

# Toarcian-Bajocian (Jurassic) deltaic systems in the North German Basin: Controls on the development from high-constructive fluvial-dominated to high-destructive wave-dominated deltas

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Toarcian-Bajocian deltaic sediments in the North German Basin (NGB) have been subject to a basin-scale study incorporating outcrop analog studies, more than 15 cored wells (> 1500 m cored intervals) and more than 500 logged wells. The high-resolution facies architecture of Toarcian-Bajocian deltas and their controls was investigated using an integrated approach of sedimentological, palaeontological, petrological and sequence-stratigraphic methods.

The analysis of lithofacies, an intense data set on biofacies and biostratigraphy (macro- and micropalaeontology, palynology) (>1500 evaluated samples) as well as stratal pattern architecture provide the basis for a high-resolution sequence-stratigraphic framework spanning from the Early Toarcian to Late Bajocian. The succession is bounded within two 2<sup>nd</sup> order Transgressive-Regressive Cycles (T-R cycle) with two maximum flooding zones (mfs) in the Lower Toarcian and Upper Bajocian and further subdivided into six 3<sup>rd</sup> order T-R cycles. Major flooding surfaces of basin-wide importance have been identified in the (1) Lower Toarcian (*falciferum* zone), (2) Lower Aalenian (*opalinum* zone) and (3) Upper Bajocian (*parkinsoni* zone). Based on the sequence-stratigraphic framework deltaic systems and their depositional environments are reconstructed within 10 time-slices to differentiate between allogenic and autogenic controls and visualised in 10 high-resolution facies maps.

Since Rhaetian times Scandinavian source areas supplied clastics to an epeiric sea of the Tethyan Ocean. High sediment input relative to wave energy resulted in high-constructive fluvial-dominated deltas in the Toarcian. These large and elongated deltas are mainly located in the NE part of the NGB, characterised by a distributive network of distributary channels with progradational and aggradational stacking pattern resulting in thick sandy delta plain and delta front deposits with steep facies gradients. From the Upper Aalenian to the Bajocian the delta plain shifted successively towards the West and deposition of lobate shaped high-constructive fluvial-dominated deltas focused in the NW part of the NGB. In the NE high-destructive wave-dominated deltas evolved characterised by a rather parallel to subparallel network of thin distributary channels dissecting a thin sandy delta plain. These deltas show progradational to retrogradational stacking pattern and their mouth bars are connected by elongated shoreface sandbars comprising longshore elongated oolitic shoals. The change in delta types marks an increase in wave energy time-constrained to the new connection between the NGB with the Tethyan realm via the Polish Basin in the Early Bajocian.

Toarcian-Bajocian deltaic systems in the NGB were sensitive to eustatic fluctuations and changes in circulation pattern, show typical lateral shifts and are therefore a considerable good example to demonstrate the interactions of allogenic and autogenic controls.