THE UPPER BRACHINA SUBGROUP:
A LATE PRECAMBRIAN INTERTIDAL DELTAIC AND
SANDFLAT SEQUENCE IN THE FLINDERS RANGES,
SOUTH AUSTRALIA.

(VOLUME I)

by

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requirements for the degree of Doctor of
Philosophy in Geology at the University
of Adelaide.

September 1978
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AGH - Alligator Gorge: Hancock Lookout
AGM - Alligator Gorge: Mambray Creek
AGP - Alligator Gorge: Pine Track
AGW - Alligator Gorge: near Wilmington
AMC - Artimore Creek
AUB - Aubrey Creek (within Pichi Richi Pass)
BCC - Brachina Creek
BKG - Buckaringa Gorge
BNC - Bunyeroo Creek
BRG - Barunga Gap
BYR - Bubbinyunna Range (1 and 2)
CNC - Crow Nest Creek (near Black Jack Range)
DWS - Dawson
EBH - East of "Buckaringa" Homestead
ECR - East End of Chace Range
GGC - Gorge Creek
HMG - Hanniman Gap
IGG - Ingram Gap
LCQ - Locheil Quarry
MLH - "Moralana" Homestead
MMC - Mernmerna Creek (on "Arkaba" Station)
MRC - Mary Creek (on "Arkaba" Station)
MTF - Mount Fergusson (near Port Pirie)
MTG - Mount Grainger (near Redcliff)
NAR - North of Aroona "Ruins"
NBC - North of Brachina Creek

(Subregion)
Western II
Western II
Western II
Western II
Central I
Western II
Central I
Western II
Central I
Western III
Central I
Central II
Eastern
Western II
Central I
Western II
Western III
Western III
Central I
Central I
Central I
NBG – North of Bunyeroo Gorge (1 and 2) Central I
NBR – Nectar Brook Range Western II
NTO – "Narinna" Homestead Turn-Off Central I
OBM – Orarapinna Barytes Mine (near Wilkawillina Gorge) Central I
PCG – Parachilna Gorge Central I
PRL – Prelinna (near Wilpena Pound) Central I
PRP – Pichi Richi Pass (Saltia) Western II
RDR – Red Range (between Wilpena Pound and Elder Range) Central I
RNP – "Rawnsley Park" (near Wilpena Pound) Central I
RNQ – Ridge North of Quorn Western II
SAR – South of Aroona "Ruins" Central I
SBC – South of Brachina Creek Central I
SBG – South of Bunyeroo Gorge (1, 2 and 3) Central I
SDC – Sacred Canyon (near Wilpena Pound) Central I
SWG – South of Warren Gorge Western II
SWH – South of Wonoka Hill (near Hawker) Central I
TDM – The Dome (near Marchant Hill) Eastern
TDP – Third Plain Central I
UDR – Ulowdna Range Central I
WCW – "Warcowie" Homestead Central I
WKC – Waukarie Creek Western II
WKH – Wonoka Hill (near Hawker) Central I
WPC – Wilpena Creek Central I
WSF – Woolshed Flat (within Pichi Richi Pass) Western II

3. LOCALITIES OUTSIDE THE STUDY AREA

A. Eyre Peninsula

PTL – Point Lowly
SXB - Spinifex Bluff

B. **Northern Flinders Ranges**

   CBC - Chambers Creek
   MBR - Mount Bayley Range
   PPG - Puttapa Gap
   PTH - Patsy Hill

C. **Mount Lofty Ranges and the Fleurieu Peninsula**

   HLC - Hallett Cove
   MNR - Marino Rocks
   OSB - O'Sullivan's Beach
   SHC - South of Hallett Cove

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V.A. Reprint of the Paper:

"Stratigraphy of the lower Wilpena Group (late Precambrian), Flinders Ranges, South Australia" by P.S. Plummer, published in Transactions of the Royal Society of South Australia, Volume 102, pages 25-38.

V.B. Pre-print of the Paper:

"Palaeoenvironmental Significance of the Nuccaleena Formation (late Precambrian), central Flinders Ranges South Australia." by P.S. Plummer
ABSTRACT

The stratigraphy of the late Precambrian upper Brachina Subgroup has been studied in detail throughout the southern and central Flinders Ranges of South Australia. Ten stratigraphically significant facies associations are readily recognisable within which 18 separate and distinct lithotypes have been defined and described. The complex regional stratigraphic arrangement has been simplified by using a Markov Chain technique of analysis. The resultant lithotype stratigraphy is used as the base upon which the palaeogeographic history of the upper Brachina Subgroup is reconstructed.

A detailed sedimentologic analysis of each lithotype was undertaken in order to ascertain their individual palaeoenvironments of deposition. This involved a petrologic analysis of the arenaceous component of each lithotype, the analysis of the suite of sedimentary structures contained within each lithotype, and the analysis of all directional structures for palaeocurrent directions. For this latter analysis a new computer technique was developed whereby up to 3 individual populations can be separately analysed from any one distribution.

Deposition of the upper Brachina Subgroup succession was due to a phase of uplift tectonism and minor accompanying basic volcanism. Within this succession two distinct depositional episodes are readily discernable. During the first episode a massive sand influx flowed from a westerly source region (the Gawler Craton) into a shallow submerged, though possibly tidally influenced mudflat as a prograding deltaic succession (the "Alligator River Delta"). This initial delta developed in the western region of the Adelaide 'Geosyncline' as a fluvial and tide modified, wave-dominated system which was fed by stable outlet channels, protected by barrier-bars and surrounded by a low intertidal aerobic
mudflat. Preserved within this mudflat deposit are the probable body fossils of primitive cup-shaped coelenterates(?), which were possibly the ancestral organisms of the Ediacara assemblage. With continued sediment influx and basin shallowing, this initial delta system evolved to an unbarred fluvial modified, tide-dominated delta which was fed by migrating channels and surrounded by an intertidal mudflat. This mudflat was anaerobic, possibly due to the activity of abundant microscopic organisms.

The second depositional episode of the upper Brachina Subgroup developed when tectonic instability affected a portion of the basin's western margin (Uplift I). As a result, part of the previously deposited deltaic succession was eroded and reworked into a vast, thin intertidal sandflat which extended through the central region, and into the northern region of the Adelaide 'Geosyncline'. A second phase of tectonic instability (Uplift II) caused renewed activity along the basin's western margin, and also induced the emergence of at least two islands within the basin. Around these islands a thin, dominantly fluvial deposit was generated. The final phase of tectonic instability (Uplift III) affected only the western margin of the basin, and produced a narrow sand deposit of probable beach origin. Meanwhile, within the basin gradual subsidence induced the development of a shallow, possibly tidal aerobic mudflat and marked the end of the upper Brachina Subgroup phase of sedimentation.
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DEDICATION

This thesis is dedicated to my parents in the hope that it is at least partial repayment for their 25 years faithful support.