

Seismic Sequence Stratigraphy of the intra-Barrow Group, Barrow Sub-basin, NWS, Australia

King, Emma¹, Tobias Payenberg¹, Simon Lang¹, Kerri Auld² (1) Australian School of Petroleum, University of Adelaide, Adelaide, Australia (2) Apache Energy, Perth, Australia

Regional exploration in the Barrow Sub-basin has dominantly focused on the Top Barrow Group and its associated structural traps. A lack of discoveries in recent times has focused attention more towards the intra- and lower Barrow Group plays, targeting potential stratigraphic/structural traps of economic proportions.

The objective of this study was to interpret the seismic sequence stratigraphy of the intra- Barrow Group sediments within the Barrow Sub-basin, with special emphasis on identifying stratigraphic traps. The study area lies south of Barrow Island, and contains the topsets of the 'Barrow delta' which comprise an amalgamation of Mesozoic sand-prone fluvial, coastal deltaic and deepwater successions. The dataset used was the Flinders 3D seismic survey and logs of some 35 wells.

The breakup of Gondwana was in its final stages during the Early Cretaceous, and attributed to the structural development of the Barrow Sub-basin. During the Early Cretaceous within the study area part of the Barrow Sub-basin there was a large fluvial/deltaic system building out toward the north to north-east. This contributed to northerly shelf margin accretion, with large-scale clinoform features and associated depositional environments interpreted on seismic throughout this interval.

The study has identified eleven new seismic sequences and developed a sequence stratigraphic framework tied to the wells. These eleven, second-order sequences have been further subdivided into systems tracts. The unraveling of the intra-Barrow Group succession has helped position the palaeo-shelf break, slope and base of slope throughout each sequence. A series of palaeo-geographic maps for each sequence have been developed to illustrate the basin's evolution. The key outcome of the study is that stratigraphic plays can be accurately tied to their sequence stratigraphic position and thus to their likely environment of deposition.

Lower Cretaceous Shallow Marine Mardie Greensand, NW Shelf, Western Australia: an Integrated Diagenetic, Ichnological and Sedimentological Analysis

Taylor, Kevin G.¹, Fiona Burns² (1) Manchester Metropolitan University, Manchester, United Kingdom (2) Curtin University of Technology, Perth, Australia

Diagenetic phases in the Mardie Greensand, Chervil area, Carnarvon Basin, are complex and dominated by iron-rich mineral cements. Abundant glaucony grains take the form of regular to irregular pellets. Grain-rimming pore-filling siderite cement ($\delta^{13}\text{C} = 5.3$ to 12.6 per mil VPDB, $\delta^{18}\text{O} = -5.5$ to 9.30 per mil VPDB) is abundant, with cement beds being prevalent in the lowermost part of the succession. Late-stage ankerite ($\delta^{13}\text{C} = -8.5$ and $\delta^{18}\text{O} = -10.2$ per mil VPDB respectively) occurs as a replacive phase or as a poikilotopic cement in coarser units. Pyrite is almost invariably late in origin. Deposition within the upper part of the Mardie succession occurred within a well oxygenated, low energy, gently dipping inner shelf setting. Trace fossil diversity is high, and dominated by '*Teichichnus zigzag*', *Skolithos*, *Diplocraterion habichi*, *Planolites* and *Macronichnus*. Within the lower part of the succession in the southernmost part of the study area, trace fossil diversity and intensity are significantly reduced. *Thalassinoides* are dominant, with minor *Skolithos*, and *Ophiomorpha irregulaire*. The upper parts of the Mardie succession represents deposition within well oxygenated, open marine shelfal conditions, and retains relatively high primary porosity and good to moderate reservoir quality. The low diversity trace fossil assemblages in the lower part of the succession represent deposition under restricted and periodically stressed marine conditions. Extensive siderite cementation is thought to be a consequence of low net sediment accumulation rates and low accommodation space during the earliest stages of transgression, leading to diagenesis dominated by bacterial iron reduction and siderite precipitation, resulting in a low reservoir quality.

Sequence Stratigraphy of the Tithonian Marine Sediments within the Laterally Confined Rift Settings of the Dampier Sub-Basin, Northwest Shelf, Australia

Marshall, Neil G.¹, M. Partington², G. DiToro², P. Robinson³ (1) Woodside Energy Ltd, Perth, Australia (2) Woodside Energy Ltd, (3) Isis Petroleum Consultants Pty Ltd,

Tithonian marine sediments of the Angel Formation in the Dampier Sub-basin have an extensive aerial distribution and have been penetrated by many exploration and development wells. The Angel system has excellent high resolution biostratigraphic control that enables time constrained correlations of sequences from proximal sand rich environments to distal sand poor settings. The younger part of the sequence associated with hydrocarbon bearing reservoirs has been cored extensively and this provides detailed information on the field scale stratigraphies and prevailing depositional processes. Despite these extensive datasets, the depositional settings and, more importantly, the architecture of the main reservoirs at a regional scale are poorly understood. Interpretations range from shelfal sequences through to either mass [gravity] flows deposited on a tectonically controlled ramp or basin floor. The source direction of the sands in particular are conjectural and the subject of great debate. A variety of mechanisms are postulated ranging from discrete feeder conduits and transfer fans sourced from the tip points of fault relay zones on the western and eastern flanks, through to axial sourcing from the north.

This paper focuses on constructing a depositional model from the sedimentary structures and ichnofossils derived from the core, integrated with the high resolution biostratigraphic data and well log stacking patterns. A sequence stratigraphic model for the sub-basin is proposed that includes a hierarchy of surfaces from regional tectono-eustatic 2nd - 3rd order events through to 4th order and higher cycles. Examples of gross depositional environment maps ranging from semi-regional to field scale are used to highlight some of the proposed sediment source directions and depositional architecture.