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## **Sedimentological and tectonostratigraphic evolution of a restricted to fully-connected, low-accommodation, shallow-marine basin: The late Jurassic Intra Draupne Formation in the Johan Sverdrup field, Southern Utsira High (Norwegian North Sea)**

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Low-accommodation shallow-marine systems are often challenging to interpret and map in the subsurface due to their amalgamated/condensed nature, which often falls within sub-seismic resolution. Outcrop examples are significantly rarer and less well documented than moderate to high accommodation systems. Detailed studies of such systems are scarce, and their resulting depositional architecture is still poorly understood.

The late Jurassic shallow-marine deposits of the Intra Draupne Formation were deposited during the lattermost stage of Jurassic rifting in the South Viking Graben. They are found in a small N-S graben, flanked by two highs, the Haugaland (west) and the Avaldsnes (east). Deposition took place under low-accommodation conditions on top of a markedly erosive regional unconformity of Middle Jurassic age. In this study, we performed a detailed 1:1 sedimentological core description and interpretation of 20 wells with the aim of providing a redefined, basin-wide and high-resolution sequence stratigraphic model to constrain the tectonostratigraphic evolution of the basin.

The Intra Draupne Formation is typically 15-20 m thick, with minimum and maximum values of 5 and 40 m respectively. The deposits are remarkably coarse-grained, dominated by coarse to very coarse sand and granule to pebble rich packages showing different degrees of textural maturity, ranging from well-rounded and very well-sorted to subangular and poorly-sorted deposits. The deposits are bioturbated with ichnofacies mainly represented by Skolithos and Thalassinoides and locally abundant Fugichnia escape traces. The bioturbation index is typically 2-3. Deposits are otherwise structureless graded/non-graded or planar/through cross stratified. Differences in the degree of textural maturity, grain-size trends and sedimentary structures are the basis for a depositional model which includes gravity-flow dominated fan delta front and prodelta lobe deposits with variable degrees of tidal and wave modification and reworking in the form of compound tidal dunes/sand ridges and barred shorefaces.

Our results suggest the presence of an Early Kimmeridgian shoreline at the easternmost part of

the study area, with westerly sourced fan-fan delta systems and separated from the Haugaland High and the basin-bounding Western Boundary Fault (WBF), by an inferred (non-preserved) coastal plain. In the Late Kimmeridgian, tectonic subsidence associated with the WBF created a major change in the basin configuration; the former shoreline and alluvial systems to the east were disconnected from their original source area and a semi-enclosed and elongated embayment was formed to the west, characterized by low energy conditions and restricted water circulation. During the Tithonian, further tectonic movements and relative sea-level rise, lead to the creation of a fully-connected marine seaway which was characterized by strong tidal currents to the west and more wave-dominated conditions to the east. Reduction of tectonic activity and sea-level rise from Late Tithonian to Early Rhyazanian forced backstepping of the delivery systems and flooding of the source areas promoting a basin-wide period of sediment starvation, which ended with deposition of the open marine Draupne shale.

This study provides information on how shallow-marine systems develop in low-accommodation settings, with implications for paleogeographic reconstructions, sandstone distribution and characterization in other areas, with more limited datasets.