

The Avalon and Ben Nevis Formations, White Rose Field, Newfoundland: Ichnological Aspects and Permeability Patterns

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Core from nine wells within the Cretaceous, Avalon (Barremian-Aptian) and Ben Nevis (Aptian-Albian) formations, from the White Rose Field, Jeanne d' Arc Basin, offshore Newfoundland has been analysed in the context of both sedimentology and ichnology. The predominantly clastic strata contain a number of distinctive facies that are interpreted to reflect deposition in a range of shoreline palaeoenvironments, ranging through to the shoreface-offshore transition.

The formations include a diverse and common trace assemblage, with elements comparable to the ichnogenera *Ophiomorpha*, *Asterosoma*, *Chondrites*, *Planolites*, *Palaeophycus*, *Teichichnus*, *Cylindrichnus*, *Thalassinoides* and *Zoophycos* in addition to rarer *Skolithos*, *Diplocraterion*, *Scolicia* escape traces and possible *Phycosiphon* and *Piscichnus*. Many intervals without identifiable traces are the subject of either biogenic mottling or cryptic bioturbation. Additionally localised *Gastrochaenolites* borings are apparent within a heavily cemented hardground.

By analogy with preliminary studies on the Ordovician Tyndall Stone from the Selkirk Formation, Red River Group of the Williston Basin, Manitoba (unpublished) and work on the Hibernia Field's expression of the Avalon and Ben Nevis formations (Spila, 2005), the different bioturbation patterns, in combination with the various physical sedimentary structures (which include planar lamination, planar bedding, hummocky cross-stratification and soft sediment deformation and dewatering structures) as well as lithological variation (between sandstone, siltstone, shaly siltstone, conglomerate and carbonate beds) will have a strong influence on fluid flow paths.

Whilst bioturbation styles undoubtedly have a profound effect upon permeability patterns within the reservoir, it is equally important to recognise the significance of other elements that influence fluid flow-paths, including faulting and differential cementation. Two distinct styles of faulting are apparent, with high-angle, post-sedimentary normal-faults as well as more complex, syn-sedimentary fracture patterns. Both of these faulting patterns are defined by low-permeability,

fine-grained cataclastic fault gouge. Cementation by both calcite and more locally by siderite also plays a role in flow patterns, with zones of both laterally continuous and more localised cementation impinging on otherwise moderately cemented sandstone.

References

Spila, M.V., 2005, Application of Ichnology in the Paleoenvironmental Reconstruction and Reservoir Characterization of the Avalon and Ben Nevis Formations, Hibernia Field, Jeanne d'Arc Basin, Grand Banks of Newfoundland. Unpublished Ph.D.thesis, University of Alberta. 188 pp.