A provisional revised stratigraphy for the Bangemall Group on the EDMUND 1:250 000 sheet

by D. McB. Martin[1], A. M. Thorne, and I. A. Copp

Abstract

Five different stratigraphic schemes for the Bangemall Group rocks on EDMUND have been published since 1968. Recent GSWA mapping has highlighted the fact that none of the existing schemes adequately reflects the observed field relationships. A revised stratigraphy for the Bangemall succession on EDMUND is presented in which the Bangemall Group is elevated to supergroup status, and the component Edmund and Collier Subgroups are raised to group level. Two newly defined units, the Blue Billy and Muntharra Formations, are recorded within the Edmund Group. In addition, the boundaries between previously recognized formations within this group have been redefined in certain cases.

KEYWORDS: Bangemall Group, Bangemall Supergroup, Edmund Subgroup, Edmund Group, Collier Subgroup, Collier Group, stratigraphy, Proterozoic

Introduction

Fine-grained siliciclastic and carbonate sedimentary rocks of the Mesoproterozoic Bangemall Group (Fig. 1) unconformably overlie metamorphosed Palaeoproterozoic sedimentary and igneous rocks of the Capricorn Orogen (Myers, 1990), and are overlain by strata of the Neoproterozoic–Palaeozoic Officer Basin (Perincek, 1996; Williams, 1992). The age of the Bangemall Group is poorly constrained; deposition is thought to have occurred between about 1.64 and 1.00 Ga. (Nelson, 1995; Williams, 1990). The Bangemall Group hosts Western Australia's largest Pb–Cu–Ba deposit (Abra), as well as minor gold and base metal mineralization (Cooper et al., 1998a).

Previous stratigraphic subdivisions of the Bangemall Group (Daniels, 1969; Chuck, 1984; Muhling and Brakel, 1985; Williams, 1990; Cooper et al., 1998a) have been complicated by the presence of lateral facies changes within, and gradational relationships between, the various units, resulting in inconsistent stratigraphic nomenclature for different geographical areas. Furthermore, there are significant disagreements between authors on the basic stratigraphic subdivision of the group, particularly with regard to definition of subgroups (Fig. 2).

One of the aims of the current systematic 1:25 000-scale geological mapping program is to simplify the stratigraphic nomenclature for the Bangemall Group and to resolve some of the problems related to regional correlation within it. In this paper, we present a provisional revised stratigraphy based on detailed mapping on the eastern part of EDMUND*, and also on work carried out by GSWA during a study of the mineral occurrences and exploration potential of the Bangemall Basin (Cooper et al., 1998a).

The Bangemall Supergroup

On EDMUND and adjacent parts of TUREE CREEK and MOUNT EGERTON, there is strong evidence for at least a two-fold subdivision of the Bangemall Group into an older Edmund Subgroup and a younger Collier Subgroup (Cooper et al., 1998a), with the Collier Subgroup being equivalent to the Mucalana Subgroup of Muhling and Brakel (1985) and Williams (1990). The results of a regional compilation of 1:100 000-scale Landsat TM imagery of the Bangemall Group (Cooper et al., 1998b), and mapping carried out during the present study, suggest that the Edmund and Collier Subgroups are separated by a significant unconformity. This break has resulted in the basal Collier Subgroup being juxtaposed against units of the Edmund Subgroup, which range in stratigraphic height from the Devil Creek Formation to the Coodardoo Formation (Fig. 2). The presence of this regional unconformity within the succession is the basis for elevation of the Bangemall Group to supergroup status, and

[1] d.martin@dme.wa.gov.au

* Capitalized names refer to standard 1:250 000 map sheets

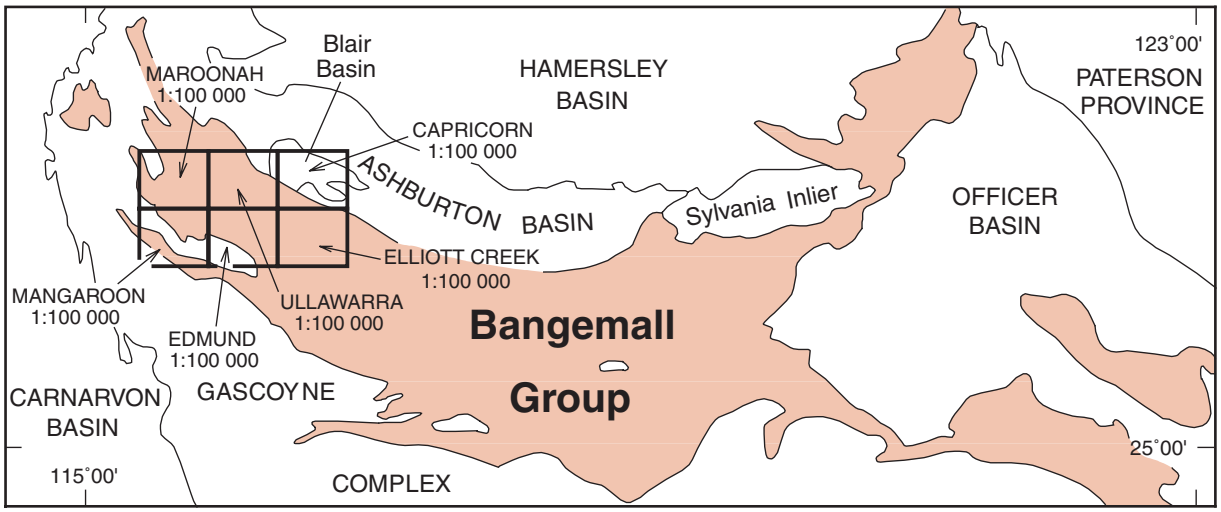

Figure 1. Distribution of the Bangemall Group in Western Australia, and location of the Edmund *1:250 000 sheet and constituent 1:100 000 sheets*

Daniels (1969)		Muhling and Brakel (1985)		Chuck (1984)		This study	
Kurabuka Formation	Bangemall Group	Kurabuka Formation	Mucalana Subgroup	Kurabuka Formation	Dooley Subgroup	Ilgarari Formation	Collier Group
		Mt Vernon Sandstone		Mt Vernon Sandstone		Calyie Formation	
Fords Creek Shale		Fords Creek Shale		Fords Creek Shale		Backdoor Formation	
Coodardoo Fm.		Coodardoo Formation	Edmund Subgroup	Coodardoo Formation		Coodardoo Formation	Edmund Group
Curran Formation		Curran Formation		Curran Formation		Ullawarra Formation	
Ullawarra Formation		Ullawarra Formation		Ullawarra Formation			
		Nanular Sandstone		Nanular Sandstone			
Devil Creek Fm.		Devil Creek Formation		Devil Creek Fm.		Devil Creek Formation	
Discovery Chert		Discovery Chert		Discovery Chert	Florry Subgroup	Discovery Formation	
Kiangi Creek Fm.		Jillawarra Formation		Jillawarra Formation		Muntharra Formation	
		Kiangi Creek Formation		Kiangi Creek Fm.		Kiangi Creek Formation	
Irregully Formation		Irregully Formation		Cheyne Springs Fm.		Cheyne Springs Fm.	
						Blue Billy Formation	
				Gooragoora Sandstone		Gooragoora Formation	
				Irregully Formation	Weegarinna Subgroup	Irregully Formation	
		Mt Augustus Sandstone, Tringadee and Coobarra Formations		Tringadee Formation			

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Figure 2. Historic development of stratigraphic nomenclature for the Bangemall Group on Edmund *and adjacent areas. The chronological arrangement of stratigraphic schemes is because Chuck (1984) drew heavily on a pre-publication copy of Muhling and Brakel (1985). Chuck's (1984) stratigraphic relationships for the Jillawarra Formation are based on his map and text description, rather than his table 7*

the Edmund and Collier Subgroups to group level.

Edmund Group

The Edmund Group unconformably overlies Palaeoproterozoic rocks of the Capricorn Orogen and is unconformably overlain by the Collier Group. On EDMUND, the Edmund Group has a maximum thickness (excluding dolerite sills) of about 3900 m. Our proposed revisions to the stratigraphy of Daniels (1969) are based on the work of Chuck (1984), although two new units have been proposed whereas others have been redefined. In all, ten formations are recognized, which in ascending order are: the Irregully, Gooragoora, Blue Billy, Cheyne Springs, Kiangi Creek, Muntharra, Discovery, Devil Creek, Ullawarra, and Coodardoo Formations. The most significant problems with the previous stratigraphic nomenclature are in the definition and correlation of units below the Discovery Formation (Fig. 2).

The Irregully Formation is the lowermost unit of the Edmund Group on EDMUND and unconformably overlies Palaeoproterozoic rocks of the Ashburton and Capricorn Formations, and igneous and metamorphic rocks of the Gascoyne Complex. Daniels (1970) and Muhling and Brakel (1985) subdivided the Irregully Formation into nine members, but Chuck (1984) and Copp (1998) redefined the formation to include only the lowermost major carbonate unit (Wongida Dolomite Member), together with a thin, locally developed basal siliciclastic unit (Yilgatherra Member). The basal sandstone and shale unit has so far not been named on EDMUND, but may be equivalent to the Tringadee Formation of Chuck (1984) and Muhling and Brakel (1985). Palaeocurrent directions in these localized sandstone units are towards the south and southeast.

Following Chuck (1984), the Gooragoora Sandstone Member is elevated to formation status, and renamed the Gooragoora Formation. The Gooragoora Formation has sharp, conformable contacts with the underlying Irregully Formation and the overlying Blue Billy Formation, and ranges in thickness from 10 to 150 m on EDMUND. Contrary to the definition of Chuck (1984), the Gooragoora Formation is lithologically and palaeoenvironmentally distinct from the Irregully Formation and is relatively heterogeneous in composition, consisting of sandstone and siltstone locally interbedded with significant amounts of carbonate (Table 1). Palaeocurrent directions in the principal sandstone units are towards the southeast.

The Gooragoora Formation is overlain by a pyritic carbonaceous siltstone unit that forms the newly proposed Blue Billy Formation. This formation is broadly equivalent to the Wannery, Chubilyer, Weewoddie, and Yeelingee Members of Daniels (1970), and the lower part of the Jillawarra Formation of Chuck (1984). The formation varies in thickness from 30 to 500 m and in places contains lenticular bodies of thick-bedded, massive quartz sandstone. The upper part of the Blue Billy Formation is transitional with the conformably overlying Cheyne Springs Formation, with the boundary being marked by a gradational change from siltstone to interbedded siltstone and planar-laminated dolomite.

The Cheyne Springs Formation was first defined by Chuck (1984) and is probably equivalent to the Warrada Dolomite Member of Daniels (1970). The Cheyne Springs Formation outcrops on the northeastern and western parts of EDMUND, where it ranges in thickness from 50 to 300 m. Typically, the formation consists of planar-laminated and cross-laminated dolomite, interbedded with siltstone, dolomitic siltstone, and minor fine-grained sandstone.

A laterally persistent unit of thick-bedded quartz sandstone and siltstone (Terrys Camp Member) marks the base of the overlying

Table 1. Proposed lithostratigraphy of the Bangemall Supergroup

Formation	*Lithologies*	*Thickness [a] (m)*	*Basal contact*
Collier Group			
Ilgarari	siltstone, numerous dolerite sills	680	sharp
Calyie	massive to cross-bedded sandstone	130	interfingering
Backdoor	planar-laminated siltstone, minor sandstone and chert	1500	?unconformity
Edmund Group			
Coodardoo	turbidite sandstone and minor siltstone	200	gradational
Ullawarra	planar-laminated siltstone, minor sandstone, numerous dolerite sills	100–650	sharp
Devil Creek	dolomitic breccia, dolograinstone, dolomudstone, minor stromatolites	85–200	sharp
Discovery	silicified carbonaceous mudstone and siltstone, minor sandstone and conglomerate at the base	50–70	sharp
Muntharra	dolomudstone and siltstone	30–50	?sharp
Kiangi Creek	planar-laminated siltstone and turbidite sandstone	200–550	?erosional
Cheyne Springs	interbedded laminated dolomudstone, siltstone, and minor sandstone	50–300	gradational
Blue Billy	pyritic carbonaceous siltstone, minor sandstone	30–500	sharp
Gooragoora	siltstone, sandstone, and minor dolomite	10–150	sharp
Irregully	dolomite (locally stromatolitic), minor sandstone and conglomerate	350–1 200	angular unconformity

NOTE: (a) Thicknesses, which exclude dolerite sills, are from measured sections and estimates from aerial photographs

Kiangi Creek Formation on EDMUND. This contact is marked locally by a thin conglomerate bed and appears to represent a disconformity with the underlying Cheyne Springs Formation. The bulk of the Kiangi Creek Formation consists of siltstone and interbedded turbidite sandstone, and varies in thickness from 200 to 550 m. Palaeocurrents in this formation are directed towards the southwest on the southeastern part of EDMUND, and towards the northwest on the northwestern part of the map sheet.

Carbonate strata between the Kiangi Creek and Discovery Formations have been assigned to the Muntharra Formation, which is equivalent to the upper part of the Jillawarra Formation of Chuck (1984). The Muntharra Formation is best exposed north of Strama Bore on Irregully Creek, where it consists mainly of non-stromatolitic dolomite and dolomitic mudstone. The lower and upper contacts of the Muntharra Formation are sharp.

Siliceous deposits of the Discovery Formation (formerly the Discovery Chert) have long been recognized as an important stratigraphic marker in the Bangemall succession. However, recent mapping has shown that in many cases the siliceous character of this unit appears to be secondary, indicating replacement of rocks ranging from carbonaceous siltstone to sandstone and conglomerate. Chuck (1984) noted that the results of drilling in the Mount Palgrave area suggest that silicification in that area is a surface enrichment of a much less siliceous black shale. In view of this compositional heterogeneity, we propose that this unit be renamed the Discovery Formation.

The Devil Creek Formation is 85–200 m thick and has a sharp, conformable contact with the underlying Discovery Formation. The Devil Creek Formation consists of dolograinstone and dolomudstone, which are locally stromatolitic and are interbedded with massive dolomitic conglomerate on the northeastern part of EDMUND. Siltstones and minor sandstones of the Ullawarra Formation conformably overlie the Devil Creek Formation and were considered to be a facies equivalent of this carbonate unit by Chuck (1984) and Muhling and Brakel (1985). The Nanular Sandstone of Chuck (1984) and Muhling and Brakel (1985) has not been recognized on EDMUND (Table 1). In addition, the Curran Formation, which gradationally overlies the Ullawarra Formation, is demoted to member status and included within the Ullawarra Formation. Palaeocurrent directions in the Ullawarra Formation are towards the northwest.

The Coodardoo Formation is the uppermost unit in the Edmund Group and has a transitional, conformable contact with the underlying Ullawarra Formation. The formation is about 200 m thick on EDMUND, and comprises thick-bedded turbidite sandstone and minor siltstone.

Collier Group

On EDMUND, the Collier Group was previously known as the Mucalana Subgroup (Muhling and Brakel, 1985; Williams, 1990), but was incorporated into the Collier Subgroup by Cooper et al. (1998a). In keeping with the original stratigraphic subdivision of the Collier Subgroup, the Fords Creek Shale (basal Mucalana Subgroup) has been renamed the Backdoor Formation. Similarly, the Calyie Formation, which consists of sandstone and siltstone, replaces the Calyie and Mount Vernon Sandstones. The Kurabuka Formation is renamed the Ilgarari Formation. Thicknesses and lithological data for components of the Collier Group are given in Table 1.

Problems in regional correlation

Two main problems exist with previous regional correlations within the Bangemall Supergroup that are especially applicable to EDMUND. The first relates to the definition of the Irregully Formation, as used by Daniels (1969) and Muhling and Brakel (1985), in which all carbonate units below the Kiangi Creek Formation were included in the Irregully Formation. This usage was modified by Chuck (1984) and Copp (1998), who redefined the Irregully Formation to include only the lowermost carbonate unit and the associated basal siliciclastic rocks.

The second problem concerns the identification and correlation of the Jillawarra Formation (Fig. 2), which was first defined by Brakel and Muhling (1976) and later included in the stratigraphic scheme of Chuck (1984). Muhling and Brakel (1985) considered the Jillawarra Formation to be partly a lateral equivalent of the Kiangi Creek Formation, but also correlated it with the Backdoor Formation of their Collier Subgroup. Alternatively, Chuck (1984) considered the Jillawarra Formation to overlie the Kiangi Creek Formation, but to also be laterally equivalent to, and interfinger with, all stratigraphic units down to the top of the Irregully Formation. In this sense, all argillaceous strata between the Irregully and Discovery Formations were mapped as Jillawarra Formation. Because of these conflicting views, the name Jillawarra Formation is not used in our present scheme, these rocks being assigned instead to three separate units: the Blue Billy, Kiangi Creek, and Muntharra Formations.

A consequence of Muhling and Brakel's (1985) correlation of the Jillawarra and Backdoor Formations was that they considered all units between the Jillawarra Formation and Fords Creek Shale to be laterally equivalent. No such correlation is implied by our stratigraphic scheme, since we assign the Backdoor Formation and rocks equivalent to the Jillawarra Formation to the Collier and Edmund Groups respectively.

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