

Ichnological Variability of Shallow Marine Strata within the Macedon Member: A Comparison of the Enfield and Laverda Depositional Systems, Exmouth Sub-Basin, Western Australia

Burns, Fiona Elizabeth¹, Carl Jonathan Stark², Duncan Lockhart³ (1) Curtin University of Technology, Perth, Australia (2) Firmground Pty Ltd, Perth, Australia (3) BHP Billiton Petroleum, Perth, Australia

The Macedon Member forms the lowstand deposits of a 3rd order Upper Jurassic sequence. Detailed seismic, core and borehole image interpretation, and re-evaluation of biostratigraphic data enables further subdivision into higher frequency stratigraphic cycles. Two of these are penetrated at the Laverda and Enfield oilfields. This study illustrates the application of ichnology in restricting the depositional range of these deposits, historically inferred to have been deposited on the upper slope, to a distal inner shelf to upper shoreface setting.

Two phases of deposition are recorded in the Laverda field. The preliminary Laverda canyon system identified on seismic (SSW – NNE), is associated with earlier lowstand incision. The lower part of the canyon fill, seen in Laverda-1, consists of conglomerates interbedded with horizontal sandstones, deposited from traction carpets and high-density turbidites. These are unconformably overlain by siltstones and sandstones with Chondrites and Phycosiphon, representing deposition in a distal inner shelf setting. The section to the NW in Laverda-2 reveals the presence of sharp-based stratified sandstones alternating with highly bioturbated fine sandstones with diverse ichnofaunas. Trace fossils include Teichichnus, Phycosiphon, Rhizocorallium, Chondrites, Skolithos and minor Ophiomorpha. These reflect the deposition of alternating storm-generated event beds and suspension strata associated with fairweather periods. A series of non-bioturbated horizontally stratified and ripple cross-laminated sandstones punctuate the succession, derived from hyperpycnal flows on the shelf.

The Enfield study interval (wells Enfield-2 and Enfield-3) is dominated by highly bioturbated sandstones passing up into cross-stratified sandstones. The ichnofabrics in the basal section are comparable to those seen in Laverda-2, reflecting deposition on the inner shelf. The overlying cross-stratified sandstones comprise pervasive Macronichnus with local occurrences of Ophiomorpha, deposited in a shoreface setting. Shallow marine conditions were maintained in the Enfield area due to its location on a palaeohigh to the northeast of the Laverda canyon system.