

Reservoir Quality in Glacial Sediments: Field Examples from the Petroliferous Permo-Carboniferous Gondwanan Strata of the Cooper Basin, Central Australia

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The proximity of Gondwanan ice sheets, which covered the southern portion of the Australian continent in the Permo-Carboniferous, led directly to the deposition of the Merrimelia Formation and Tirrawarra Sandstone in the Cooper Basin, Australia's largest onshore hydrocarbon bearing basin. Initially, the Gondwanan glaciers were dominant such that only terminoglacial facies were deposited (Merrimelia Formation). Subsequently, the glaciers retreated until only braid plain or proglacial sedimentation dominated (Tirrawarra Sandstone).

In general, proglacial facies form rocks with potential reservoir quality. In contrast, terminoglacial environments typically form "seal" rocks. Reservoir quality of the Merrimelia and Tirrawarra units has been determined by studying the types and amounts of rock fragments present, facies style, diagenetic/thermal overprint, and compactional effects.

A distinctive feature of rocks formed in glacial settings is the inhibition of clay laden meltwaters into the sedimentary pile. In the case of the glacio-aeolian sandstones (Merrimelia Formation), of the Merrimelia field detrital smectite/illite derived from infiltrating glacial meltwaters coated framework grains. This detrital clay "coat" was subsequently transformed to illite at depth, compartmentalising this highly porous rock and drastically reducing the natural deliverability of these sandstones. In contrast, the longitudinal bar sandstones (Merrimelia and Tirrawarra "facies") at Malgoona field are highly illitic where "boxwork" illite morphologies form isolated "psuedomatrix" after the breakdown of feldspars and volcano-clastic rock fragments. This mode of illite occurrence has little effect on reservoir deliverability as the clay does not inhibit pore throats. Subsequently, oil has been produced from these reservoirs, albeit at a slow rate, since the mid-1980's.