



LOWER CAMBRIAN CARBONATE STRATIGRAPHY AND SEDIMENTOLOGY,
OLD WIRREALPA SPRING, FLINDERS RANGES,
SOUTH AUSTRALIA.

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ABSTRACT

The early Lower Cambrian carbonates of the Flinders Ranges, South Australia, are characterized by numerous facies changes. Regional lateral facies changes occur along zones of long-active tectonism within the depositional basin. A study of measured sections throughout the Ranges has shown that the regional carbonate stratigraphy may be described in terms of six major lithological subdivisions. These do not necessarily correspond with established formations, and certain anomalies are apparent in both the mapped distribution of various lithofacies, and in the stratigraphic nomenclature itself. These anomalies are discussed at length and some are accounted for by the introduction of two new formations, the Woodendinna Dolomite and the Wirrapowie Limestone.

More intensive studies at Old Wirrealpa Spring have documented the relationship between abundant facies changes in the Lower Cambrian carbonates there, and the contemporaneous emplacement of a complex structure termed the Wirrealpa Diapir. The latter structure consists of a relatively thick and intact sequence of older Precambrian sediments which are associated with extensive exposures of breccia and megabreccia. Certain breccias are tectonic, but large areas are of sedimentary origin and may underlie or interfinger with nearby Lower Cambrian carbonate sequences.

"Diapiric" material was periodically exposed along a tectonically active zone and lithoclast debris was shed into the Lower Cambrian carbonates. This zone of uplift trends NW-SE and separates contemporaneous sequences of markedly different thickness and lithofacies.

To the northeast, thick carbonates of the Black Dog Hill sequence become finer grained and less lithoclast rich away from the uplifted zone. Ooid and lithoclast grainstones and packstones can be observed passing into dark lime mudstones. Columnar stromatolites which are present in the basal beds show morphological variations which can be related to progressive changes in the environment of deposition. Ooids in the grainstones are of two distinct types, and these too reflect lateral changes in the conditions under which they formed.

Lower Cambrian sequences deposited southwest of the zone of uplift (Donkey Bore and Wirrealpa Hill sequences), are much thinner than their equivalents to the northeast. They are generally indicative of open high-energy marine conditions. Ooid and skeletal grainstones are dominant. In the immediate vicinity of the zone of uplift these sequences

contain a number of significant erosional unconformities. Associated with these are well-preserved karst features. The karst includes vertical cave systems which are filled with younger Cambrian debris, flowstones and pisoliths.

Mottled textures, which are widespread in the Lower Cambrian carbonates of the Adelaide "Geosyncline", are well developed at Old Wirrealpa Spring. Detailed investigations, particularly within the Black Dog Hill sequence, have shown that the textures are formed by carbonate dissolution within the unconsolidated sediments due to the movement of reactive interstitial fluids.