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Integrated Sedimentological, Ichnological and Sequence Stratigraphic Model of a Coarse Clastic Fan Delta Reservoir: Middle Jurassic Oseberg Formation, North Sea, Norway

The Middle Jurassic (latest Toarcian to Aalenian) Oseberg Formation is a prolific hydrocarbon-producing interval within the fault-bounded Oseberg Main and Oseberg East fields of the Northern North Sea. Detailed sedimentological, ichnological and stratigraphic analyses demonstrate that the Oseberg Formation formed as coarse-clastic, Gilbert-type fan deltas modified by tidal processes, that prograded incrementally into a fully marine basin. The delta complex overlies a regional sequence boundary (possibly transgressively modified) excavated into shelf mudstones of the underlying Drake Formation.

Twenty-five sedimentary facies, grouped into six facies associations, reflect delta bottomsets and lower foresets, tide-influenced delta front and prodelta regions, structureless, non-cohesive sediment gravity flows deposited along delta foresets and toesets, avalanche flows along delta foresets, delta topsets, and transgressive reworking of the delta tops. Delta foreset deposits, comprising the main reservoir facies, are sporadically bioturbated with low diversity suites of *Palaeophycus, Cylindrichnus, Rosselia, Asterosoma, Diplocraterion, Ophiomorpha, Planolites, Skolithos* and fugichnia. Most bottomset and prodelta/offshore facies associations are more thoroughly bioturbated and contain comparatively diverse trace fossil suites reflecting proximal, archetypal, and distal *Cruziana* ichnofacies. Some prodelta mudstones are, however, largely unburrowed and contain abundant plant debris.

At least five lobe complexes are delineated, bounded by marine flooding surfaces and/or abandonment deposits. In the main Oseberg Field, the lobe contacts are subtle due to minimal lithologic contrast. Lobe complexes in the Oseberg East Field, however, intertongue with thick, heterolithic successions that are highly complex internally and display *Glossifungites* ichnofacies-demarcated discontinuities. The ensuing sequence stratigraphic revisions will have important implications on the reservoir's zonation.