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The geology of Bunyeroo, Brachina, and Parachilna Gorges

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Abstract: The Adelaidean succession exposed in the Flinders Ranges provides one of the most complete sedimentary records of the late Proterozoic found anywhere on earth (Preiss, 1987). Excellent exposures of the Wilpena Group stratigraphic units of the upper Adelaidean Rift Complex are bisected by three perpendicular gorges (Bunyeroo, Brachina and Parachilna or BB&P, respectively) immediately to the northwest of Wilpena Pound. This area is referred to as the ABC Range. The stratigraphic layers exposed in the gorges dip steeply to the west. As a result, walking up these gorges from east to west provides an excellent introduction to the time-sequence geology of the upper Adelaidean Rift Complex. The following section describes the stratigraphic units that are ncountered as one travels up sequence from east to west beginning at the base of the first hills that form the lower parts of these gorges (Figure 1).

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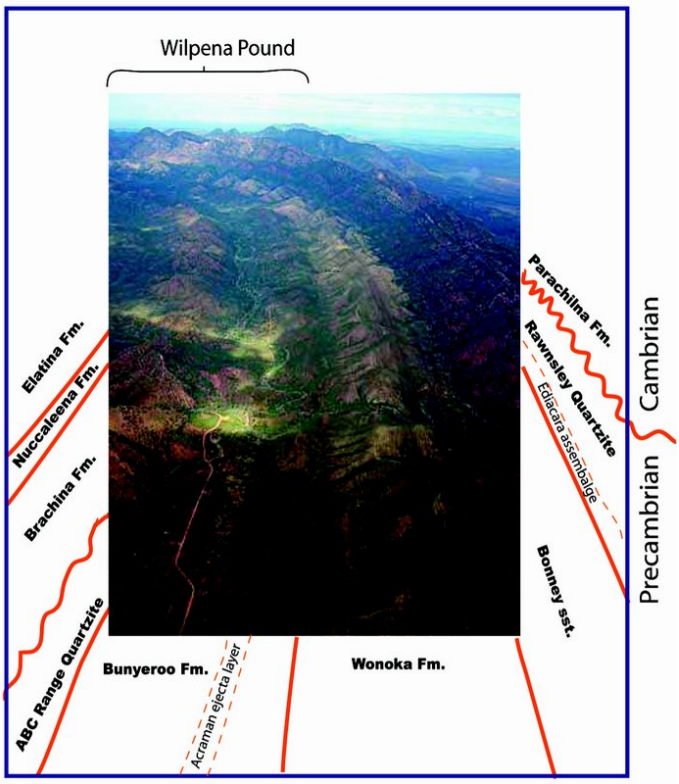
Introduction

The Adelaidean succession exposed in the Flinders Ranges provides one of the most complete sedimentary records of the late Proterozoic found anywhere on earth (Preiss, 1987). Excellent exposures of the Wilpena Group stratigraphic units of the upper Adelaidean Rift Complex are bisected by three perpendicular gorges (Bunyeroo, Brachina and Parachilna or BB and P, respectively) immediately to the northwest of Wilpena Pound. This area is referred to as the ABC Range. The stratigraphic layers exposed in the gorges dip steeply to the west. As a result, walking up these gorges from east to west provides an excellent introduction to the time-sequence geology of the upper Adelaidean Rift Complex. The following section describes the stratigraphic units that are encountered as one travels up sequence from east to west beginning at the base of the first hills that form the lower parts of these gorges (Figure 1).

Figure 1. ABC Range



Oblique aerial view of the ABC Range, looking south towards Wilpena Pound.

Formations

Brachina Formation

The Brachina Formation is a red-brown and olive-green siltstone, grading in places to shale and flaggy fine sandstone. In several locations the Brachina Formation is highly fractured with regular joints defining long rectangular prisms. This characteristic has led to several Brachina Formation units being informally referred to as Pencil shale. This formation forms the low angled slopes of the first ridgeline that is intersected form the east (the beginning of the ABC Range). The Brachina Formation is believed to have been deposited in very low energy conditions and may represent the distal margin of the proximal deltaic ABC Range quartzite (Preiss, 1987).

ABC range Quartzite

This formation is a pale pinkish grey fine to medium grained quartzite with minor micaceous siltstone partings REF. This Sandy unit contains and abundance of cross-bedding, ripple marks, mud cracks and shale chip conglomerates indicating a marginal marine environment grading from sub-tidal to inter-tidal up sequence (Preiss, 1987 and references therein). The ABC range Quartzite is believed to be a proximal sandy deltaic unit that is diachronously associated with the Brachina Formation (Preiss, 1987). The ABC Range Quartzite is so named because it defines the weathering resistant ridgeline and small cliffs of the prominent first ridge of the ABC Range. This member forms the steeper western slopes of the first ridge line and terminates in the creek to the west.

Bunyeroo Formation

The Bunyeroo formation consists of red brown shale and siltstone with minor fine sandy layers. The Bunyeroo Formation represents a rapid marine transgression inundating the underlying ABC Range Quartzite (Preiss, 1987). The vast majority of the formation is believed to be of deep water origin, however, the presence of sandier units and stromatolitic horizons in the upper part of the formation indicate a shallower environment (Preiss, 1987 and references therein).

Acraman Impact Ejecta Layer

Brachina and Bunyeroo Gorges contain the type sections for the Acraman impact ejecta layer Acraman Impact

Ejecta Layer (AEIL). This layer was first discovered by Dr Vic Gostin near Pichi Richi Pass in the Southern Flinders Ranges (Gostin Pers Comm.). Since its discovery the AIEL has been found at more than 20 localities across the Flinders Ranges. In addition, impact debris has been found sedimentary layers of a similar stratigraphic position on the Stuart Shelf and in the Officer and Amadeus Basins. The AEIL forms a distinct horizon (less than 6cm thick) with a characteristic stratigraphic succession. At the base of the AEIL a layer of volcanic rock fragments, up to several centimeters in diameter, surrounded by a course sandy matrix forms a sharp contact with the underlying mudstone. This layer is overlain by a thin sandy mudstone layer. A rare cross bedded sandstone occurs at the termination of the AEIL in Brachina Gorge before the resumption of monotonous mudstones and siltstones continues above (Gostin et al., 1986). The next layer is a graded sandstone horizon. The AEIL is believed to have been deposited immediately after a large bolide impacted with the palaeosurface of the Gawler Craton (c. 580 Ma) approximately 300km to the west of the Flinders Ranges (Williams, 1986). Lake Acraman (a salt lake in the central Gawler Craton) is believed to be centered on the point of impact (Williams, 1986). For more information refer to the extended abstract on the AIEL contained in this volume.

Wonoka Formation

The Wonoka Formation is a grey to white silty and fine sandy limestone that is well laminated and often cross-bedded. The upper parts of the formation contain load casts lenticular bedding, slump folds and ooid grainstone horizons. In many places the contact with the underlying Bunyeroo Formation is thought to be concordant. However, several regional scale submarine canyons have been identified that cut down through much of the lower Wilpena Group stratigraphy, originating along the contact with the Bunyeroo Formation. The submarine fill is considered exclusively Wonoka Formation (Preiss, 1987). Water depth uncertain for submarine canyons. Lenticular bedding may represent near shore storm reworking of sediments. Upper oolitic units are thought to represent shallow water and possible lagoonal environments.

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