

## **Sedimentology and Depositional Evolution of the Glaciogenic Early Permian Grant Group, Canning Basin, NW Australia**

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The late Paleozoic ice age (LPIA) was the longest-lived phase of icehouse climate in the Earth's Phanerozoic history, when most of the Gondwanan landmass was glaciated at some point in time between the Late Devonian and Mid Permian. Late Paleozoic glaciogenic sedimentary sequences contain prolific hydrocarbon reserves in Oman and Saudi Arabia and have great potential for future production in a number of other basins, including the Parana Basin of Brazil and Canning and Bonaparte Basins of Western Australia.

Interpreting glaciogenic sedimentary rocks is made difficult by the complexity of glacial depositional environments. Some of the significant challenges include reconstructing paleogeography with limited field and subsurface data, and understanding the complex interplay between glacier/ice sheet dynamics and the associated sedimentary record.

These complexities are investigated for the glaciogenic Grant Group, deposited in the Canning Basin during the LPIA in the Early Permian. This study focuses on the regional scale evolution of the LPIA in the Canning Basin using field sedimentology and detrital zircon data, integrated with extensive subsurface data, to constrain the glacial setting, depositional architecture and sediment provenance. Results indicate the glaciation was continental in scale, with ice sheets principally advancing into the basin from cratonic areas located to the south and east, and with long distance provenance from as distant as eastern Australia.

The gross architecture and evolution of the depositional environments of the Grant Group was investigated using detailed logging of outcrops in the Fitzroy Valley, integrated with analysis of cored sections from the Barbwire Terrace. A complex suite of sedimentary facies was recorded, which indicates deposition within an epicontinental shelf environment surrounded by glaciated cratonic uplands. The stratal architecture of the Grant Group records the interplay between high sediment supply and fluctuations in glacioeustatic relative sea-level that were probably glacioeustatic. Eight facies associations were interpreted within a single depositional sequence, which records the evolution from glacial maxima (erosion and ice-contact to proglacial fluvial sedimentation) through deglacial (marine flooding) to post-glacial (delta progradation) environmental conditions. This is analogous to late Cenozoic sequences documented from Antarctic and other high latitude epicontinental environments.