DEPARTMENT OF MINES
SOUTH AUSTRALIA

THE POUND QUARTZITE: BONNEY SANDSTONE MEMBER AND RAWNSLEY QUARTZITE MEMBER

by

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ABSTRACT

The Bonney Sandstone Member and Rawnsley Quartzite Member of the Upper Proterozoic Pound Quartzite are defined and described in a section measured in Bunyeroo Gorge about 240 miles north of Adelaide, South Australia.

The Bonney Sandstone Member, previously known as the lower red member of the Pound Quartzite, is composed of reddish sandstone and siltstone, and is 1,000 feet (305m) thick in the type section. The overlying Rawnsley Quartzite Member is composed predominantly of white sandstones, contains in its lower part the Ediacara fauna recently reviewed by Mary Wade and is about 1665 feet (508m) thick. Both Members display a variety of sedimentary structures suggestive of shallow water conditions. To the north of the type section the members are readily identified in Brachina Gorge but not so readily in Parachilna Gorge.

INTRODUCTION

The purpose of this paper is to name and define the already known lower reddish and upper white members of the Upper Proterozoic Pound Quartzite, South Australia. This is largely at the suggestion of Mary Wade (1970) who has described the fossil fauna of the upper member and incidentally given much information on the lithology and distribution of the Pound Quartzite.

The term "Pound Quartzite" appears to have been used first by Mawson (1938, p. 255) who described a section just north of Parachilna Gorge. This section may thus be accepted as the type section of the Pound Quartzite, and

Dalgarno and Johnson (1966) have shown its approximate position (approximate because Mawson did not show the section line on a map) on the Parachilna 1:250,000 geological map. On this map the upper and lower members of the Pound Quartzite have been shown between Hawker and Parachilna: this is substantially in agreement with the subdivision proposed here and that which Mawson (1941) described. Mawson recognized the two members at Wilpena Pound in a section near St. Mary Peak.

Other authors who have more recently described the Pound Quartzite and commented on previous work are Goldring and Curnow (1967, upper member at Ediacara) and Reeson (1970, Beltana area). Dalgarno and Johnson (in Thomson et. al., 1964) discuss the Pound Quartzite in its setting in the Wilpena Group.

I am grateful to Dr. Mary Wade for her helpful suggestions during preparation of this text.

STRATIGRAPHY

General

In order to arrive at a useful subdivision of the Pound Quartzite a section was measured with tape and compass in Bunyeroo Gorge, about 36 miles north of Hawker, or 240 miles north of Adelaide, and sections examined further north in Brachina and Parachilna Gorges.

From evidence presented by Wade (1970) the Pound Quartzite in Parachilna Gorge is atypical (e.g. reddish beds occur extensively in the upper member), hence the type section of the members of the Pound Quartzite is that measured in Bunyeroo Gorge. This is described in detail in the Appendix with a less detailed description of the Pound Quartzite type section near Parachilna Gorge.

Since no previous workers have placed any limestones in the Pound Quartzite, the base of the Pound has been chosen above the limestones of the gradational interval between the typical Wonoka Formation and the overlying Pound.

Bonney Sandstone Member of the Pound Quartzite

The Bonney Sandstone Member is named after Point Bonney on the eastern edge of Wilpena Pound. The type section of the Member is Bunyeroo Gorge, approximate lat. 31°25'S. and long. 138°33'E. The Member is characterised by reddish sandstones, siltstone and quartzite, flaggy to medium bedded, which overly flaggy limestone and siltstone of the Wonoka Formation and underly the harder, more quartzitic white upper member of the Pound Quartzite. The Member is about 1,000 feet (305m) thick and dips about 55 degrees north-westerly. Harder sandstone or quartzite beds form prominent strike ridges.

The basal bed is reddish, micaceous silty sandstone which overlies a calcitic greyish or olive sandstone-siltstone sequence (Wonoka Formation) on limestone. The uppermost beds are pale reddish medium- and coarse-grained sandstones which are coloured differently from and are less prominently outcropping than the overlying basal sandstone bed of the upper member.

Rawnsley Quartzite Member of the Pound Quartzite

The Rawnsley Quartzite Member is named after Rawnsley Bluff, the south-eastern rampart of Wilpena Pound. The type section locality is as for the underlying Bonney Sandstone Member. Characteristic rocks are white or very light grey quartzite and sandstone; these form more prominent ridges than the underlying reddish sandstones of the lower member and the overlying softer white sandstone of the Cambrian Parachilna Formation. The Member is about 1665 feet (508m) thick.

The base of the Member is distinguished mainly by colour - white, as against the predominant red of the Bonney Sandstone. About 225 feet above the base, succeeding sandstone and quartzite beds, are flagstones, the lowest fossiliferous bed 3 of Wade (1970 Fig. 4, B). This is overlain by reddish sand-

stone and siltstone, then a thick sequence of sandstone and quartzite, the lowermost beds of which are fossiliferous while the higher beds form a prominent ridge. No fossils were found by the writer during measurement of the section, but Wade (1970, Table 1) lists indeterminate medusoids, Edicara flindersi Sprigg, a new species of medusoid and form B of Glaessner (1969).

Recognition elsewhere

The red and white members of the Pound Quartzite have been recognized widely in the Copley and Parachilna 1:250,000 areas and in the north-west and eastern part of the Orroroo 1:250,000 area, but a precise choice of boundary between the Members defined here is not always easy.

In Brachina Gorge, south side, pale reddish flaggy sandstone of the Bonney Sandstone Member is overlain by 7.3 feet (2.2m$_x$) of white sandstone, then a thick sequence of hard, more prominent white quartzite. Since the colour boundary here between red and white sandstones is irregular the base of the Rawnsley Quartzite Member is best placed at the base of the prominent quartzite.

In Parachilna Gorge and the section examined just north of there, choice of boundary is guided by position of the lowest fossiliferous beds and of lithologic correlation of pale reddish sandstones of unit No. 5, Parachilna Gorge, with unit No. 15, Bunyeroo Gorge (see figures). The Rawnsley Quartzite Member contains many more soft sandstones and red beds in Parachilna Gorge than in Bunyeroo Gorge.

Environment

Sedimentary structures in the Pound Quartzite have been noted in the Appendix (Bunyeroo Gorge Section) and include tabular and trough cross-beds, micro-cross-lamination, parting lineation, ripple marks, mud cracks, prints resembling rain prints, clay flakes, wavy bedding, flaser bedding (resembling

lenticular deposits in ripple troughs) and slump structures.

Prints like rain prints have only been found on loose flagstones and their orientation is yet to be proved. If correctly identified, they indicate subaerial exposure of muds. Mud cracks may also develop under these conditions, but none were seen at the level of the prints. Shrinkage of clay can occur under water, as indicated by White (1961; noted by Goldring and Curnow, 1967, p. 207). Flaser bedding may originate in a tidal flat environment (Reineck and Wunderlich, 1968). Troughs are commonly a few cm. deep, but one of 30 cm. depth was noted. Shallow marine, to possibly tidal flat, conditions are thus indicated.

Shore-line and current trends shown by ripple marks and cross-bedding vary widely. In the Bonney Sandstone Member there is a slight predominance of transport to the north-east while in the Rawnsley Quartzite Member it is to the south-east. Shore lines shown by ripple marks tend to trend both north-easterly and south-easterly in each Member. Not much significance can be attached to these results because of the few observations made.

BGF:CMH
2.3.1971.

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APPENDIX

In the descriptions below, quartzite refers to hard, prominently outcropping sandstones which may not all be quartzite in the strict sense; cross-beds refers to tabular cross-beds and the accompanying dimensions are the maximum thickness of the unit; ripple mark length is wave length or distance between adjacent ridges; beds refers to distance between joints which are parallel to bedding.

1. The Pound Quartzite in Bunyeroo Gorge.

The section was measured by tape and compass and thicknesses of beds calculated with the aid of tables by Mandelbaum and Sanford (1962). It includes the upper part of the Wonoka Formation which contains red beds very similar to the lower member of the Pound Quartzite. Below Unit 1 are limestones and shale. Colours have been described with reference to the Rock Colour Chart of the Geological Society of America.

Unit	Notes	Thickness feet (metres)
	Rawnsley Quartzite Member	
23	Quartzite, slightly clayey, white to very light grey, weathering reddish brown, pale brownish, generally medium-grained, some coarse-grained layers, laminated, 12 - 40 cm. cross-beds with transport approximately ?S, SE, W, ENE, 9-15 cm. trough cross-beds, ripple marks with length 1-4 cm. and restored trends approximately 010°, 045°, 120°, 135°, 180°, interference ripple marks, 1-2 cm. clay pellet cavities, 1 cm. white rounded concretions in upper part, good ½-25 cm. layering in upper part, beds 13-85 cm.; ridge forming - harder than the overlying white	

Unit	Notes	Thickness feet (metres)
	sandstones of the Parachilna Formation.	300 (91)
22	Quartzite, slightly clayey and slightly calcitic in part, white, very light grey, weathering pale brownish, medium- and coarse-grained, laminated, 4-40 cm. cross-beds, transport to SW, SE, ESE, 13-17 cm. trough cross-beds, clay pellet cavities up to 6 cm., beds 3-95 cm.; ridge-forming, upper part covered by colluvium.	510 (155)
21	Quartzite, clayey, slightly calcareous, white, pale brownish weathering, medium-grained, 2½ cm. clay pellet cavities, 10 cm. cross-bed, transport to SE, beds 3 cm. -2m; weathering pits, outcrop not as prominent or blocky as (20).	75 (23)
20	Quartzite with minor reddish coarse-grained sandstone, clayey, white, weathering pale brownish or greyish orange, medium and coarse-grained, laminated, bedding slightly lenticular or wedge-like, 6-25 cm. cross-beds with transport SE, SSE, raised circular ?concretionary structures, mud cracks, ripple marks with length 2½, 10 cm, one ripple trend 050°, current ripples indicate transport 290°, 330°, reddish sandstone 16-60 cm. troughs trend 020-030°, 1-3 cm. pale greenish grey shale pellets, 1-4 cm. rounded white concretionary patches, beds 2-80 cm; minor honeycomb weathering, ridge-former; the base is fossiliferous bed 6 (Wade, 1970).	475 (145)

Unit	Notes	Thickness feet (metres)
19	Sandstone, silty sandstone, siltstone, moderate reddish, pale to greyish red, fine grained, well laminated, bedding partly wavy and lenticular, 4 cm. trough cross-bed, beds 2mm. - 13 cm. averaging 1-2 cm.; valley side, northward extension of fossiliferous bed 5 (Wade, 1970).	25 (8)
18	Sandstone (flagstone), pale grey, pale reddish, weathering pale orange or yellowish grey, fine-grained, well-laminated, bedding slightly lenticular in places, slight cross-beds or troughs 1-2 cm., rare circular ?rain prints, flaggy, beds ½ - 12 cm.; outcrop on valley side east of prominent ridge, northward extension of fossiliferous bed 3 (Wade, 1970).	55 (17)
17a	(Considered to be equivalent to 17 and apparently not faulted, south side of Bunyeroo Gorge). Sandstone and quartzite, clayey, slightly calcitic in part, white, very pale brownish, very pale pinkish, coarse- and medium-grained, laminated, 25 and 35 cm. cross-beds with transport south-easterly, wavy bedding, penecontemporaneous faults, beds 1-60 cm.; weathering pits and honeycomb weathering, ridge-forming.	200 (61)
17	Sandstone and quartzite, clayey, white, weathering greyish-orange, very pale orange, coarse- and medium-grained, laminated, 5 cm. cross-bed with transport ?NE, 5 cm. trough cross-bed, minor layers of rounded 3 mm. quartz grains; honeycomb weathering, more	

Unit	Notes	Thickness feet (metres)
	blocky and prominent outcrop than (16), thickness uncertain because of faulting.	225 (69)
16	Sandstone, slightly clayey, slightly calcitic in part, white, yellowish grey, minor pale pink layers, weathering pale brownish, medium- and coarse-grained, laminated, 6-20 cm. cross-beds with transport ?NE and ?SE, one restored transport direction 130°, wavy bedding, flaser bedding, ripple marks with 3-4 cm. length and restored trends of 020° and 030°, beds 5 cm. - 1m; pitting and honeycomb weathering.	25 (8)
	Rawnsley Quartzite Member, units 16-23: Total thickness 1665 feet (508m).	
	Bonney Sandstone Member	
15	Sandstone, calcitic in part, ?feldspathic, very pale and darker reddish colour banding, in places moderate reddish with white patches and veins, medium-grained with coarse-grained lenses, laminated, wavy bedding, slump structures, apparent transport to SW, ENE and NE; 6-20 cm. cross-beds and trough cross-beds, somewhat massive and smooth-weathering; cave formation and pitting; 1 ft. medium-grained quartzite lens about 6 ft. below top.	165 (50)
14	Quartzite and sandstone, pale reddish and reddish, weathering pale reddish to dark grey, medium-grained, 40 cm. cross-bed, transport to	

Unit	Notes	Thickness feet (metres)
	?ENE, ripple marks with restored trend 150°, beds 3-50 cm.; slight ridge.	14 (4)
13	Siltstone and sandstone, similar to (11); poor outcrop.	47 (14)
12	Sandstone, feldspathic, pale reddish, medium grained, laminated, 60 cm. cross-bed, beds 60 cm.	2.3 (0.7)
11	Siltstone and flaggy sandstone, interbedded, medium reddish, fine- to medium-grained, laminated, 3 cm. trough cross-beds, beds 5 mm. - 9 cm.	33 (10)
10	Sandstone, feldspathic, micaceous, pale to moderate reddish, weathering reddish brown, grey, medium-grained, laminated, cross-beds 2 cm. to 1 m., trough cross-beds 1-30 cm., beds 1 cm. - 1m; ridge-forming, but poorly outcropping.	90 (27)
9	Sandstone, micaceous, feldspathic, silty, moderate red to greyish red, weathering light and dark reddish, fine to medium-grained, laminated, 4 cm. cross-beds, 1-2 cm. ripple cross-beds, ripple marks with restored trend 160°, beds 5 mm. - 20 cm.; poor outcrop in upper part.	155 (47)
8	Sandstone, feldspathic, micaceous, minor shaly sandstone, siltstone, reddish colour similar to (7), medium-grained, laminated, 10 cm. cross-bed, micro-cross-lamination, trough cross-bed 30 cm. by 3m. in section, nodules 1-2 cm., beds up	

Unit	Notes	Thickness feet (metres)
	to 65 cm.; ridge and slope.	200 (59)
7	Sandstone, slightly micaceous, feldspathic, moderate red and pale to greyish red bleached in patches to pale orange, weathering pale brownish and reddish, medium-grained, laminated, cross-beds 122 cm., 10 cm. and 50 cm. (trough) 1 cm. mud flakes; irregular to rounded ½ cm. concretionary nodules stand out on weathered surface; beds 5-70 cm.; ridge.	67 (20)
6	Partly covered interval, flaggy reddish siltstone and quartzite similar to (4); valley.	33 (10)
5	Sandstone, moderate reddish, weathering dark reddish and pale brownish, fine- to medium-grained, laminated, parting lineation with restored trend 170°, micro-cross-lamination, transport approximately NE and ?NW, beds 1-22 cm., ridge.	27 (8)
4	Sandstone, siltstone, finely micaceous in part, pale greenish grey, moderate red to greyish red, weathering greenish and reddish, fine- to medium-grained, laminated, ripple marks 7-10 cm. length and restored trend 085°, mud cracks, cross-bedding, minor 1 cm. sandy lenses, clay pellets up to 6 cm., beds 3 mm. - 5 cm.; valley and slope.	80 (25)

Unit	Notes	Thickness feet (metres)
3	Quartzite, finely micaceous in darker laminae, pale brownish to yellowish grey, pale brownish weathering, fine- to medium-grained, laminated, wavy and lenticular bedding, small-scale slump structures, beds 5 mm. to 8 cm.; valley edge.	2.3 (0.7)
2	Quartzite, pale reddish, weathering pale brownish grey, fine- to medium-grained, laminated, ripple marks with 2-4 cm. length and restored trends 20°, 045°, 110°, 3cm. cross-beds, mud cracks, 1 cm. clay flakes, beds 3-12 cm.; valley edge.	1.7 (0.5)
1	Sandstone, slightly micaceous, silty, pale reddish, fine- to medium-grained, well laminated, 2-4 cm. cross-beds, lenticular bedding, wavy bedding, small scale slump structures, ripple marks with 2-5 cm. length and restored trends 030°, 055°, mud cracks, 5 mm. -1cm. clay flakes, beds 2-30 cm.; slight ridge.	85 (26)
	Total thickness of Bonney Sandstone Member, units 1-15: 1002 feet (305 m).	
	Total thickness of Pound Quartzite: 2670 feet (815 metres).	
	Wonoka Formation	
	(Upper part only)	
10	Siltstone, sandstone, partly calcitic, finely micaceous, yellowish orange, greyish orange, olive grey, weathering brownish, becoming reddish and greenish in upper part, partly medium-grained	

Unit	Notes	Thickness feet (metres)
	laminated, 5 cm. cross-beds, beds 5 mm. - 8 cm.	26 (8)
9	Limestone, medium grey, weathering light grey, fine grained, laminated, wavy bedding slump structures, calcarenite, breccia, algal structures, beds 1-55 cm.	53 (16)
8	Siltstone, shale, sandstone, with interbedded limestone near top, greyish olive, light olive grey and yellowish, weathering light greenish, fine- to medium-grained, finely laminated, small scale cross-bedding, fissile to flaggy beds 3 mm. - 6 cm.	11 (3)
7	Sandstone, light greenish grey, fine- to medium-grained, faintly laminated in part, beds 8-33 cm.	3½ (1)
6	Sandstone similar to (5) but more massive, partly medium-grained, 25 cm. cross-bed, transport ?SW, 10 cm. mud crack polygons, ripple marks with 6-7 cm. length and restored trend 070°; minor coarse-grained pale greenish sandstone, pale reddish and white laminated medium-grained calcitic sandstone.	27 (8)
5	Sandstone, partly with fine micaceous siltstone laminae, pale red, greyish red, weathering reddish, fine-grained, 1 cm. cross-beds, transport to ?NE or E, 5 cm. shale pellets, 12 cm. mud crack polygons, ripple marks with 4 cm. length and restored trend easterly, beds	

Unit-	Notes	Thickness feet (metres)
	mostly flaggy, 1-75 cm.	31 (9)
4	Quartzite and sandstone with shaly laminae, micaceous, partly calcitic, light brownish, greenish grey, olive grey, weathering yellowish, reddish, dark brownish, fine-grained, laminated, ripple marks with 3-4 cm. length and restored trend 130°, wavy bedding, small scale cross-bedding, beds 3 mm. to 5 cm.	12 (4)
3	Quartzite, yellowish grey and very light grey, weathering yellowish orange, fine- to medium-grained, laminated, rare 1 cm. clay pellet cavities, 3 cm. cross-beds, 5-20 cm. beds, minor finely micaceous, pale reddish and yellowish siltstone interbeds; low ridge.	5½ (2)
2	Quartzite, similar to (1) but with thicker sandy lenses up to 7 cm.	1 (0.3)
1	Quartzite, slightly clayey, shaly, calcitic in lower part, light to medium brownish and yellowish grey, weathering light brownish, fine- to medium-grained, wavy dark lamination, lenticular bedding; east side of low, narrow ridge.	8½ (3)
2	The Pound Quartzite in a type section north of Parachilna Gorge (position as on Blimman 1:63,360 geological map).	
	The Pound Quartzite in the area examined is underlain immediately (under unit 1) by a	

Unit	Notes	Thickness feet (metres)
	thin limestone, then flaggy reddish sandstone and siltstone and further thicker limestone beds of the Wonoka Formation. The Pound Quartzite is overlain by softer, coarse-grained, clayey sandstone of the Parachilna Formation. Thicknesses are approximate and have been measured from an air photo (Blinman run 2, 9521, scale approximately 4,150 feet to 1 inch).	
	Rawnsley Quartzite Member	
9	Quartzite, partly clayey, white or very pale grey, medium- and coarse-grained, laminated, medium-bedded, cross-bedding; ridge former.	190 (58)
8	Sandstone and quartzite, clayey, white, very pale grey or pale pinkish, fine- to coarse-grained, laminated, flaggy, cross-bedding, ripple marks; minor thin, pale yellow green siltstone layers in lower part, generally softer than adjacent units and resembling (5); honeycomb weathering.	780 (238)
7	Quartzite, slightly clayey, white or pale pinkish, medium-grained, laminated, medium-bedded to flaggy, with minor reddish, flaggy siltstone and sandstone, clay pellet cavities, ridge-former.	160 (49)
6	Sandstone, similar to and grading into (5) but with harder white rippled or wavy bedded	

Unit	Notes	Thickness feet (metres)
	sandstone layers ½ - 1 cm. thick, becoming whiter in upper part, honeycomb weathering; forms an east-facing cliff.	60 (18)
	Total thickness of Rawnsley Quartzite Member 1190 feet (363 metres).	
	Bonney Sandstone Member	
5	Sandstone, softer, pale pinkish, medium and coarse-grained, laminated, partly flaggy, cross-bedding, smooth and massive outcrop in valley.	100 (30)
4	Quartzite (and poorly outcropping sandstone), slightly clayey, pale reddish, medium-grained, laminated, medium-bedded, clay pellet cavities, ripple marks, 2 cm. brown spots, 1-2 cm. white concretionary spots; ridge crest and upper western slope.	320 (97)
3	Sandstone, brownish-grey, and reddish, flaggy, clay pellet cavities; eastern side of ridge top.	70 (21)
2	Sandstone and quartzite, slightly clayey, paler reddish and more prominently outcropping than (1), medium-grained, laminated, flaggy to medium-bedded, cross-bedding, clay pellett cavities; upper, steep, east-facing, slope.	110 (33)

Unit	Notes	Thickness feet (metres)
1	Sandstone and siltstone, slightly micaceous, reddish, laminated, flaggy, poorly exposed on east-facing slope.	110 (33)
	Total thickness of Bonney Sandstone Member 710 feet (217 metres).	
	Total thickness of Pound Quartzite: 1900 feet (580 metres).	

24955

Photograph 9071: Cross-bedded sandstone layer in larger cross-bed unit, Bonney Sandstone Member, section unit 15, Bunyeroo Gorge.

24956

Photograph 9072L Minor trough structure showing slumping on left hand side. Just below trough is a coarse-grained sandstone layer. Bonney Sandstone Member, section unit 15, Bunyeroo Gorge.

24957

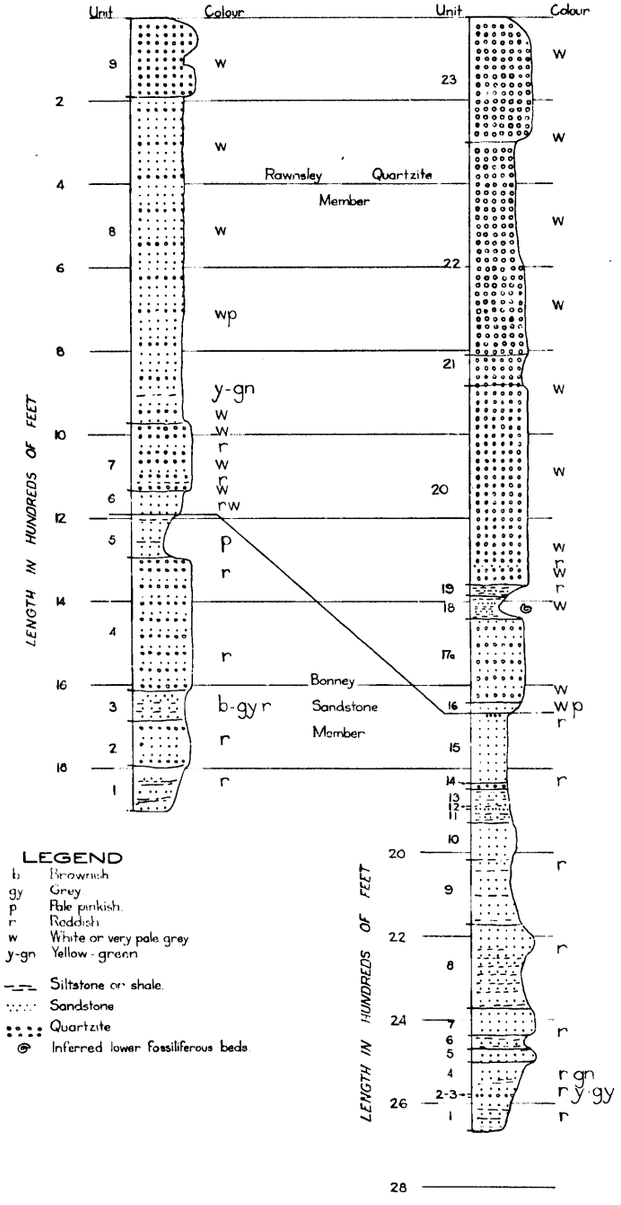
Photograph 9075: Ripple marks in partly coarse-grained quartzite, Rawnsley Quartzite Member, section unit 23, Bunyeroo Gorge.

24958

Photograph 9077: Well laminated medium- to coarse-grained quartzite, Rawnsley Quartzite Member, section unit 23, Bunyeroo Gorge.

POUND QUARTZITE

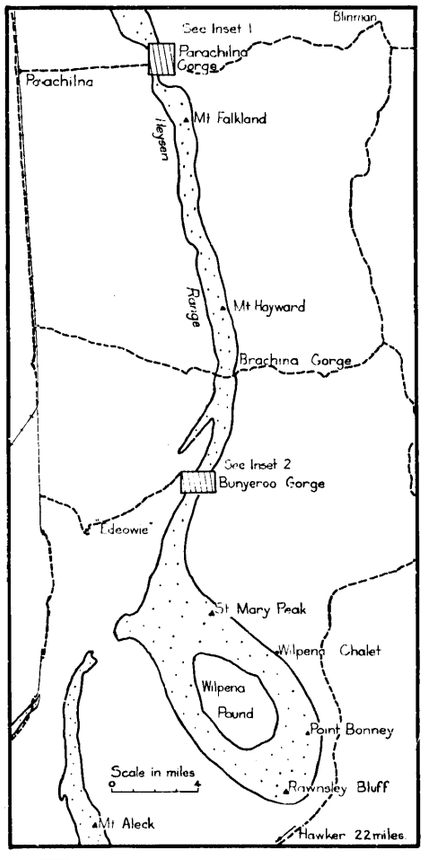
North of Parachilna Gorge — Bunyeroo Gorge



LEGEND

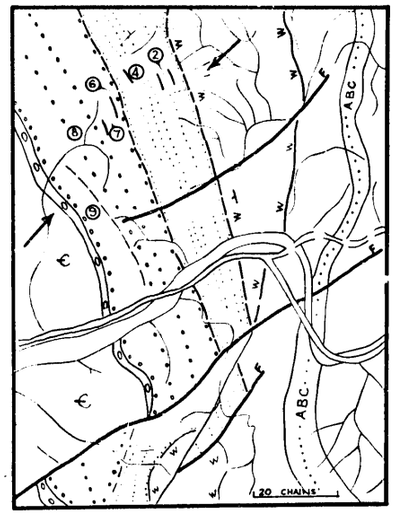
- b Brownish
- gy Grey
- p Pale pinkish
- r Reddish
- w White or very pale grey
- y-gn Yellow-green
- Siltstone or shale
- Sandstone
- Quartzite
- Inferred lower fossiliferous beds

LOCALITY PLAN

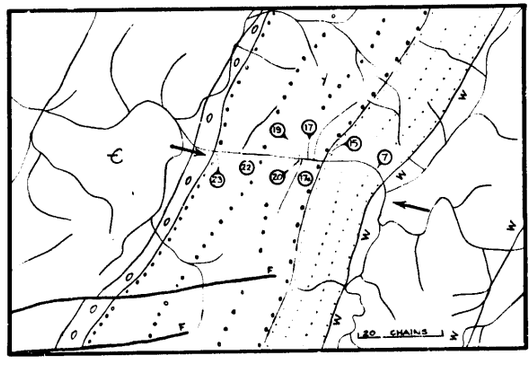


Pound Quartzite (After Dalgarno and Johnson 1966)

INSET 1



INSET 2



LEGEND

- Section examined
- ① Unit number
- € Cambrian
- Parachilna Formation (Cambrian)
- Rawnsley Quartzite Member
- Bonney Sandstone Member
- w w Wonoka Formation
- ABC ABC Range Quartzite
- Fault

After Dalgarno and Johnson 1966.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

BUNYEROO GORGE–PARACHILNA GORGE AREA

POUND QUARTZITE

STRATIGRAPHIC SECTIONS AND LOCATIONS

REGIONAL MAPPING SECTION	B.G. FORBES SENIOR GEOLOGIST	Drn. B.G.F.	SCALE: As Shown
		Tcd. S.J.C.	71-172 Fac
Director of Mines		Ckd. E.B.T.	
		Exd.	DATE: 5th FEB. 1971