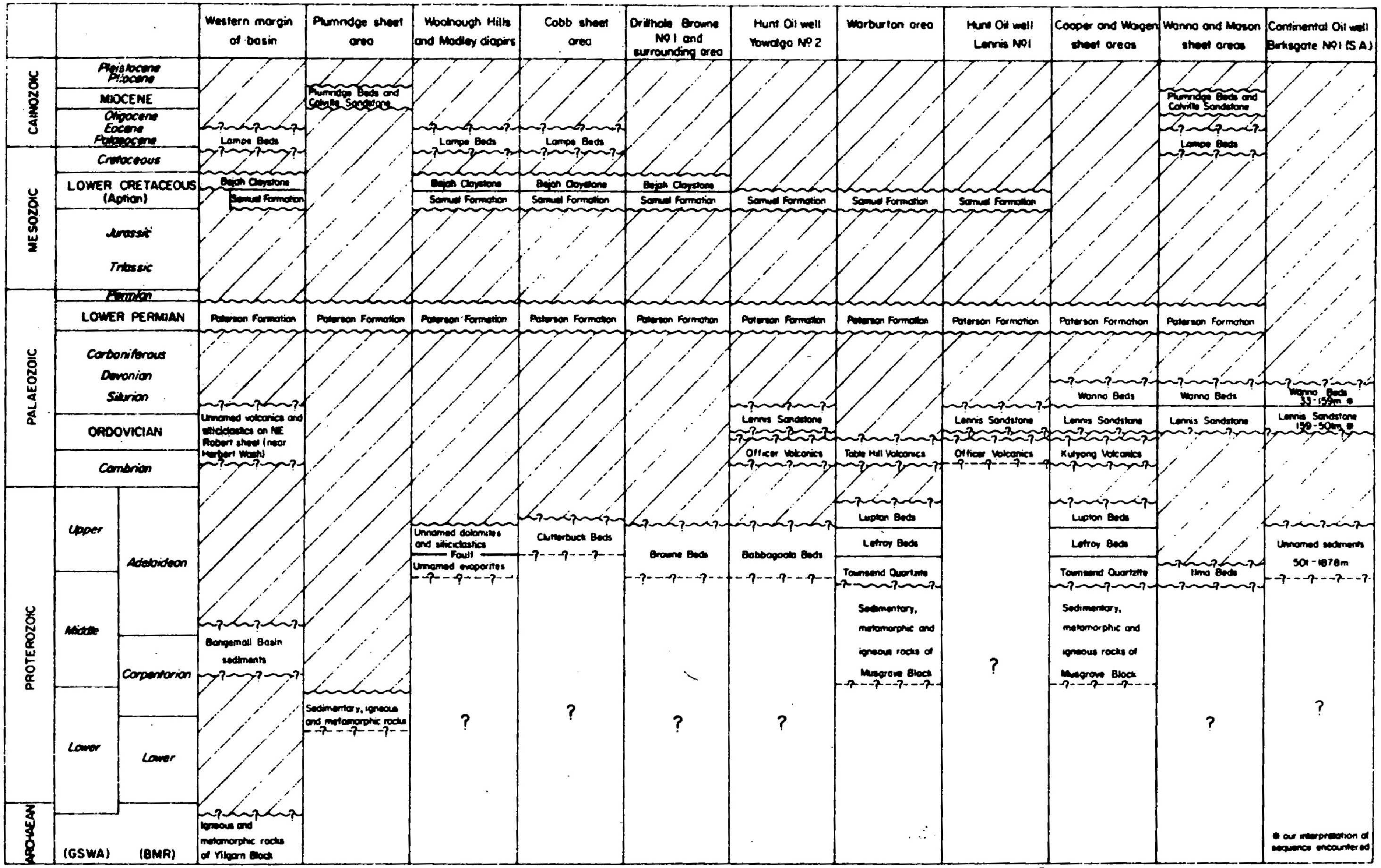
Table 1: Correlation diagram of stratigraphic units



Contact conformable
Contact unconformable to disconformable
-?~~?- Contact unconformable to disconformable, stratigraphic level uncertain
-?--?- Nature and stratigraphic level of contact uncertain
? Sequence unknown
Hiatus

To accompany Record 1972/66

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TABLE 2.

Results of Chemical Analyses of Selected Basalt Samples

For approximate location and formation names see Appendix 2

Sample No.	7188 0001	7188 0002	7188 0003	7188 0004	7188 0005	7188 0006	7188 0007	7188 0008	7188 0009	7188 0010	7188 0011	7188 0012	7188 0006
SiO_2	52.8%	52.7	52.6	53.0	53.0	52.8	53.1	54.3	53.9	53.9	55.7	54.8	49.3
Al_2O_3	13.8	13.7	13.6	13.0	13.1	13.1	13.2	14.5	14.4	14.5	14.2	14.2	16.1
Fe_2O_3	1.93	2.15	1.92	2.65	2.70	2.70	2.50	2.80	4.65	4.65	5.05	4.25	6.75
FeO	10.8	10.7	11.0	11.3	11.3	11.5	11.5	7.60	5.95	5.70	5.30	5.95	2.25
MgO	5.20	5.30	5.10	4.30	4.30	4.30	4.30	5.20	5.10	5.10	4.35	4.75	9.15
CaO	8.20	8.15	8.30	7.70	7.70	7.60	7.70	6.30	5.90	6.20	4.50	5.15	10.7
Na_2O	2.10	2.15	2.15	2.35	2.35	2.35	2.40	4.70	4.65	4.65	3.25	2.25	1.53
K_2O	1.31	1.40	1.35	1.61	1.59	1.61	1.56	1.35	1.69	1.69	4.00	5.35	0.54
H_2O+	1.03	0.83	1.07	0.91	0.85	0.80	0.71	1.59	1.43	1.73	1.23	1.22	0.99
H_2O-	0.17	0.31	0.13	0.41	0.43	0.46	0.41	0.45	0.73	0.61	0.67	0.60	1.73
TiO_2	1.91	1.95	1.96	2.10	2.10	2.10	2.10	0.95	0.99	0.99	0.97	0.94	0.64
MnO	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.17	0.18	0.16	0.18	0.17	0.12
P_2O_5	0.21	0.21	0.21	0.23	0.23	0.23	0.23	0.08	0.08	0.07	0.08	0.08	0.05
CO_2	0.05	0.07	0.13	0.06	0.05	0.07	0.05	0.05	0.13	0.09	0.09	0.06	0.07

Analyses by : R.J. Buckley

TABLE 3.

Results of X-ray Diffraction Analyses of Selected Samples

For lithology, approximate location, and formation name see Appendix 2

Sample No.	Mineralogy
71880003	Feldspar, diopside, quartz, kaolinite.
72880001	Opal $^{C-T}$
72880003	Kaolinite, quartz.
72880004	Quartz, kaolinite, mica.
72880005	Calcite, quartz, dolomite.
72880006	Quartz, kaolinite, calcite.
72880007	Dolomite, quartz, kaolinite.
72880008	Kaolinite, quartz, opal^{C-T}.
72880009	Calcite, quartz.
72880010	Calcite, quartz, kaolinite.
72880015	Quartz, hematite, anatase.
72880016	Quartz, kaolinite.
72880017	Quartz, anatase.
72880018	Quartz.
72880019	Quartz, goethite, kaolinite.
72880020	Quartz, goethite, kaolinite.
72880021	Quartz, lithiophorite, kaolinite.
72880022	Quartz, goethite, hematite, kaolinite.
72880023	Quartz, goethite, hematite.
72880024	Quartz, goethite, anatase.
72880025	Goethite, kaolinite, quartz.
72880026	Kaolinite, goethite, quartz.
72880027	Hematite, goethite, kaolinite.
72880028	Kaolinite, quartz, mica, hematite.
72880029	Quartz, goethite.
72880039	Quartz, mica, feldspar, hematite.
72880040	Feldspar (Sanidine?), hematite, montmorillonite.
72880043	Quartz, hematite.
72880045	Feldspar, quartz, diopside.
72880048	Quartz, feldspar, mica, kaolinite, diopside.
72880049	Quartz, goethite, kaolinite.
72880058	Opal^{C-T}, kaolinite, quartz.
72880059	Quartz, kaolinite, opal^{C-T}, mica.

Sample No.	Mineralogy
72880060	Quartz, opal^{C-T}, kaolinite, mica.
72880061	Opal $^{C-T}$, quartz, kaolinite.
72880062	Quartz, opal $^{C-T}$,
72880063	Opal $^{C-T}$, quartz.
72880064	Opal $^{C-T}$, kaolinite, quartz.
72880065	Opal $^{C-T}$, quartz, kaolinite.
72880066	Kaolinite, hematite, goethite.
72880073	Quartz, hematite, kaolinite.
72880074	Quartz, kaolinite.
72880075	Opal $^{C-T}$, quartz, kaolinite.
72880076	Opal $^{C-T}$, kaolinite, quartz, bementite.
72880078	Quartz, kaolinite, mica.
72880080	Opal $^{C-T}$, quartz, kaolinite.
72880082	Opal $^{C-T}$, quartz, kaolinite.
72880083	Opal $^{C-T}$, quartz, kaolinite.
72880084	Quartz, opal $^{C-T}$, kaolinite.
72880085	Opal $^{C-T}$, quartz, kaolinite, mica.
72880087	Kaolinite, quartz, halite, mica.
72880088	Kaolinite, quartz, mica.
72880089	Kaolinite, quartz, feldspar, mica.
72880094	Feldspar, quartz, magnetite, mica.
72880096	Quartz, dolomite.
72880099	Dolomite, quartz, calcite, feldspar, mica.
72880105	Goethite, quartz.
72880106	Dolomite, quartz.
72880110	Dolomite, quartz, calcite.
72880115	Quartz, kaolinite, mica.
72880116	Quartz, kaolinite, mica.
72880118	Quartz, kaolinite, mica, feldspar
72880119	Quartz, kaolinite, mica.
72880125	Quartz, feldspar, opal^{C-T}, mica, diopside.
72880128	Quartz, hematite, mica.
72880131	Calcite, quartz, garnet (almandine?), mica.
72880136	Quartz, kaolinite, mica, anatase.
72880148	Quartz, kaolinite, feldspar, mica, hematite.
72880153	Quartz, kaolinite, mica.
72880155	Quartz, kaolinite, mica.

Sample No.	Mineralogy
72880156	Quartz, kaolinite, mica.
72880157	Quartz, opal $^{C-T}$, kaolinite.
72880159	Quartz, kaolinite, mica.
72880160	Kaolinite, quartz, mica.
72880162	Quartz, feldspar, kaolinite, halite.
72880165	Quartz, kaolinite, mica.
72880168	Quartz, kaolinite, mica.
72880171	Quartz, kaolinite, halite, mica.
72880174	Goethite, quartz.
72880180	Quartz, opal $^{C-T}$, kaolinite, halite, mica.
72880184	Kaolinite, quartz, opal $^{C-T}$, mica.
72880185	Goethite, quartz.
72880189	Quartz, hematite.

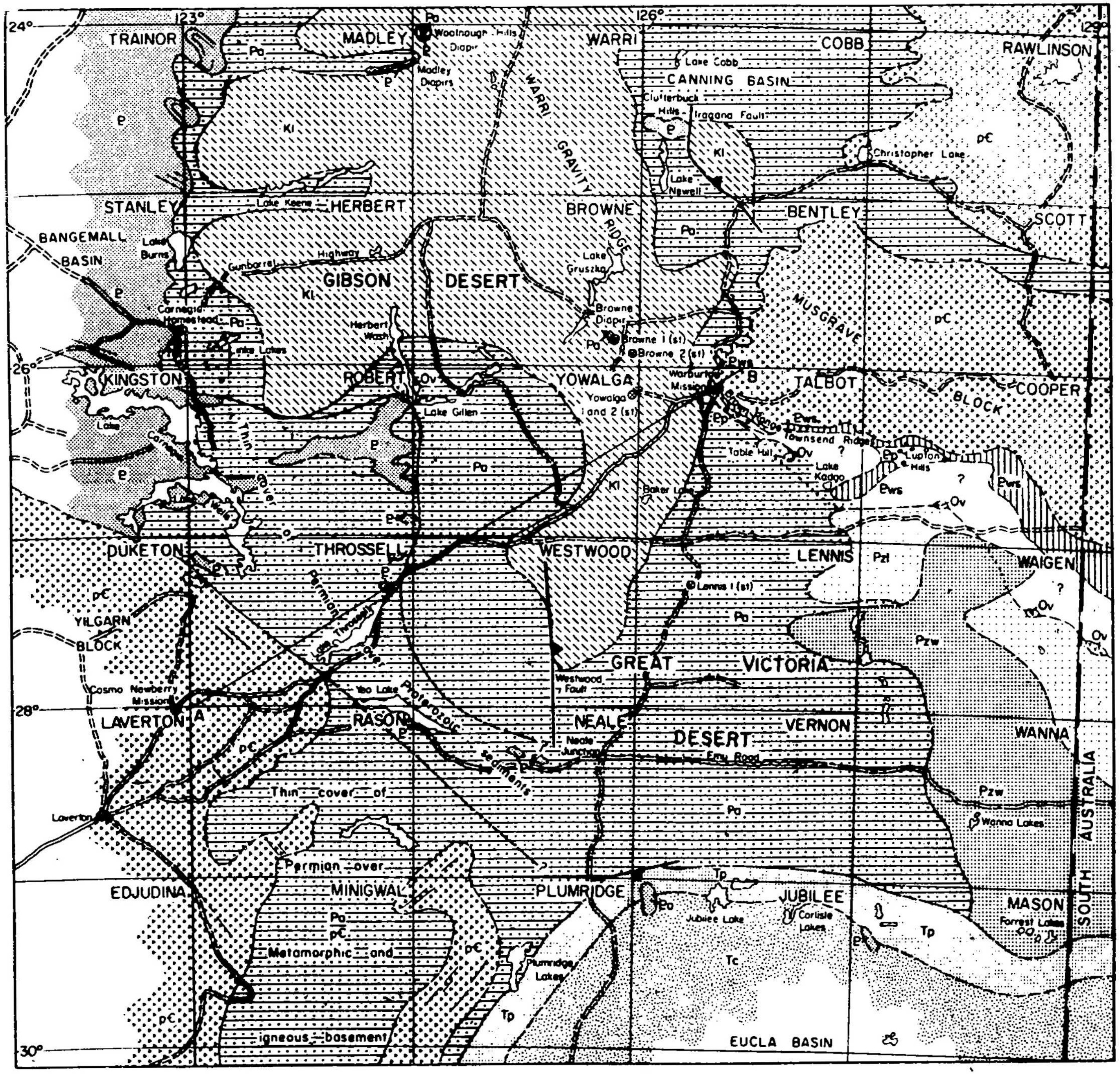
<u>Note</u>:

	Anatase	TiO_2	
	Bementite	$H_{10}Mn_8 \; Si_7 \; O_{27}$	
	Lithiophorite	$(Li, Al) \; MnO_2 \; (OH)_2$	
	Opal $^{C-T}$	$SiO_2 \; x \; H_2O$	(Jones & Segnit, 1971)

Analyses by G. Berryman

PLATE 1

PRELIMINARY SOLID GEOLOGY MAP OFFICER BASIN



Reference

CAINOZOIC	TERTIARY (Miocene)	Tp	Plumridge Beds
		Tc	Colville Sandstone
MESOZOIC	CRETACEOUS	Kl	Bejah Claystone and Samuel Formation
PALAEOZOIC	PERMIAN	Po	Paterson Formation
		Pzw	Wanna Beds
		Pzl	Lennis Sandstone
	ORDOVICIAN ?	Ov	Table Hill Volcanics and Kulyong Volcanics
PROTEROZOIC		P	Undivided
		Pp	Lupton Beds and Lefroy Beds
		Pws	Townsend Quartzite
		?	Geology uncertain
PRECAMBRIAN		p€	Undivided Igneous, Metamorphic and Sedimentary rocks

Geological boundary, position approximate

Inferred extent of Proterozoic rocks at shallow depth

Fault

Trend Line

⊗ (st) Drillhole (stratigraphic)

A—B Line of section

Graded road

Track

0 50 100 150 km

0 50 100 M

To accompany Record 1972/66

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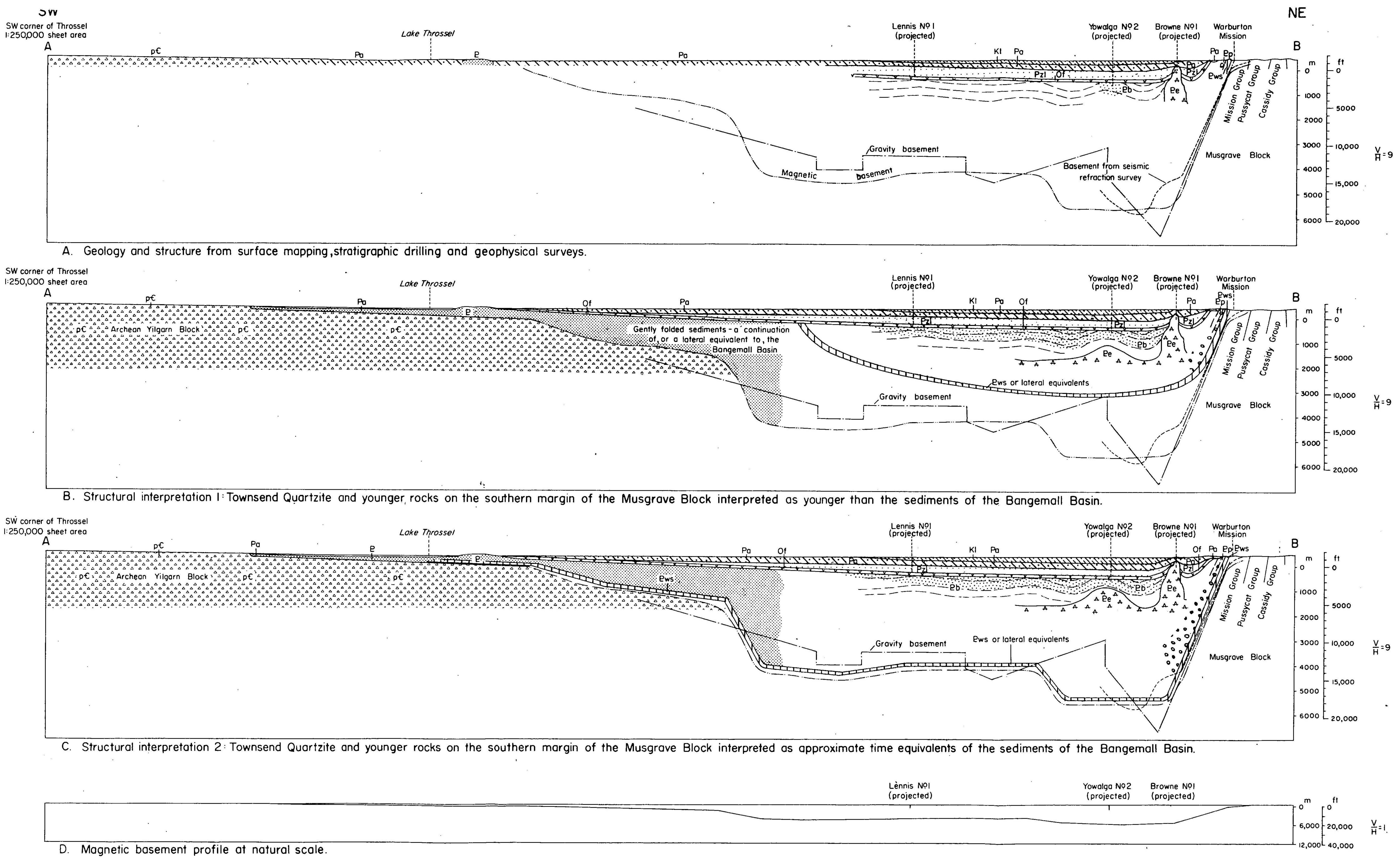
GEOLOGICAL CROSS-SECTION OF THE OFFICER BASIN, W.A.

The section line runs from near Warburton Mission to near Cosmo Newberry Mission (see Plate I.). Cainozoic deposits omitted



A. Geology and structure from surface mapping, stratigraphic drilling and geophysical surveys.

B. Structural interpretation 1: Townsend Quartzite and younger rocks on the southern margin of the Musgrave Block interpreted as younger than the sediments of the Bangemall Basin.

C. Structural interpretation 2: Townsend Quartzite and younger rocks on the southern margin of the Musgrave Block interpreted as approximate time equivalents of the sediments of the Bangemall Basin.

D. Magnetic basement profile at natural scale.

Reference

MESOZOIC — CRETACEOUS
- Kl — Bejah Claystone and Samuel Formation

PALAEOZOIC
- PERMIAN: Pa — Paterson Formation
- Pzl — Lennis Sandstone
- ORDOVICIAN ?: Of — Officer and Table Hill Volcanics

PROTEROZOIC
- P — Undivided
- Pb — Babbagoola Beds
- Pe — Browne Beds
- Pp — Lupton Beds and Lefroy Beds
- Ews — Townsend Quartzite

PRECAMBRIAN
- pC — Igneous and metamorphic rocks

Geological boundary, approximate and inferred

Trend line, from seismic reflection surveys

Magnetic basement from Hunt Oil aeromagnetic survey

Basement, from seismic refraction survey by Geophysical Associates Pty. Ltd for Hunt Oil

Basement profile interpreted from gravity data assuming:
1. observed profile essentially due to variation in relief of basement
2. density contrast of -0.2 gm/cc between basement and basin sediments
3. regional gravity values of about -30 milligals

0 20 40 60 80 100 km
0 20 40 60 M

To accompany Record 1972/66

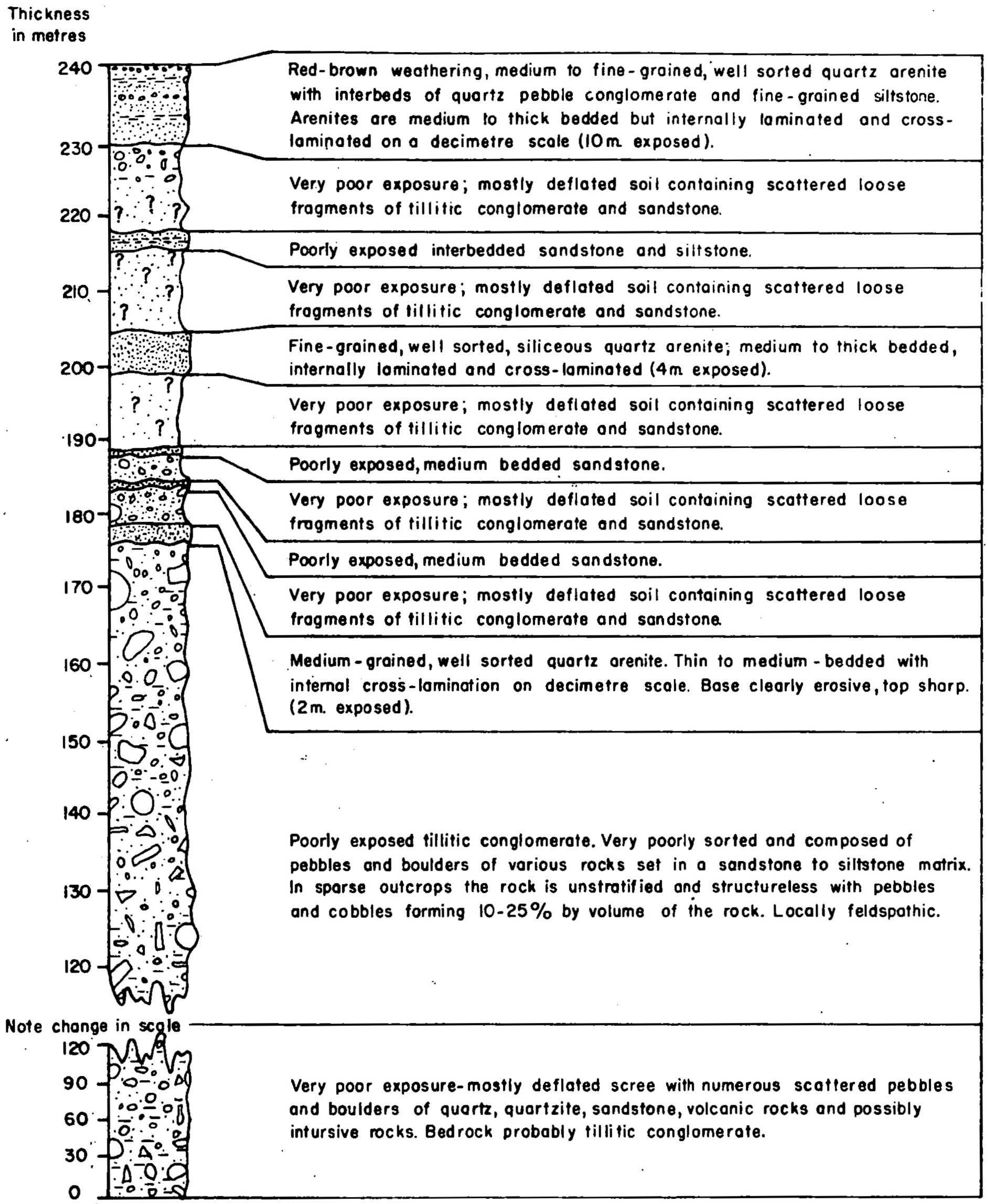
W/A/235

APPENDIX I

Detailed descriptions of Type and Reference sections

FIGURE I.

TYPE SECTION OF THE LUPTON BEDS AT LUPTON HILLS



Section measured by pacing at Latitude 26° 31' South, Longitude 128° 01' East on Cooper (SG 52-10) 1:250,000 sheet.

N.J.V

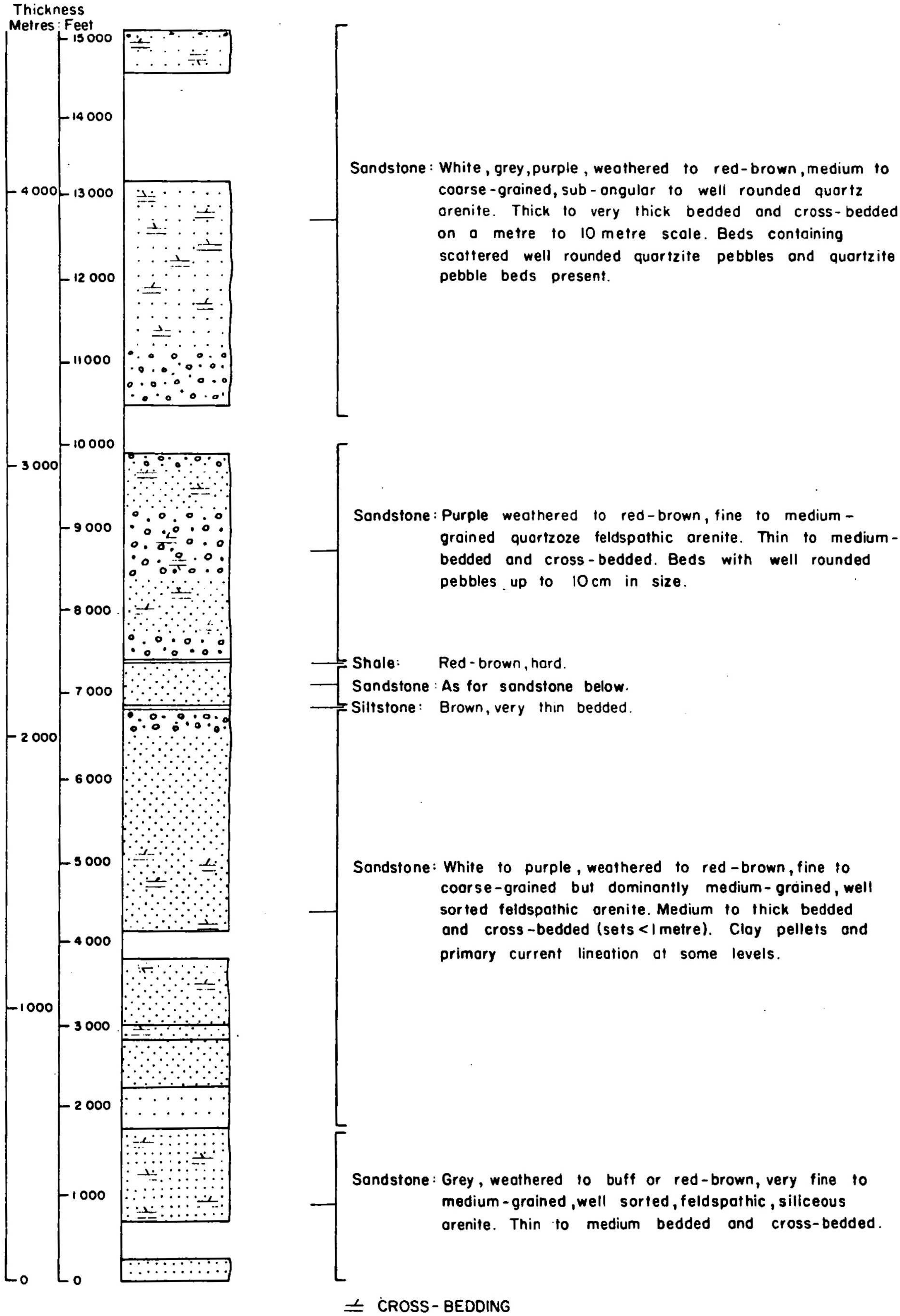
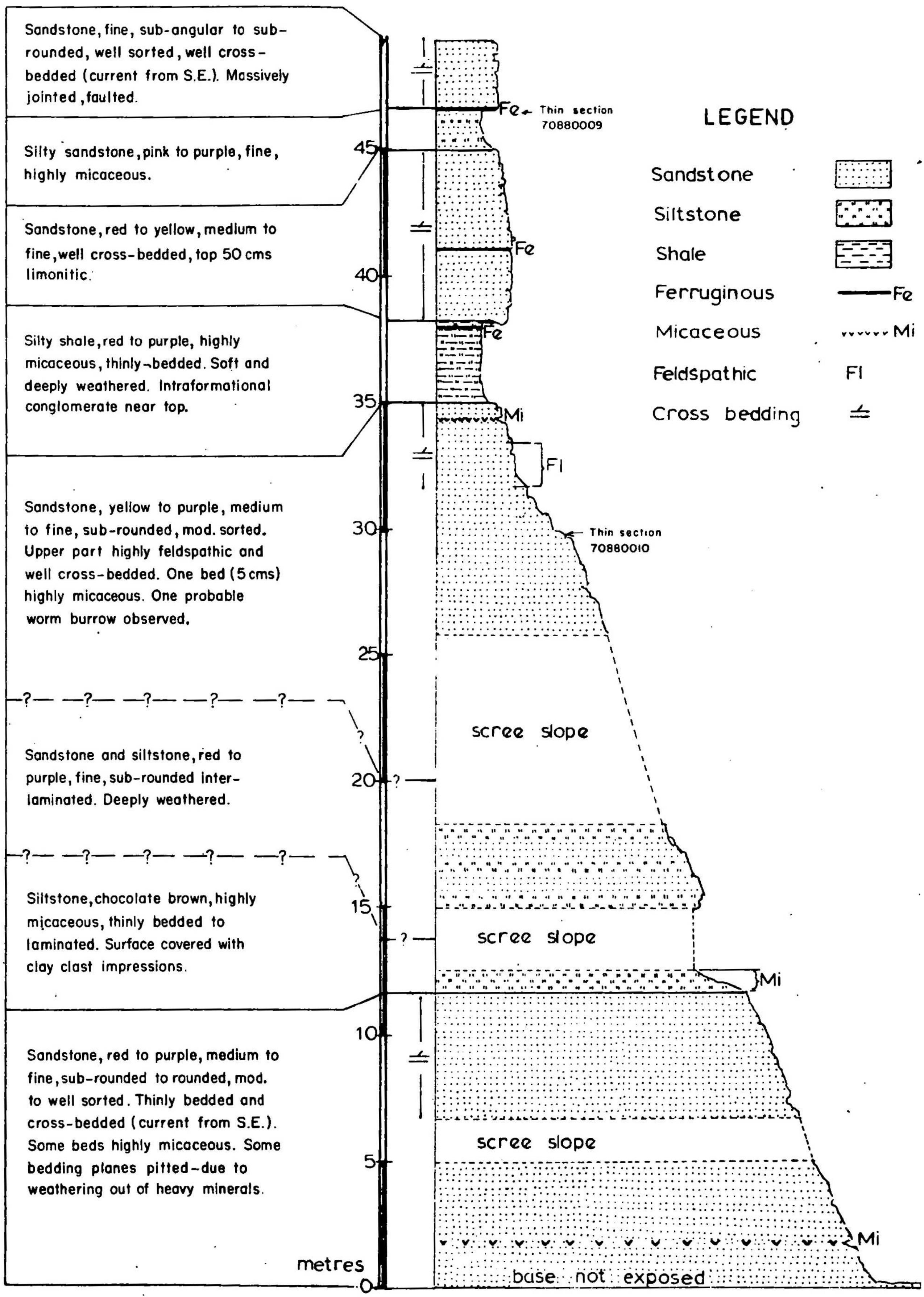


FIGURE 2: TYPE SECTION OF THE CLUTTERBUCK BEDS AT CLUTTERBUCK HILLS (COBB SG 52-1 1:250,000 SHEET)

(Section after Mack and Herrmann, 1965)

FIGURE 4

REFERENCE SECTION OF THE LENNIS SANDSTONE



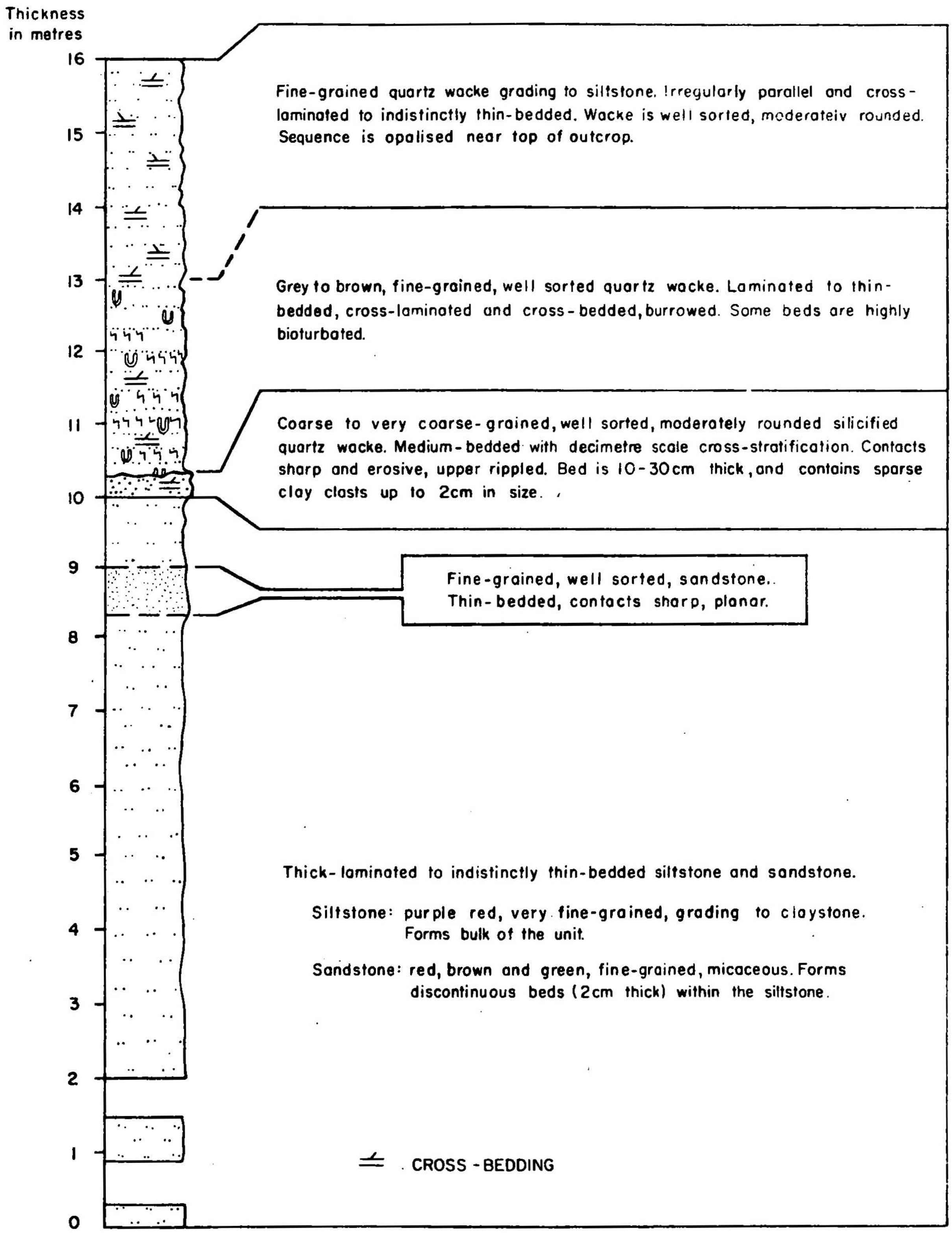
Section measured by tape and Abney Level at unnamed exposure (Latitude 27°13' South, Longitude 127°24' East) on the Lennis (SG 52-13) 1:250 000 sheet.

To accompany Record 1972/66

G52/A13/5 *N.J.V*

FIGURE 5.

TYPE SECTION OF THE SAMUEL FORMATION AT MOUNT CHARLES

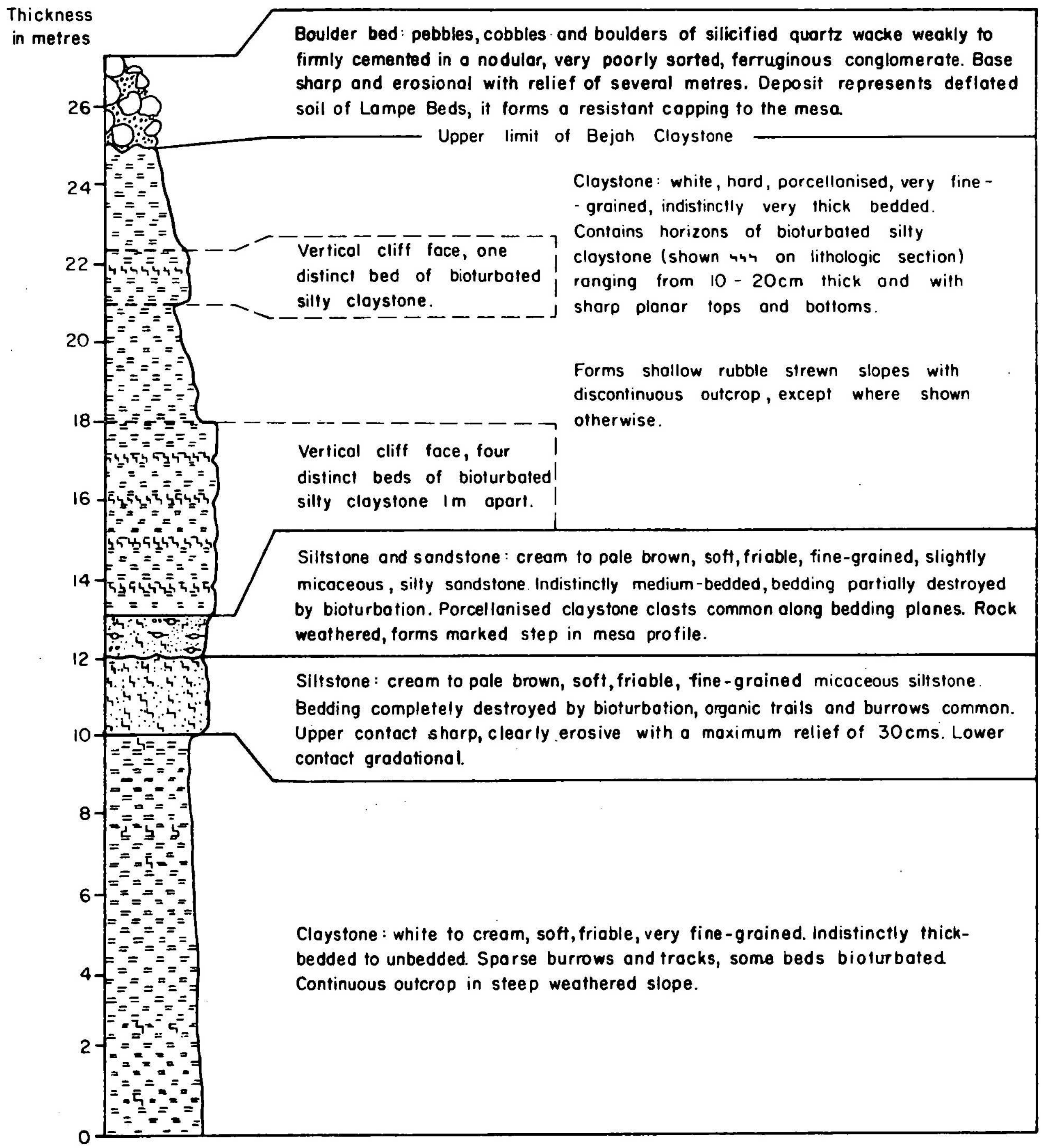


Section measured by tape at outcrops north and south of the Gunbarrel Highway at Mount Charles (Latitude 25° 45' South, Longitude 126° 11' East) on the Bentley (SG 52-5) 1:250,000 sheet.

N.J.V

FIGURE 6.

REFERENCE SECTION OF THE BEJAH CLAYSTONE



Section measured by pacing and tape and abney level at unnamed mesa (Latitude 25° 28' South, Longitude 125° 06' East) on the Browne (SG 51-8) 1:250,000 sheet.

N.J.V

APPENDIX 2

Catalogue of Registered Specimens from the Officer Basin, held at the Bureau of Mineral Resources, Canberra.

Specimens are grouped according to formations, which are arranged alphabetically

Registered No.	Rock type	Formation	1:250000 Sheet area
70880013	Claystone	Bejah Claystone	Browne
72880074	Sandstone	Bejah Claystone	Madley
72880075	Claystone	Bejah Claystone	Herbert
72880076	Claystone	Bejah Claystone	Madley
72880077	Siltstone	Bejah Claystone	Madley
72880078	Claystone	Bejah Claystone	Wanna
72880079	Claystone	Bejah Claystone	Herbert
72880080	Claystone	Bejah Claystone	Browne
72880081	Claystone	Bejah Claystone	Browne
72880082	Claystone	Bejah Claystone	Browne
72880083	Claystone	Bejah Claystone	Browne
72880084	Claystone	Bejah Claystone	Robert
72880085	Claystone	Bejah Claystone	Robert
72880001	Chalcedony	Cainozoic unit	Warri
72880002	Sandstone	Cainozoic unit	Warri
72880003	Chalcedony	Cainozoic unit	Warri
72880004	Breccia	Cainozoic unit	Warri
72880005	Calcrete	Cainozoic unit	Waigen
72880006	Chalcedony	Cainozoic unit	Warri
72880007	Calcrete	Cainozoic unit	Wanna
72880008	Chalcedony	Cainozoic unit	Warri
72880009	Calcrete	Cainozoic unit	Westwood
72880010	Calcrete	Cainozoic unit	Warri
72880020	Laterite	Cainozoic unit	Stanley
72880021	Laterite	Cainozoic unit	Yowalga
72880022	Laterite	Cainozoic unit	Throssell
72880023	Laterite	Cainozoic unit	Stanley
72880024	Laterite	Cainozoic unit	Birksgate
72880025	Laterite	Cainozoic unit	Browne
72880026	Laterite	Cainozoic unit	Herbert
72880027	Laterite	Cainozoic unit	Lennis

Registered No.	Rock Type	Formation	1:250000 Sheet Area
72880102	Sandstone	Clutterbuck Beds	Cobb
72880133	Sandstone	Clutterbuck Beds	Cobb
71880008	Basalt	Kulyong Volcanics	Waigen
71880009	Basalt	Kulyong Volcanics	Birksgate
71880010	Basalt	Kulyong Volcanics	Birksgate
72880039	Basalt	Kulyong Volcanics	Cooper
72880040	Basalt	Kulyong Volcanics	Cooper
72880041	Basalt	Kulyong Volcanics	Cooper
72880042	Basalt	Kulyong Volcanics	Cooper
72880043	Quartz Vug	Kulyong Volcanics	Cooper
72880044	Basalt	Kulyong Volcanics	Robert
72880045	Basalt	Kulyong Volcanics	Waigen
72880014	Sandstone	Lampe Beds	Herbert
72880015	Sandstone	Lampe Beds	Browne
72880016	Sandstone	Lampe Beds	Browne
72880017	Sandstone	Lampe Beds	Herbert
72880018	Breccia	Lampe Beds	Throssel
72880019	Sandstone	Lampe Beds	Cobb
70880010	Sandstone	Lennis Sandstone	Lennis
72880028	Sandstone	Lennis Sandstone	Talbot
72880029	Sandstone	Lennis Sandstone	Waigen
72880030	Sandstone	Lennis Sandstone	Waigen
72880031	Sandstone	Lennis Sandstone	Wanna
72880032	Sandstone	Lennis Sandstone	Waigen
72880033	Sandstone	Lennis Sandstone	Talbot
72880034	Sandstone	Lennis Sandstone	Lennis
72880035	Sandstone	Lennis Sandstone	Lennis
72880138	Sandstone	Lupton Beds	Cooper
72880011	Limestone	Nullarbor Limestone	Waigen
72880013	Sandstone	Nullarbor Limestone	Waigen
70880006	Basalt	Officer Volcanics	Robert
71880001	Basalt	Officer Volcanics	Robert
71880002	Basalt	Officer Volcanics	Robert
71880003	Basalt	Officer Volcanics	Robert
72880036	Basalt	Officer Volcanics	Robert
72880037	Sandstone	Officer Volcanics	Robert
72880038	Sandstone	Officer Volcanics	Robert

Registered No.	Rock Type	Formation	1:250000 Sheet Area
70880002	Sandstone	Paterson Formation	Yowalga
70880004	Siltstone	Paterson Formation	Neale
70880005	Sandstone	Paterson Formation	Rason
70880009	Sandstone	Paterson Formation	Lennis
70880011	Siltstone	Paterson Formation	Browne
70880014	Sandstone	Paterson Formation	Herbert
72880046	Sandstone	Paterson Formation	Madley
72880047	Sandstone	Paterson Formation	Madley
72880089	Granite erratic	Paterson Formation	Herbert
72880149	Sandstone	Paterson Formation	Madley
72880150	Sandstone	Paterson Formation	Trainor
72880151	Conglomerate	Paterson Formation	Madley
72880152	Sandstone	Paterson Formation	Madley
72880153	Claystone	Paterson Formation	Madley
72880154	Sandstone	Paterson Formation	Madley
72880155	Claystone	Paterson Formation	Madley
72880156	Claystone	Paterson Formation	Madley
72880157	Claystone	Paterson Formation	Madley
72880158	Sandstone	Paterson Formation	Madley
72880159	Claystone	Paterson Formation	Madley
72880160	Claystone	Paterson Formation	Madley
72880161	Sandstone	Paterson Formation	Herbert
72880162	Siltstone	Paterson Formation	Herbert
72880163	Tillite	Paterson Formation	Herbert
72880164	Sandstone	Paterson Formation	Herbert
72880165	Sandstone	Paterson Formation	Herbert
72880166	Tillite	Paterson Formation	Herbert
72880167	Sandstone	Paterson Formation	Westwood
72880168	Tillite	Paterson Formation	Westwood
72880169	Siltstone	Paterson Formation	Westwood
72880170	Sandstone	Paterson Formation	Westwood
72880171	Claystone	Paterson Formation	Westwood
72880172	Sandstone	Paterson Formation	Westwood
72880173	Sandstone	Paterson Formation	Westwood
72880174	Sandstone	Paterson Formation	Warri
72880175	Tillite	Paterson Formation	Warri

Registered No.	Rock Type	Formation	1:250000 Sheet Area
72880176	Sandstone	Paterson Formation	Wanna
72880177	Sandstone	Paterson Formation	Robert
72880178	Sandstone	Paterson Formation	Talbot
72880179	Chert Erratic	Paterson Formation	Throssel
72880180	Claystone	Paterson Formation	Robert
72880181	Chert	Paterson Formation	Robert
72880182	Claystone	Paterson Formation	Robert
72880183	Sandstone	Paterson Formation	Rason
72880184	Claystone	Paterson Formation	Minigwal
72880185	Claystone	Paterson Formation	Neale
72880186	Claystone	Paterson Formation	Lennis
72880187	Sandstone	Paterson Formation	Lennis
72880188	Chert Erratic	Paterson Formation	Stanley
72880189	Sandstone	Paterson Formation	Cobb
72880190	Sandstone	Paterson Formation	Cooper
72880191	Sandstone	Paterson Formation	Cooper
72880192	Sandstone	Paterson Formation	Cooper
72880193	Sandstone	Paterson Formation	Bentley
72880194	Fossil Wood	Paterson Formation	Browne
72880195	Conglomerate	Paterson Formation	Herbert
70880007	Sandstone	Proterozoic unit	Robert
70880008	Chert	Proterozoic unit	Robert
70880015	Dolomite	Proterozoic unit	Robert
70880016	Dolomite	Proterozoic unit	Robert
71880004	Basalt	Proterozoic unit	Kingston
71880005	Basalt	Proterozoic unit	Kingston
71880006	Basalt	Proterozoic unit	Kingston
71880007	Basalt	Proterozoic unit	Kingston
72880091	Sandstone	Proterozoic unit	Trainor
72880092	Sandstone	Proterozoic unit	Trainor
72880093	Sandstone	Proterozoic unit	Stanley
72880094	Basalt	Proterozoic unit	Stanley
72880095	Sandstone	Proterozoic unit	Madley
72880096	Dolomite	Proterozoic unit	Madley
72880097	Dolomite	Proterozoic unit	Madley
72880098	Dolomite	Proterozoic unit	Madley

Registered No.	Rock Type	Formation	1:250000 Sheet Area
72880099	Dolomite	Proterozoic unit	Trainor
72880100	Dolomite	Proterozoic unit	Trainor
72880101	Sandstone	Proterozoic unit	Madley
72880103	Sandstone	Proterozoic unit	Trainor
72880104	Sandstone	Proterozoic unit	Trainor
72880105	Haematite	Proterozoic unit	Trainor
72880106	Dolomite	Proterozoic unit	Trainor
72880107	Dolomite	Proterozoic unit	Trainor
72880108a	Sandstone	Proterozoic unit	Trainor
72880108b	Quartzite	Proterozoic unit	Madley
72880109	Chalcedony	Proterozoic unit	Madley
72880110	Dolomite	Proterozoic unit	Madley
72880111	Dolomite	Proterozoic unit	Madley
72880112	Dolomite	Proterozoic unit	Madley
72880113	Chert	Proterozoic unit	Madley
72880114	Dolomite	Proterozoic unit	Robert
72880115	Shale	Proterozoic unit	Robert
72880116	Siltstone	Proterozoic unit	Robert
72880117	Chert	Proterozoic unit	Robert
72880118	Siltstone	Proterozoic unit	Robert
72880119	Siltstone	Proterozoic unit	Robert
72880120	Sandstone	Proterozoic unit	Robert
72880121	Chert	Proterozoic unit	Robert
72880122	Chert	Proterozoic unit	Robert
72880123	Quartzite	Proterozoic unit	Madley
72880124	Dolomite	Proterozoic unit	Madley
72880125	Siltstone	Proterozoic unit	Madley
72880126	Dolomite	Proterozoic unit	Madley
72880127	Dolomite	Proterozoic unit	Madley
72880128	Shale	Proterozoic unit	Kingston
72880129	Chert	Proterozoic unit	Kingston
72880130	Sandstone	Proterozoic unit	Robert
72880131	Dolomite	Proterozoic unit	Robert
72880132	Sandstone	Proterozoic unit	Robert
72880134	Chert	Proterozoic unit	Birksgate
72830135	Conglomerate	Proterozoic unit	Birksgate
72880136	Siltstone	Proterozoic unit	Birksgate

Registered No.	Rock Type	Formation	1:250000 Sheet Area
72880140	Dolomite	Proterozoic unit	Throssel
72880141	Dolomite	Proterozoic unit	Throssel
72880142	Dolomite	Proterozoic unit	Throssel
72880143	Dolomite	Proterozoic unit	Warri
72880144	Siltstone	Proterozoic unit	Warri
72880145	Gypsum	Proterozoic unit	Warri
72880146	Sandstone	Proterozoic unit	Warri
72880147	Siltstone	Proterozoic unit	Waigen
72880148	Shale	Proterozoic unit	Robert
70880001	Sandstone	Samuel Formation	Westwood
70880003	Sandstone	Samuel Formation	Westwood
70880012	Siltstone	Samuel Formation	Browne
72880056b	Sandstone	Samuel Formation	Westwood
72880057	Sandstone	Samuel Formation	Westwood
72880058	Chalcedony	Samuel Formation	Herbert
72880059	Siltstone	Samuel Formation	Herbert
72880060	Sandstone	Samuel Formation	Herbert
72880061	Siltstone	Samuel Formation	Herbert
72880062	Sandstone	Samuel Formation	Bentley
72880063	Siltstone	Samuel Formation	Browne
72880064	Claystone	Samuel Formation	Madley
72880065	Siltstone	Samuel Formation	Bentley
72880066	Siltstone	Samuel Formation	Westwood
72880067	Sandstone	Samuel Formation	Browne
72880068	Sandstone	Samuel Formation	Cobb
72880069	Sandstone	Samuel Formation	Browne
72880070	Siltstone	Samuel Formation	Browne
72880071	Sandstone	Samuel Formation	Yowalga
72880072	Sandstone	Samuel Formation	Browne
72880073	Sandstone	Samuel Formation	Bentley
71880011	Basalt	Table Hill Volcanics	Talbot
71880012	Basalt	Table Hill Volcanics	Talbot
72880137	Quartzite	Townsend Quartzite	Cooper
72880139	Quartzite	Townsend Quartzite	Talbot
72880012	Sandstone	Wanna Beds	Waigen
72880048	Sandstone	Wanna Beds	Wanna
72880049	Sandstone	Wanna Beds	Wanna

Registered No.	Rock Type	Formation	1:250000 Sheet Area
72880050	Sandstone	Wanna Beds	Waigen
72880051	Sandstone	Wanna Beds	Waigen
72880052	Sandstone	Wanna Beds	Waigen
72880053	Sandstone	Wanna Beds	Lennis
72880054	Sandstone	Wanna Beds	Lennis
72880055	Sandstone	Wanna Beds	Waigen
72880056a	Sandstone	Wanna Beds	Waigen
72880086	Dolerite	Yilgarn Block	Minigwal
72880087	Granite	Yilgarn Block	Minigwal
72880088	Granite	Yilgarn Block	Minigwal
72880090	Gneiss	Yilgarn Block	Throssel