

- 1969, Edmund, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- 1970, Wyloo, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- Daniels, J. L., and MacLeod, W. N., 1965, Newman, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- de la Hunty, L. E., 1964, Balfour Downs, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- Gee, R. D., de Laeter, J. R., and Drake, J. R., 1976, Geology and geochronology of altered rhyolite from the lower part of the Bangemall Group near Tangadee: West. Australia Geol. Survey Ann. Rept. 1975, p. 112.
- Glaessner, M. F., Preiss, W. V., and Walter, M. R., 1969, Precambrian columnar stromatolites in Australia. Morphological and stratigraphic analysis: Science, v. 164, p. 1056-1058.
- Hall, W. D. M., and Goode, A. D. T., 1975, The Nabberu Basin: A newly discovered Lower Proterozoic Basin in Western Australia: Geol. Soc. Australia, First Australian Geol. Convention, Abs., p. 88-89.
- Halligan, R., and Daniels, J. L., 1964, Precambrian geology of the Ashburton Valley region, North-West Division: West. Australia Geol. Survey Ann. Rept. 1963, p. 38-46.
- Horwitz, R. C., 1975, Provisional geological map at 1:2 500 000 of the Northeast Margin of the Yilgarn Block, Western Australia: Australia C.S.I.R.O. Mineral Investig. Rept. No. F.P. 10.
- MacLeod, W. N., 1970, Peak Hill, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- Muhling, P. C., Brakel, A. T., and Davidson, W. A., in prep., Mount Egerton, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- Walter, M. R., 1972, Stromatolites and the biostratigraphy of the Australian Precambrian and Cambrian: Palaeont. Assoc. Spec. Papers in Palaeontology, No. 11, 190 p.
- Williams, I. R., Brakel, A. T., Chin, R. J., and Williams, S. J., 1976, The stratigraphy of the eastern Bangemall Basin and the Paterson Province: West. Australia Geol. Survey Ann. Rept. 1975, p. 79.

THE STRATIGRAPHY OF THE EASTERN BANGEMALL BASIN AND THE PATERSON PROVINCE

by I. R. Williams, A. T. Brakel, R. J. Chin, and S. J. Williams

ABSTRACT

Stratigraphic reappraisals of the Paterson Province and northeast part of the Bangemall Basin, east of the Hamersley Basin and Pilbara Block, Western Australia, have produced important changes in the interpretation of the Proterozoic sequences of the region.

The oldest rocks of the area are the gneisses, schists, and igneous rocks of the Rudall Metamorphic Complex which forms the core of the Paterson Province. This metamorphic domain is unconformably overlain by the Yeneena Group, a moderately to strongly folded and faulted, mixed sedimentary succession of ?Lower or Middle Proterozoic age. Four formations, the basal Coolbro Sandstone, the Broadhurst Formation, the Choorun Formation, and the Isdell Formation are recognized within it in the Rudall Sheet area.

An unconformity is present between the Yeneena Group and the flat-lying to gently folded Middle Proterozoic Bangemall Group, which consists largely of sandstone. Two formations, the Skates Hills Formation and the McFadden Sandstone, comprise the Bangemall Group in its northeastern and eastern extent, while three formations, the Calyie Sandstone, the Backdoor Formation, and the Wonyulganna Sandstone, believed to be facies equivalents, are present to the west.

The Bangemall Group—Yeneena Group boundary, regarded as the margin of the Bangemall Basin, can be traced southeasterly across the Rudall and Gunanya Sheet areas. An inlier of ?Lower Proterozoic sedimentary rocks is exposed in the southeast quadrant of the Trainor Sheet area. These older rocks may be correlatives of the Yeneena Group to the north or the Nabberu Basin rocks which lie to the south.

The McFadden Sandstone is unconformably overlain by small areas of the Proterozoic Durba Sandstone.

An isolated and uncorrelated, folded and faulted Proterozoic sedimentary sequence, the Karara Beds, is unconformable on the Rudall Metamorphic Complex and the Yeneena Group in the vicinity of Karara Well.

INTRODUCTION

This report outlines important stratigraphic reappraisals of the Proterozoic sedimentary sequences in the eastern part of the Bangemall Basin and the Paterson Province. The area, shown on Figure 42, lies largely in the southwestern part of the Great Sandy Desert and covers all of the Rudall, Gunanya, Trainor, and Buller 1:250 000 Sheet areas, and parts of the Paterson Range, Balfour Downs, Tabletop, Runton, Madley, and Stanley Sheet areas.

The significant changes to the 1973 edition of the Geological Map of Western Australia following recent mapping in this region are: the location of the northeastern margin of the Bangemall Group; the identification of a sedimentary sequence called the Yeneena Group, which unconformably underlies the Bangemall Group, and which forms the cover sequence of the Paterson Province; the extension of the Rudall Metamorphic Complex much farther to the southeast; the detection of an isolated sedimentary sequence of uncertain age but unconformable on the Yeneena Group in the Karara Well area; the recognition of a younger sandstone formation unconformably overlying the Bangemall Group at Durba Hills; and the discovery of an inlier of pre-Bangemall Group rocks in the southeast of the Trainor Sheet area. The derivation and detailed description of the type areas and sections for the Proterozoic units are given in the following Explanatory Notes, in preparation, belonging to the G.S.W.A. 1:250 000 Geological Series: Rudall (Chin and others), Runton (Crowe and Chin), Gunanya (I. Williams and S. Williams), and Trainor (Leech and Brakel).

The stratigraphy, as it is now understood, is shown in Table 22 and the regional distribution of the units is given on Figure 42.

TABLE 22. STRATIGRAPHY OF THE EASTERN BANGEMALL BASIN AND THE PATERSON PROVINCE

Buller 1:250 000		Trainer 1:250 000		Gunanya-Rudall 1:250 000		Tabletop-Runton 1:250 000	
		Durba Sandstone		Durba Sandstone		Karara Beds?	
BANGEMALL GROUP	Calyie Sandstone	BANGEMALL GROUP	McFadden Sandstone	BANGEMALL GROUP	McFadden Sandstone		
	Backdoor Formation		Skates Hills Formation				
	Wonyulgunna Sandstone						
		unconformity					
		Unnamed ? Lower Proterozoic Formation		YENEENA GROUP	Isdell Formation	YENEENA GROUP	
					Choorun Formation		
					Broadhurst Formation		
					Coolbro Sandstone		
				unconformity			
				RUDALL METAMORPHIC COMPLEX		RUDALL METAMORPHIC COMPLEX	

RUDALL METAMORPHIC COMPLEX

The Rudall Metamorphic Complex forms the basement rocks in the Paterson Province. The complex extends for 100 km east-southeasterly through the Rudall, Gunanya, and Tabletop Sheet areas to the Runton Sheet area where it is unconformably overlain by Phanerozoic sedimentary rocks of the Canning Basin. A small inlier occurs in the McKay Range on the northern edge of the Gunanya Sheet area.

The complex is composed of two main lithological assemblages which are not distinguished on Figure 42. A gneissic assemblage is perhaps the oldest and consists largely of orthogneiss, gneissic amphibolite, and paragneiss. The gneisses have undergone retrograde metamorphism during a later period of metamorphism and deformation. This later period has also involved a second and possibly younger group of metasedimentary rocks including mainly quartzite and quartz-mica schist. Both assemblages have undergone polyphase deformation. Several periods of granitic, mafic, and ultramafic intrusions are evident.

YENEENA GROUP

The Rudall Metamorphic Complex is unconformably overlain by a thick ?Lower or Middle Proterozoic clastic and carbonate succession called the Yeneena Group. The unconformity is complexly folded and faulted, and along the western margin of the Rudall Metamorphic Complex thrusts, high-angle reverse faults, and fold axial planes in the Yeneena Group dip consistently northeast. The lower units of the Yeneena Group have undergone low-grade dynamic metamorphism. Both metamorphism and deformation decrease westwards in the Yeneena Group.

The group occupies the northwestern, northern, and central western parts of the Rudall Sheet area. It extends northwards across the western margin of the Paterson Range Sheet area and marginally into the Nullagine Sheet area (Hickman, 1975) where it unconformably overlies crystalline rocks and Lower Proterozoic sedimentary rocks in the Gregory Range area. The group also extends westwards into the Balfour Downs Sheet area (de la Hunty, 1964) where it unconformably overlies the Fortescue Group. On both sheets the unit has been called the Bocrabee Sandstone.

The Yeneena Group can also be traced south-eastwards through the McKay Range, across the Gunanya Sheet area to the Lady Victoria Hills and into the Runton and Madley Sheet areas where it crops out in the Runton Range and Constance Headland.

A large inlier of folded and faulted Proterozoic rocks around the Telfer gold deposits in the Paterson Range Sheet area is believed to be equivalent to the higher formations in the Yeneena Group. In this area the succession has been intruded by granite at Mount Crofton which has been dated at 614 ± 42 m.y. (Trendall, 1974).

Four constituent formations are recognized in the Rudall Sheet area, but because of the discontinuous nature of the exposures, it is not possible to assign all the Yeneena Group rocks to formations.

COOLBRO SANDSTONE

The basal unit is the Coolbro Sandstone, a predominantly medium-grained quartz sandstone that is commonly cross-bedded. It contains at the base a discontinuous but locally conspicuous conglomerate unit with minor shale and siltstone beds. The clasts in the conglomerate are derived from the underlying metamorphic complex.

The Coolbro Sandstone is well exposed in the north central part of the Rudall Sheet area around Coolbro Creek and in the Throssell Range but it thins rapidly southwestward.

BROADHURST FORMATION

The Coolbro Sandstone is unconformably overlain by the poorly exposed Broadhurst Formation which consists of interbedded micaceous siltstone, mudstone, shale, graphitic shale, and fine-grained sandstone. Phyllite and graphitic shales occur in the vicinity of the Three Sisters Hills. The formation crops out in the Broadhurst Range and in the Three Sisters Hills area.

CHOORUN FORMATION

The Broadhurst Formation is conformably overlain by the Choorun Formation, a thick interbedded unit of fine to coarse-grained sandstone, micaceous siltstone, quartz pebble conglomerate, calcareous mudstone, and shaley dolomite. The formation occupies much of the central western part of the Rudall Sheet area and extends into the Balfour Downs Sheet area.

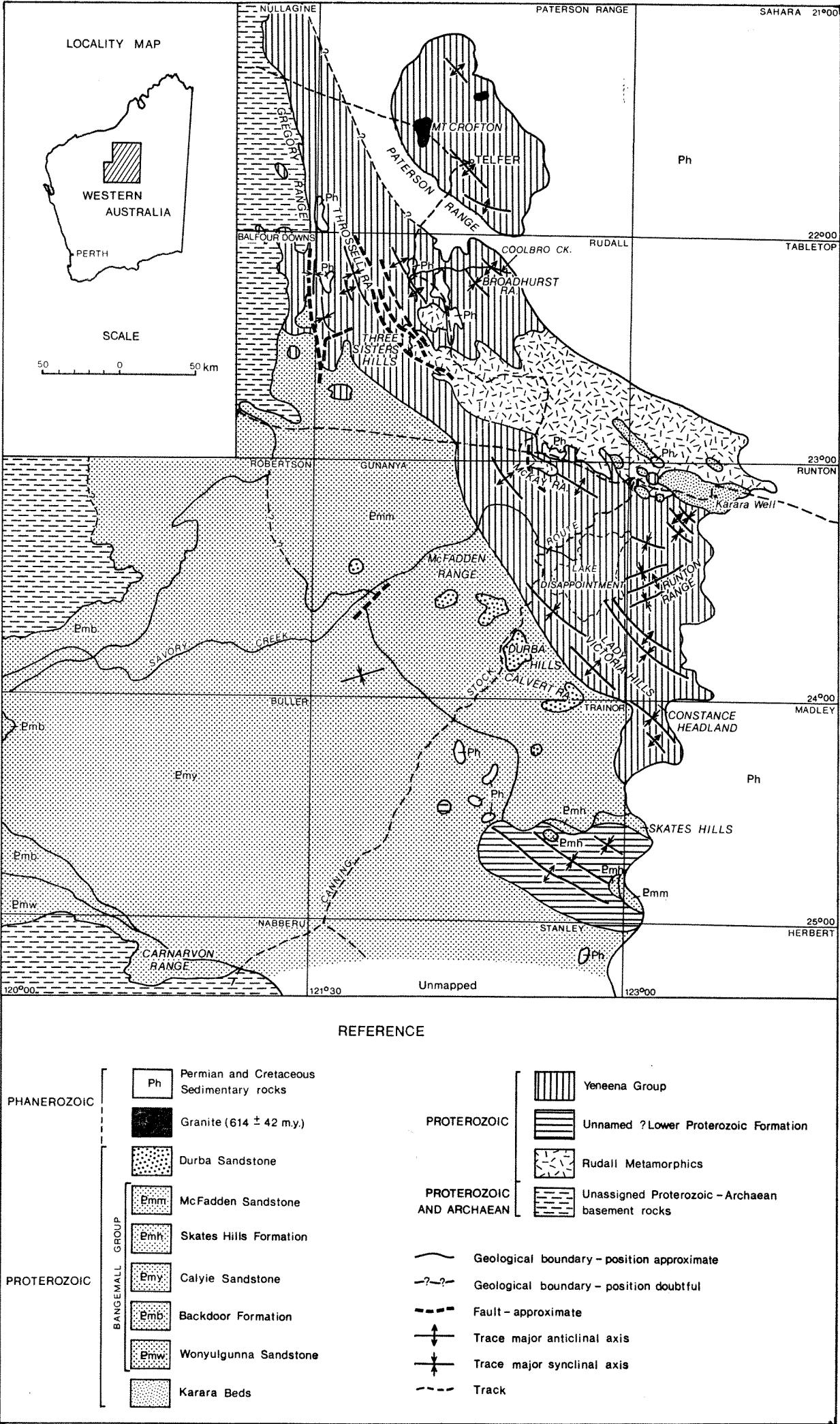


Figure 42. Solid geology of the eastern Bangemall Basin and Paterson Province.

ISDELL FORMATION

The uppermost formation of the Yeneena Group in the Rudall Sheet area is the Isdell Formation. It is predominantly dolomite and dolomitic shale, with variable amounts of interbedded sandstone, siltstone, and minor pebble conglomerate. The clastic components increase westwards. The formation occurs in a major synclinal structure in the northwest and along the north central margin of the Rudall Sheet area. This formation, and possibly the upper part of the Choorun Formation, may be correlatives of the carbonate-clastic sequences in the Paterson Range Sheet area.

KARARA BEDS

Near Karara Well, in the Runton Sheet area, a sequence of folded conglomerate, sandstone, and minor siltstone and dolomite lies unconformably on both the Yeneena Group and the Rudall Metamorphic Complex. These are called the Karara Beds and occur in a number of scattered, disconnected outcrops in the adjacent corners of Rudall, Tabletop, Runton, and Gunanya Sheet areas. Their regional stratigraphic position is uncertain. They may correlate with the Bangemall Group, the Durba Sandstone, or rocks to the south in the Runton Sheet area at present placed in the Yeneena Group.

They may also constitute a completely separate sequence, represented by erosional or non-depositional periods elsewhere in the Proterozoic succession.

UNASSIGNED ?LOWER PROTEROZOIC ROCKS IN THE TRAINOR SHEET AREA

An unnamed ?Lower Proterozoic formation occurs as an inlier in the southeastern portion of the Trainor Sheet area, and adjacent part of the Madley Sheet area. It is a hard siliceous sandstone unit with some micaceous siltstone and shale lenses. The sandstones vary from massively bedded to laminated quartz arenites. Cross-bedding is widespread but not conspicuous in outcrop.

The formation is overlain by gently dipping Bangemall Group rocks. Along the northern margin of the inlier there is a strong angular unconformity between the Bangemall Group rocks and the older rocks. However, along the southern margin both units dip in the same direction, so that the contact, which is not exposed, appears to be disconformable.

The traces of the major fold axes are parallel to those in the Yeneena Group rocks farther north (Fig. 42). However, direct correlation is not possible at this stage and the rocks may be the time equivalent of part of the Nabberu Basin sequence to the south, or the Yeneena Group to the north.

BANGEMALL GROUP

The Middle Proterozoic Bangemall Group occupies over half the area under discussion and its extent can now be taken as the limit of the Bangemall Basin. Most of its constituent formations are not developed over the whole region because of lateral facies changes.

SKATES HILLS FORMATION

At the base of the Bangemall Group in the Skates Hills (Madley Sheet area) and parts of the southeastern Trainor Sheet area is a succession of conglomerate, interbedded sandstone, shale, and siltstone, and finally stromatolitic dolomite, termed the Skates Hills Formation. The unit varies in thickness and lenses out in places. The basal boulder-bearing cobble conglomerate is likewise lenticular. The formation rests unconformably on the unnamed ?Lower Proterozoic sandstone unit mentioned previously.

McFADDEN SANDSTONE

The Skates Hills Formation is conformably overlain by the McFadden Sandstone. This formation consists largely of quartzose and feldspathic arenite and wacke. It is characterized by flaggy, well-laminated beds, and cross-bedding sets up to 8 m thick. Pebble and granule-bearing rocks are common.

The McFadden Sandstone unconformably overlies the Yeneena Group along the northeastern margin of the Bangemall Basin. It is also unconformable on the ?Lower Proterozoic sandstone unit in the southeast quadrant of the Trainor Sheet area. Westwards, the unit loses its characteristic features and it appears to grade laterally into the Calyie Sandstone.

In the southwestern corner of the Gunanya Sheet area around Savory Creek it appears to overlie part of the Calyie Sandstone. The extent of the unit in the adjoining Robertson Sheet area is unknown. The formation is best developed in the McFadden Range and is unconformably overlain by the Durba Sandstone in the Durba Hills and Calvert Range.

CALYIE SANDSTONE

The western half of the Trainor Sheet area and most of the Buller Sheet area are occupied by a sandstone unit which is a continuation of the Calyie Sandstone defined on the adjacent Collier Sheet area (Brakel and Muhling, 1976). The unit consists mainly of flat-lying and gently dipping quartz arenite with minor siltstone and conglomerate lenses.

The formation grades into the McFadden Sandstone and disconformably overlies the ?Lower Proterozoic sandstone unit in the southeast Trainor Sheet area.

BACKDOOR FORMATION

The Backdoor Formation is a sequence of shale, siltstone, chert, and fine-grained sandstone that occurs in the western part of the area under discussion. It also crops out extensively in the Collier Sheet area (Brakel and Muhling, 1976). It conformably underlies the Calyie Sandstone but appears to lens out near the boundary of the Nabberu Sheet area. The shale and siltstone of the "Manganese Group" (de la Hunty, 1969) which conformably underlies the Calyie Sandstone in the centre of the Robertson Sheet area are presumed to correlate with the Backdoor Formation.

WONYULGUNNA SANDSTONE

The newly recognized Wonyulgunna Sandstone is a prominent ridge-forming unit which lies conformably beneath the Backdoor Formation.

It unconformably overlies a basement that consists of schist and metamorphosed banded iron-formation intruded by granite.

DURBA SANDSTONE

The Durba Sandstone is a flat-lying, massive quartz arenite which unconformably overlies the McFadden Sandstone in the Gunanya and Trainor Sheet areas. The formation occurs as a series of scattered outliers situated along a rough southeasterly trend which may represent a very shallow depositional basin aligned parallel to structural trends in the older rocks of the Paterson Province. Its age and correlation are uncertain. Lithologically similar sandstone is present within the Calyie Sandstone in the Buller Sheet area, so that the Durba Sandstone may belong to the Bangemall Group, the unconformity being only of local significance. Alternatively the deposit may be of post-Bangemall Group age, representing a last, brief, and limited return of deposition at the close of the Proterozoic sedimentation in the region.

PHANEROZOIC ROCKS

A number of scattered Permian outliers of the glaciogenic Paterson Formation occur in the Paterson Range, Rudall, and Trainor Sheet areas. The Paterson Range, southwest of Telfer, is the largest Permian outcrop area separated from the Canning Basin.

No Cretaceous rocks have been recognized beyond the main boundary of the Officer and Canning Basins.

CONCLUSIONS

The geological history of the region can be briefly summarized as follows.

The oldest rocks form the metamorphic and igneous Rudall Metamorphic Complex, in which polyphase deformation is recorded. The rocks involved are probably Lower Proterozoic in age, and may include reworked Archaean terrains.

The complex is unconformably overlain by the Yeneena Group, a sedimentary sequence which was laid down in a shallow marine shelf environment and consists largely of detritus derived from the Rudall Metamorphic Complex. Initial gravel and sand accumulation was followed by lower energy conditions indicated by alternating sand and mud, and finally carbonate, silt, sand, and gravel sedimentation. This sequence may have resulted from migrating, contemporaneously adjacent sub-environments instead of only gross temporal variation. It is likely that this probable Lower or Middle Proterozoic deposition extended over a large area beyond the present outcrop limits.

The unnamed ?Lower Proterozoic sandstone in the Trainor Sheet area may also have been deposited at this time in a near-shore location. The region was subsequently modified by tectonism which decreased in intensity to the southwest and imparted to the rocks a general northwesterly structural trend.

In the Karara Well area a sedimentary sequence, possibly developed in a discrete marine basin, was laid down after an interval of erosion had effected the Yeneena Group. The age of these sediments is uncertain.

To the southwest a marine transgression, which was part of that taking place over the area of the Bangemall Basin, led to the deposition of shelf sediments which were dominantly sand, except for some lenses of gravel and dolomite. An east to west lateral change in facies was present due to the nature of the detritus supplied to the basin and differing depositional environments, such as deeper water to the west. Later movements accompanied by dolerite intrusions, caused some mostly gentle folding. In the centre of the region a last short depositional episode represented by the Durba Sandstone occurred after some erosion of the Bangemall Group rocks, in what may have been a small, very shallow basin elongated parallel to the older structural trends. The constituent sand was quite likely reworked from the underlying sandstone.

The final Proterozoic activity took place in the northeastern district which underwent further tectonism and metamorphism accompanied by the emplacement of granites in the Paterson Range area at the close of Precambrian time. No further record of geological activity is preserved in the region until the Late Palaeozoic when widespread Permian glaciation took place.

An important result of the recent mapping is the discovery of the pre-Bangemall Group rocks along parts of the western margin of the Officer Basin. These strongly imply that the eastern limit of Precambrian outcrops also marks the real eastern edge of the structural Bangemall Basin, which would not, therefore, continue as an unbroken subsurface unit into Central Australia. Separate Middle Proterozoic basins under the Phanerozoic cover cannot be ruled out. A structural reason for the location of the western margin of the Officer Basin is also implied.

REFERENCES

- Brakel, A. T., and Muhling, P. C., 1976, Stratigraphy, sedimentation, and structure in the western and central part of the Bangemall Basin: West. Australia Geol. Survey Ann. Rept. 1976, p. 70.
- Chin, R. J., Williams, I. R., Williams, S. J., and Crowe, R.W.A., in prep., Explanatory notes on the Rudall 1:250 000 Geological Sheet, W.A.: West. Australia Geol. Survey Rec. (unpublished).
- Crowe, R. W. A., and Chin, R. J., in prep., Explanatory notes Runton, W.A. 1:250 000 Sheet: Australia Bur. Mineral Resources Rec. (unpublished).
- de la Hunty, L. E., 1964, Balfour Downs, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- 1969, Robertson, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- Hickman, A. H., 1975, Explanatory notes on the Nullagine 1:250 000 Geological Sheet, W.A.: West. Australia Geol. Survey Rec. 1975/5 (unpublished).
- Leech, R. E. J., and Brakel, A. T., in prep., Explanatory notes on the Trainor 1:250 000 Geological Sheet, W.A.: West. Australia Geol. Survey Rec. (unpublished).
- Trendall, A. F., 1974, The age of a granite near Mount Crofton, Paterson Range Sheet: West. Australia Geol. Survey Ann. Rept. 1973, p. 92-96.
- Williams, I. R., and Williams, S. J., in prep., Explanatory notes on the Gunanya 1:250 000 Geological Sheet, W.A.: West. Australia Geol. Survey Rec. (unpublished).

THE KALUWEERIE CONGLOMERATE: A PROTEROZOIC FLUVIATILE SEDIMENT FROM THE NORTHEAST YILGARN BLOCK, WESTERN AUSTRALIA

by P. D. Allchurch* and J. A. Bunting

ABSTRACT

An outlier of unmetamorphosed polymictic conglomerate and lithic arenite lying unconformably on Archaean granitic rocks, and considered to be Proterozoic in age, is interpreted as a fluvatile deposit. The sediments are immature and contain a variety of granitic and low-grade metamorphic rock fragments. The deposit is elongated east-west, is slightly sinuous, and was probably derived from the erosion of adjacent granitic rocks and the Booylgoo Range greenstone belt to the west.

The subhorizontal attitude of these beds and other probable Proterozoic outliers on the northeastern part of the Yilgarn Block, together with their lack of deformation illustrates the stability of the shield since Proterozoic times. It is suggested that the flatness of the shield surface relates to Proterozoic erosion and is not a more recent phenomenon.

INTRODUCTION

Outliers of Proterozoic sedimentary rocks from well within the area of the Archaean Yilgarn Block are rare and have not generally been recognized. The Kaluweerie Conglomerate is one such deposit. The purpose of this paper is to present a description of the rocks in the Kaluweerie Hill area, to discuss their depositional environment, and to compare them with other Proterozoic outliers in the region.

Kaluweerie Hill lies in the southwest corner of the Sir Samuel 1:250 000 Sheet area. It is approximately 620 km northeast of Perth and 140 km south of Wiluna.

*Australian Selection (Proprietary) Limited.