

## DISCUSSION AND CONCLUSIONS

The main attributes of ERTS imagery are:

- (1) They are small-scale
- (2) They approximate closely to orthophotos
- (3) The imagery is multispectral
- (4) They present repetitive coverage under constant sun angle and constant image processing.

Factors 1 and 4 enable very large tracts of the earth's surface to be viewed under constant conditions, without the patchwork quilt effect of conventional mosaics. Factor 2 enables imagery to be compared directly with geological maps. However, it should be pointed out that at smaller scales, involving larger areas, projection problems will arise. Factor 3 in itself is not of any advantage for the type of application envisaged here, although it has been noted that certain bands have their individual uses. It is acknowledged here that no attempt has been made to adequately assess the value of the multi-spectral factor by using colour composites. It is concluded that the greatest value of ERTS lies in the overview that the satellite coverage allows.

The most significant contribution lies in demonstrating large strike faults. These structures have previously been postulated, mainly on negative evidence, and only in a few cases has their presence been established. Strike trends which serve to outline these faults are more perceptible on MSS 6 and 7, than on the other two bands. In the context of regional fault and lineament analysis the ERTS data are more useful than conventional photomosaics, especially at the continental scale. In this respect it would be an extra

tool of the regional geologist that would complement, rather than replace, photogeology and other forms of remote sensing such as aeromagnetics. The imagery gives only a broad guide to first-order block distribution and at the reconnaissance stage has little to recommend it over the more conventional methods employing areal photomosaics and aeromagnetic maps. No routine day to day use of ERTS imagery can be envisaged at this stage.

These conclusions are intended to apply only to the Kalgoorlie test area; however they do accord with other ACERTS investigations, and other studies, reported in the Weekly Abstracts of the National Technical Information Service of the U.S. Department of Commerce. Examination of other parts of the State indicates a varying potential use for ERTS imagery. For example, in the forested and cultivated areas of the southwestern portion of the Yilgarn Block, no lithological and very little structural information is extractable, whereas in the Pilbara Block the patterns of post-granite mafic dykes, and the shape of the granite domes with their delicately scalloped edges is depicted with superior clarity on the imagery than on small-scale mosaics.

## REFERENCES

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- Williams, I. R., 1970, Kurnalpi, W.A.: West. Australia Geol. Survey 1:250 000 Geol. Series Explan. Notes.
- 1974, Structural subdivision of the Eastern Goldfields Province, Yilgarn Block: West. Australia Geol. Survey Ann. Rept. 1973, p. 53-59.

## DEFINITIONS OF NEW AND REVISED STRATIGRAPHIC UNITS OF THE EASTERN PILBARA REGION

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### ABSTRACT

New and revised stratigraphic units of the eastern Pilbara region, Western Australia, are formally defined. They are the Archaean Warrawoona Group (mainly a volcanic sequence), its two principal divisions the Talga Talga and Salgash Subgroups, and its formations (Duffer Formation, Marble Bar Chert, Kelly, Panorama and Wyman Formations), the Boobina Porphyry, and the Gorge Creek Group (dominantly a sedimentary sequence) the Soansville Subgroup, and five of the Group's formations (Corboy and Paddy Market Formations, Honeyeater Basalt, Budjan Creek Formation and Lalla Rookh Sandstone); the Lower Proterozoic Tumbiana Formation (Fortescue Group) and two members (Mingah Tuff and Meentheena Carbonate) and the Lower Proterozoic Spinaway Porphyry.

### INTRODUCTION

This report describes and formally defines new and revised stratigraphic units in the Archaean and Lower Proterozoic rocks of the eastern Pilbara region, made necessary as a result of regional mapping of the Marble Bar 1:250 000 Sheet area. Descriptions of the regional geology, including

that of various Archaean granitic plutons named during mapping, but omitted from this report, are given by Hickman and Lipple (1974, see particularly Fig. 3). Although initially defined for the Marble Bar 1:250 000 Sheet area, the units are applicable to the eastern Pilbara region generally. Additional stratigraphic and plutonic units occurring only in the Nullagine 1:250 000 Sheet area are described by Hickman (in prep.).

Discussion of earlier Archaean stratigraphic nomenclature in the Pilbara region is given by Ryan (1964, 1965). Development of the stratigraphic subdivision of the Pilbara region may be seen by comparison of the earliest scheme presented by Maitland (1908, frontispiece), the subdivision of Noldart and Wyatt (1962, 1:500 000 geological structure map of the Pilbara region), and that of this report.

The Archaean layered succession is divided into a lower, dominantly volcanic suite, the Warrawoona Group and an Upper (locally unconformable), mainly clastic sedimentary suite, the Gorge Creek Group. The constituent subdivisions, together with some previous stratigraphic schemes, are given in Table 9. For convenience, an intrusive metamorphosed Archaean porphyry, the Boobina Porphyry, is described with the Warrawoona Group.

TABLE 9. GENERALIZED STRATIGRAPHY OF THE ARCHAEOAN LAYERED SUCCESSION

Group	Subgroup	Formation			Maximum Thickness (km)	Lithology	Former Stratigraphic Divisions			
Gorge Creek Group		1	2	3	2-3	1 and 2. Sandstone and conglomerate	Mosquito Creek Beds (Maitland 1906)	Gorge Creek Formation of Low (1965) = Lalla Rookh Sandstone and Paddy Market Formation (jaspilites) Series (Maitland, 1908; David, 1950, p. 4; Finucane, 1953; Ryan 1964). 'Series' (Low, 1965) System (Fairbridge, 1953, Chap. I, p. 33, Ryan, 1964) Succession/succession (Noldart and Wyatt, 1962, p. 14, 47, 100-101, 105-107; Ryan, 1964-1965)—Middle Creek Formation; Eastern Creek Formation = Gorge Creek Formation (Low, 1965, Ryan, 1964, 1965) = Dromedary conglomerate; Budjan Creek Formation.		
		Lalla Rookh Sandstone	Budjan Creek Formation	Mosquito Creek Formation*	5-10	3. Mainly turbidities, generally schistose, local conglomerate and sandstone near the base				
		Honeyeater Basalt			0-1	Pillow Basalt				
	Soanesville Subgroup	Paddy Market Formation			1	Banded Iron Formation and ferruginous clastic sedimentary rocks	Cleaverville Formation (Ryan, 1964, 1965)	Cleaverville Formation of Ryan (1964, 1965) = jaspilite unit (Paddy Market Formation) in Gorge Creek Formation of Low (1965).		
		Charteris Basalt*			0-1	Pillow Basalt				
		Corboy Formation			1-2	Quartzite, sandstone and psammopelitic sedimentary rocks				
Warrawoona Group		Wyman Formation			1	Porphyritic, columnar-jointed rhyolite	Warrawoona Beds (Maitland, 1905, 1908)	Regal Formation (Ryan, 1964, 1965):		
	Salgash Subgroup	— — —			2-3	Pillow basalt and chert				
		Panorama Formation		Kelly Formation	1	Dacitic lava tuff and agglomerate and chert with local sandstone and conglomerate				
		— — —			3-5	Pillow basalt and chert				
		Marble Bar Chert			0.1	Banded Chert				
		— — —			0-0.3	Pillow Basalt				Warrawoona Beds (Maitland, 1908—see frontispiece for best illustration of his stratigraphic divisions) 'Series' (Maitland, 1908; Finucane, 1953) 'Series' (Low, 1965) System (Fairbridge, 1953, Chap. I, p. 33) Succession/succession (Noldart and Wyatt, 1962; Ryan, 1964, 1965)
		Duffer Formation			5-8	Dacitic agglomerate				
	Talga Talga Subgroup	— — —			5-8	Basalt with subordinate ultramafic and chert units				

\* Not present in Marble Bar Sheet area.

— — — unnamed units

— V — V — unconformity

Pilbara System (Noldart and Wyatt, 1962) (Ryan, 1964, 1965 included granitic rocks also)

Roebourne Group (Ryan, 1964, 1965)

Warrawoona Beds (Maitland, 1905, 1908)

? relationship uncertain

Partly overlying the Warrawoona Group, with a moderate angular unconformity, is the Mosquito Creek Formation which at present is considered to be part of the Gorge Creek Group.

Within the Lower Proterozoic Fortescue Group, the Tumbiana Formation and two members are formally defined. An intrusive Lower Proterozoic porphyry, the Spinaway Porphyry, is described with the other Fortescue Group units because it occurs at a particular stratigraphic level in the group.

## ARCHAEOAN LAYERED SUCCESSION

A summary of the Archaean stratigraphic units is given in Table 9.

The Charteris Basalt and Mosquito Creek Formation are included in Table 9 for completeness, but are not defined here as they are restricted to the Nullagine Sheet area, and will be described by Hickman (in prep.).

It will be noted that the Talga Talga Subgroup is not divided into formations. Although units of formational status are present in the type area, more work is required to determine whether these can be extrapolated to other parts of the region.

For convenience cosanguineous igneous rocks, within the volcanic piles, are included as part of the units in which they occur.

### WARRAWOONA GROUP

*Derivation of name:* Warrawoona mining centre (latitude South—S, longitude East—E), (21° 20' 05" S, 119° 54' 25" E), 1 : 250 000 Marble Bar Sheet area.

*Definition:* The Warrawoona Group consists of the Talga Talga Subgroup; Duffer Formation; Salgash Subgroup includes Marble Bar Chert, Kelly and Panorama Formation; and the Wyman Formation (youngest).

*Lithology:* It consists mainly of volcanic rocks with subordinate ultramafic rocks, chert and clastic sedimentary rocks.

*Thickness:* Range, 5–20 km.

*Stratigraphic relations:* Lower margin intruded by, or faulted against, Archaean granitic rocks. Overlain both conformably and unconformably by the Gorge Creek Group.

*Age:* Archaean, as intruded by Archaean granitic rocks (dated in the Mooyella area by de Laeter and Blockley (1972) at  $3\,125 \pm 366$  m.y.). Felsic porphyry, from Copper Hills mine, dated by de Laeter and Trendall (1970) at  $2\,880 \pm 66$  m.y.

*Synonymy:* The term, Warrawoona Group, supercedes "Warrawoona Succession" of Noldart and Wyatt (1962, p. 14, 47, 100–101, 107–117) and "Warrawoona Beds" of Maitland (1908, p. 155, 156, 161, 162, 284, 286, 287) and "Warrawoona Series" of Maitland (1908, p. 156), Finucane (1953), and Ryan (1964, 1965).

### Talga Talga Subgroup

*Derivation of name:* Talga Talga mining centre (21° 0' 10" S, 119° 48' 15" E), Marble Bar 1 : 250 000 Sheet area.

*Type area:* Near Talga Talga mining centre, from the granite contact westwards through the mining centre almost to the Coongan River.

*Lithology:* In the type area, the Talga Talga Subgroup consists of a lower pillow basalt sequence containing some stratiform and some lensoid ultramafic units, overlain by a thin sequence of intercalated basalt, siltstone and chert. The chert is overlain by a stratiform, ?vesicular brecciated ultramafic layer, then a thick monotonous sequence of pillow basalt with minor thin chert horizons. The basalt may be quite vesicular, even scoriaceous. The upper margin is marked locally by a thin siltstone. Elsewhere the subgroup consists essentially of pillow basalt with associated minor felsic volcanic, ultramafic and sedimentary rocks.

*Thickness:* Maximum, 5–8 km.

*Stratigraphic relations:* The Talga Talga Subgroup is the lowest exposed portion of the Warrawoona Group. It is intruded by Archaean granitic rocks along the lower margins and conformably overlain by lavas and pyroclastic rocks of the Duffer Formation.

### Duffer Formation

*Derivation of name:* Duffer Creek (21° 7' 20" S, 119° 45' 35" E) Marble Bar 1 : 250 000 Sheet area.

*Type area:* The area north of Marble Bar town-site, extending westwards from the lower reaches of the Duffer Creek, across the Coongan River to the base of the ranges west of the river. The formation is well exposed around Marble Bar town-site and along the banks of the Coongan River.

*Lithology:* A volcanic pile of predominantly dacite lava, tuff and agglomerate. Pyroclastic rocks are a feature of this formation. Dacite lava is massive to schistose and may be vesicular or porphyritic. Intercalations of pillow basalt, tuff and agglomerate are also present, particularly in the northern portion of the Marble Bar Belt, and some sedimentary rocks are common throughout the sequence. Minor porphyritic intrusions also occur. Thin cherts are present in the upper part of the succession.

*Thickness:* Maximum, 5–8 km.

*Stratigraphic relations:* The Duffer Formation conformably overlies pillow basalt of the Talga Talga Subgroup and conformably underlies the pillow basalt and cherts of the Salgash Subgroup. The Marble Bar Chert or Chinaman Pool chert locally form the stratigraphic unit overlying the Duffer Formation.

*Synonymy:* Noldart and Wyatt (1962, p. 88–89) refer without definition to a series of feldspar porphyry dykes as the "Duffer's Creek Porphyry". They mapped the steeply-dipping Archaean volcanic rocks to the north of the Coongan River—Duffer Creek junction as Proterozoic porphyry flows, suggested that the dykes were feeders, and implied that the flows were also part of the Duffer Creek Porphyry. The porphyry dykes were noted by Maitland (1908, p. 7, 19 and 205) as intruding Archaean basalt but were not named by him. He described the area west of the Coongan River as agglomerate, not porphyry as shown by Noldart and Wyatt (1962). The nature of rocks on the adjacent Port Hedland 1 : 250 000 Sheet (Low, 1965, p. 10), also mapped as Proterozoic porphyry, is uncertain. These may actually be partly an extension of the Archaean volcanic rocks in the Marble Bar Sheet area, herein defined as belonging to the Duffer Formation, or, more probably, are equivalent to the Lower Proterozoic Bamboo Creek Porphyry exposed on the Nullagine 1 : 250 000 Sheet (Noldart and Wyatt, 1962; and Hickman, in prep.). De la Hunty (1963, p. 26–27, 32; and 1964, p. 13) also used the name for rocks on the Balfour Downs 1 : 250 000 Sheet area.

As the name "Duffer" was previously used without adequate description or definition, it is re-applied to the suite of Archaean volcanic rocks which dominate the area that Noldart and Wyatt incorrectly show as Proterozoic porphyry, and which they imply is the main outcrop area of the "Duffer Creek Porphyry".

Hickman and Lippie (1974) have shown that the rocks in the Copper Hills area referred to, but not strictly defined, by Noldart and Wyatt (1962, p. 108, 192–193, Plate V) as "Copper Hills Porphyry", are actually Archaean felsic rocks of the Duffer Formation.

### Salgash Subgroup

*Derivation of name:* Salgash mining centre (21° 16' 45" S, 119° 47' 35" E), Marble Bar 1 : 250 000 Sheet area.

*Definition:* The Salgash Subgroup consists of the Marble Bar Chert, the Chinaman Pool chert (an informal name), the Panorama and Kelly Formations (lithostratigraphically equivalent) and other unassigned volcanic rocks.

**Type area:** The type area is between Camel Creek and Salgash. The subgroup is also well exposed along Chinaman Creek, west of Marble Bar and in the North Pole Dome, southwest of North Pole.

**Lithology:** The unit consists of approximately 2 km of lower basalt lavas, commonly pillowed with intercalated chert horizons; 1 km of dacite lava tuff and agglomerate with local sedimentary rocks (Panorama Formation and Kelly Formation); and about 0.5-1 km of upper basalt lavas, commonly pillowed with intercalated chert horizons; and minor felsic volcanic and ultramafic units.

**Thickness:** The unit has variable thickness, between 1-8 km, due partly to variation in original depositional thickness, and partly to tectonic thinning.

**Stratigraphic relations:** The subgroup conformably overlies the Duffer Formation and underlies the Wyman Formation. The upper margin is locally unconformable, as in the Kelly Belt. A distinctive association of closely spaced, thick chert units, including the Marble Bar Chert and Chinaman Pool chert within the pillow basalt, occurs at the base of the subgroup. This association has been recognised from the Pilgangoora Syncline to McPhee Dome.

#### Marble Bar Chert

**Derivation of name:** The Marble Bar (21° 8' 50" S, 119° 42' 40" E), Marble Bar 1 : 250 000 Sheet area. This is the popular name given to the chert where it crops out in the Coongan River, and from which the adjacent pool and nearby township derive their names.

**Type area:** The Marble Bar, in the Coongan River, 5 km southwest of the Marble Bar township.

**Lithology:** The Marble Bar Chert is a colourful red and white banded chert exhibiting local hydroplastic brecciation with injection veins of massive dark grey chert. The chert is illustrated by Maitland (1908, Figs. 45-48) and Noldart and Wyatt (1962, p. 108-109).

**Thickness:** 100 m.

**Stratigraphic relations:** The unit occurs conformably within the Salgash Subgroup at, or near, the contact with the underlying Duffer Formation.

**Synonymy:** The same unit was referred to by Noldart and Wyatt (1962, p. 114-116) as the Marble Bar Jaspillite. It was also described by Maitland (1908, p. 19, 204).

#### Panorama Formation

**Derivation of name:** Panorama Ridge, which is a prominent ridge extending about 22 km west from 21° 15' 10" S, 119° 30' 10" E to 21° 16' 0" S, 119° 17' 30" E, Marble Bar 1 : 250 000 Sheet area.

**Type area:** Panorama ridge, in the area 6 km northeast from North Shaw mining centre.

**Lithology:** Dacite lava, tuff and agglomerate are dominant in the western portion. The lava is generally massive but may be vesicular or porphyritic. Minor sedimentary rocks including shale, sandstone and conglomerate, are intercalated within the volcanic sequence. Banded cherts including red and white, grey and white, black and white, and green varieties are prominent. In the eastern portion of the formation, sandstone, grit and conglomerate become dominant. The conglomerate contains abundant clasts of chert, dacite, vein quartz and rare basalt. Current stratification is common in the sandstone and grit units.

**Thickness:** Maximum 1 km.

**Stratigraphic relations:** The Panorama Formation is a lenticular volcanic-sedimentary rock sequence occurring conformably within unassigned pillow basalt of the Salgash Subgroup. The volcanic and sedimentary rocks exhibit an interfingering contemporary facies relationship with some contribution from the volcanic pile to the adjacent sedimentary deposits. A similar felsic volcanic-conglomerate unit in the North Shaw Belt is correlated with the Panorama Formation. The Panorama and the Kelly Formations are equivalent.

#### Kelly Formation

**Derivation of name:** Kelly copper mine (21° 47' 30" S, 119° 52' 05" E), Marble Bar 1 : 250 000 Sheet area.

**Type area:** Three km southwest of Kelly copper mine.

**Lithology:** The Kelly Formation consists of porphyritic and vesicular dacite lavas, tuff and agglomerate with some porphyritic dacite sills and minor chert horizons. Some of the dacite lavas exhibit columnar jointing.

**Thickness:** Maximum 1 km.

**Stratigraphic relations:** The Kelly Formation is a felsic volcanic pile interfingering with the conformably surrounding unassigned pillow basalts of the Salgash Subgroup. It is equivalent to the Panorama Formation, and is overlain unconformably by the Wyman Formation.

#### Wyman Formation

**Derivation of name:** Wymans Well (21° 17' 45" S, 119° 47' 05" E), Marble Bar 1 : 250 000 Sheet area.

**Type area:** The type area is along Camel Creek, south of Wymans Well where the Formation occurs in rugged orange coloured hills, and near Fieldings Gully. The unit is also well exposed in the upper reaches of Budjan Creek.

**Lithology:** The formation typically consists of massive to schistose, flow banded, porphyritic rhyolite, locally with notable columnar jointing. It also contains felsic tuff and agglomerate and minor basalt lava and agglomerate in the Soanesville Belt. The columnar jointing is well illustrated by photographs in Noldart and Wyatt (1962, p. 108-109).

**Thickness:** Maximum, about 1 km.

**Stratigraphic relations:** Conformably overlies the Salgash Subgroup in the Warrawoona Syncline.

Unconformably overlies the Salgash Subgroup in the Kelly Belt and is there unconformably overlain by the Budjan Creek Formation. It is unconformably overlain by the Soanesville Subgroup in the Soanesville Belt.

**Synonymy:** Rocks of this unit in the Wymans Well and Upper Budjan Creek areas were described by Noldart and Wyatt (1962, p. 108-109, 192 and Fig. 43, 44) as belonging to the "Copper Hills Porphyry".

#### Boobina Porphyry

**Derivation of name:** Boobina Creek (21° 41' 35" S, 119° 56' 55" E), Marble Bar 1 : 250 000 Sheet area.

**Type area:** The Boobina Porphyry and its relationships with surrounding rocks may be readily observed along the Corunna Downs road 2-3 km Northwest from Copper Hills. It is also well exposed along the road between Copper Hills and Kelly, near 21° 41' 35" S, 119° 56' 55" E.

**Lithology:** A weakly metamorphosed dacite porphyry with a dark grey-green, purple or black aphanitic groundmass. Euhedral to subhedral phenocrysts constitute about sixty percent of the rock and are principally plagioclase (An<sub>30</sub>) and quartz with lesser amounts of biotite. Plagioclase laths often form glomeroporphyritic groups. The larger phenocrysts are the more altered. In the area south of Kelly, instead of biotite, the porphyry contains altered hornblende. The colourless matrix of the rock is too fine for microscopic identification, but is probably a quartz-feldspathic aggregate. The texture is consistent with devitrification of glass or metamorphic recrystallization of an extremely fine groundmass.

**Rock relationships:** The Boobina Porphyry intrudes the Talga Talga Subgroup and Duffer and Kelly Formations. It is intruded by the probably late Archaean Mondana Adamellite which contains abundant xenoliths of the porphyry. The porphyry exhibits a low grade regional metamorphism similar to adjacent Archaean layered succession. In the Kelly area the porphyry is intruded by several white, fine-grained, quartz-feldspar porphyry dykes. The unit is faulted against the Duffer Formation and some faults and shears within the porphyry are quartz-filled and contain copper mineralization.

**Structure:** The two masses cropping out northwest and southwest of Copper Hills may be connected in depth.

**Synonymy:** The "coarse-grained feldspar porphyry . . . to fine-grained black feldspar porphyry" of Noldart and Wyatt (1962, p. 193 and Plate V), corresponds to the mass herein defined as the Boobina Porphyry.

The material dated at  $2880 \pm 66$  m.y., by de Laeter and Trendall, 1970, as Copper Hills Porphyry, in thin section closely resembles the Boobina Porphyry.

#### GORGE CREEK GROUP

**Derivation of name:** Gorge Creek ( $20^{\circ} 51' 25''$  S,  $119^{\circ} 30' 55''$  E) which crosses the Great Northern Highway, about 1 km west of Farrell Well, Port Hedland 1 : 250 000 Sheet area.

**Definition:** The Gorge Creek Group consists of the Soanesville Subgroup (Corboy Formation, Charteris Basalt and Paddy Market Formations), Honeyeater Basalt, the coequivalent Lalla Rookh Sandstone and Budjan Creek Formation and the Mosquito Creek Formation.

**Lithology:** It consists mainly of sandstone, grit, conglomerate, argillaceous sedimentary rock, banded iron formation and minor basalt.

**Thickness:** Maximum, 5-8 km.

**Stratigraphic Relations:** Conformably (locally unconformably) overlies and folded with the Warrawoona Group. Relationships with the Warrawoona Group often obscured by regional slides. Unconformably overlain by the Lower Proterozoic Fortescue Group. Intruded by Archaean granitic rocks.

**Synonymy:** The term, Gorge Creek Group, supersedes "Gorge Creek Formation" of Low (1965, p. 8), Kriewaldt and Ryan (1967, Table 2), Noldart and Wyatt (1962, p. 105-106), and Ryan (1964 and 1965).

#### Soanesville Subgroup

**Derivation of name:** Soanesville mining centre ( $21^{\circ} 31' 50''$  S,  $119^{\circ} 10' 55''$  E), Marble Bar 1 : 250 000 Sheet area.

**Definition:** The Soanesville Subgroup consists of the Paddy Market Formation (youngest) and the Corboy Formation, and unassigned sedimentary and volcanic rocks in the Soanesville Belt. Southwest of Yandicoogina mining centre, basaltic volcanic rocks (Charteris Basalt) occur between the Paddy Market Formation and the Corboy Formation.

**Lithology:** The subgroup includes sandstone, siltstone, ferruginous shale, banded iron formation and pillow basalt. Ultramafic and gabbroic sills intrude the formation.

**Thickness:** Maximum, 5-8 km.

**Stratigraphic relations:** Conformably overlain by Honeyeater Basalt, and both conformably and unconformably overlies the Wyman Formation, Salgash Subgroup and Talga Talga Subgroup.

In the Soanesville Belt unassigned rocks of the subgroup are unconformably overlain by a thin, flatlying sequence of felsic lavas, centred on  $21^{\circ} 22' 53''$  S,  $119^{\circ} 07' 20''$  E, which have not been assigned to any named unit. The connection of the unassigned Soanesville Subgroup sedimentary rocks with the Corboy Formation, farther north, is obscured by structural complexity and further study is required to elucidate its nature.

#### Corboy Formation

**Derivation of name:** Corboy mining centre ( $21^{\circ} 44' 30''$  S,  $119^{\circ} 39' 25''$  E), Marble Bar 1 : 250 000 Sheet area.

**Type area:** Around the Corboy mining centre in the Coongan Syncline.

**Lithology:** The unit consists mostly of quartzite, sandstone and psammopelitic sedimentary rocks. There are minor felsic volcanics and ultramafic rocks in the southern portion of the formation, and basalt, usually pillowed, in the northern portion.

**Thickness:** 1-2 km.

**Stratigraphic relations:** The relationships of the Corboy Formation to the surrounding units is in many places obscured by regional slides. It conformably overlies the Wyman Formation and conformably underlies the Paddy Market Formation.

#### Paddy Market Formation

**Derivation of name:** Paddy Market Creek ( $21^{\circ} 22' 55''$  S,  $119^{\circ} 15' 15''$  E), Marble Bar 1 : 250 000 Sheet area.

**Type area:** The unit is well exposed in a gorge cut by Paddy Market Creek through a prominent ridge at  $21^{\circ} 22' 55''$  S,  $119^{\circ} 15' 15''$  E. It is also well exposed east of Split Rock homestead and north of Honeyeater Creek ( $21^{\circ} 13' 30''$  S,  $119^{\circ} 14' 50''$  E). Ferruginous shale is prominent in the area north of Honeyeater Creek.

**Lithology:** Banded iron formation, shale and ferruginous sandstone and siltstone.

**Thickness:** Maximum, about 1 km.

**Stratigraphic relations:** Conformably underlies the Honeyeater Basalt and conformably overlies the Corboy Formation.

**Synonymy:** The Cleaverville Formation of Ryan (1964, 1965) is equivalent to jaspilites of the Gorge Creek Formation of Low (1965) and these are synonymous with the Paddy Market Formation.

#### Honeyeater Basalt

**Derivation of name:** Honeyeater Creek (which crosses the unit at  $21^{\circ} 14' 00''$  S,  $119^{\circ} 15' 55''$  E) Marble Bar 1 : 250 000 Sheet area.

**Type area:** Adjacent to Honeyeater Creek.

**Lithology:** The Honeyeater Basalt consists of a monotonous sequence of variolitic, amygdaloidal and pillowed basalt.

**Thickness:** 0.5 km.

**Stratigraphic relations:** Conformably overlies the sedimentary rocks of the Soanesville Syncline and the Paddy Market Formation in the Lalla Rookh Syncline. Conformably overlain by the Lalla Rookh Sandstone.

#### Lalla Rookh Sandstone

**Derivation of name:** Lalla Rookh mining centre ( $21^{\circ} 03' 10''$  S,  $119^{\circ} 16' 35''$  E), Marble Bar 1 : 250 000 Sheet area.

**Type area:** In the Lalla Rookh Syncline, south-eastwards from near the Lalla Rookh mining centre.

**Lithology:** Sandstone and conglomerate, usually well bedded and locally showing cross-stratification and ripple marks.

**Thickness:** Maximum 2-3 km.

**Stratigraphic relations:** The Lalla Rookh Sandstone conformably overlies the Honeyeater Basalt. Some local unconformities with the other Warrawoona Group are notable. Equivalent to the Budjan Creek Formation.

#### Budjan Creek Formation

**Derivation of name:** Budjan Creek ( $21^{\circ} 50' 30''$  S,  $119^{\circ} 52' 05''$  E), Marble Bar 1 : 250 000 Sheet area.

**Type area:** The unit is well exposed in gorges cut by the upper reaches of Budjan Creek.

**Lithology:** The basal conglomerate, containing chert, vein quartz and dacite clasts, is overlain by shale, siltstone and sandstone units and capped by a thick conglomerate containing angular chert clasts.

**Thickness:** Exposed thickness is between 1-1.5 km.

**Stratigraphic relations:** Unconformably overlies Wyman Formation and Salgash Subgroup. Upper margin partly concealed by unconformable cover of Lower Proterozoic Fortescue Group, and partly faulted against divisions of the Warrawoona Group. Equivalent to Lalla Rookh Sandstone.

**References:** Noldart and Wyatt (1962), Kriewaldt (1964), Low (1965), Ryan (1964, 1965, 1966), Ryan and Kriewaldt, (1964).

## LOWER PROTEROZOIC FORTESCUE GROUP

### Tumbiana Formation

*Derivation of name:* Tumbiana Pool in the Nullagine River (21° 14' 30" S, 120° 29' 20" E), Nullagine 1 : 250 000 Sheet area.

*Type area:* From Pelican Pool (21° 20' 25" S, 120° 21' 25" E) to 3 km northeast on the Nullagine River.

*Lithology:* Upper carbonate member lower tuff member.

*Thickness:* At Meentheena, about 200 m. In Marble Bar Sheet area about 50 m.

*Stratigraphic relations:* Part of Lower Proterozoic Fortescue Group. Conformably overlies Kylene Basalt. Conformably overlain by Nymerina Basalt. Subdivided into Meentheena Carbonate Member and Mingah Tuff Member.

*Synonymy:* Original name, "Tumbiana Pisolite" (Noldart and Wyatt, 1962, p. 80).

### Mingah Tuff Member

*Derivation of name:* Mingah Well, Meentheena Station (21° 18' 30" S, 120° 25' 05" E), Nullagine 1 : 250 000 Sheet area.

*Type area:* Pelican Pool (21° 20' 25" S, 120° 21' 25" E) on the Nullagine River.

*Lithology:* Basaltic to intermediate tuff. Minor siltstone, mudstone and basalt. Has characteristic pisolitic texture in places, and ripple marks locally. Thin carbonate overlain by basalt (30 m thick) occur near the middle of the sequence.

*Thickness:* 150 m at Pelican Pool.

*Stratigraphic relations:* Underlies Meentheena Carbonate Member, conformable overlies Kylene Basalt.

*Structure:* Sheet-like.

### Meentheena Carbonate Member

*Derivation of name:* Meentheena homestead (21° 18' 23" S, 120° 26' 03" E), Nullagine 1 : 250 000 Sheet area.

*Type area:* 3 km northeast of Pelican Pool (21° 20' 25" S, 120° 21' 25" E).

*Lithology:* Ripple-bedded dark grey siliceous carbonate rocks, containing algal stromatolites and syndepositional slump structures.

*Thickness:* 20 m.

*Stratigraphic relations:* Underlies Nymerina Basalt, overlies Mingah Tuff Member.

*Structure:* Sheet-like (Krynine's classification, 1948). Member extends from the Gregory Range into the Pyramid 1 : 250 000 Sheet area.

### Spinaway Porphyry

*Derivation of name:* Spinaway Well, Nullagine 1 : 250 000 Sheet area (21° 36' 45" S, 120° 3' 20" E).

*Type area:* The Spinaway Porphyry is well exposed 18 km south of Spinaway Well near the Great Northern Highway.

*Lithology:* It is a coarse-grained plagioclase quartz dacite porphyry with abundant euhedral calcic oligoclase phenocrysts and quartz phenocrysts set in a dark blue-black quartz-feldspathic groundmass. Opaque minerals, secondary sphene and numerous small apatite crystals are associated with chlorite pseudomorphing original pyroxene. There are pleochroic haloes due to ?allanite and zircon. Secondary sericite, calcite and epidote are common. Further description of the Spinaway Porphyry is given by Hickman (in prep.).

*Stratigraphic relations:* Intrusive sill into the Hardey Sandstone of the Fortescue Group.

*Age:* Lower Proterozoic, as preliminary geochronological studies indicate an age of  $2124 \pm 195$  m.y. (Trendall, 1975).

*Synonymy:* Correlated with the Bamboo Creek Porphyry by Noldart and Wyatt (1962, p. 89).

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