

Depositional Architecture of a Sand-Dominated Turbidite System – Detailed Sedimentological Analysis of the Macedon Member, Permit WA-12-R, Exmouth Sub-Basin, Western Australia

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Sedimentological re-evaluation of the Macedon Member has two key purposes; a) Provide a regional depositional picture, and b) Interpret the Macedon section over the Macedon Gas Field. Seismic quality over the southeastern section is poor, with a dominance of multiples, thus the initial phases of geological modelling and reservoir simulation rely on the geological inputs. Eleven wells containing borehole image logs provide the basis for the sedimentological description, with core calibration from six of these.

Initial lowstand deposition consists of a regionally extensive veneer of unconfined, massive bedded, high density turbidites. A seismic scale Mass Transport Complex (MTC) signifies the maximum extent of lowstand development. Depositional architecture is variable with rotated slump blocks, debris flows, ductile deformation in argillaceous lithofacies, and fractured sandstones all identified. The random depositional architecture restricts the lateral reservoir predictability away from well penetrations.

The onset of slope fan development occurred proximal to the Macedon Gas Field, with the underlying MTC providing topographic control on deposition. Continued sediment supply from the south to southwest, resulted in unconfined fan lobes building out towards the northeast. Chondrites and Phycosiphon ichnofabrics in south-eastern wells indicates deposition occurred on the distal inner to outer shelf. Wells in the central part of the block are generally devoid of traces, suggesting deposition on the upper to mid slope. This section has the best reservoir quality, lateral continuity of sandbodies and also limited baffle development.

Reduction in sediment supply associated with an increase in basin subsidence resulted in a switch to a mud dominated channel levee system. Sediment supply switched to the south-east, restricting development of channel levee complexes to the eastern section of the block. The increased of reservoir heterogeneity, isolation of sandbodies and development of multiple baffles increases the risk of reservoir compartmentalisation in the section of the Macedon.