

Depositional facies and sequence stratigraphy of the Hibernia reservoir sandstones, Hibernia field, Jeanne d'Arc basin.

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Detailed facies analysis of the Hibernia reservoir revealed the presence of deltaic sediments overlain by lagoonal mudstones and backbarrier sandstones. The deltaic sediments comprise delta plain, river mouth bar and prodelta facies associations. The delta plain is the most prevalent and diverse association observed. It includes channel-fill sandstone, levee, flood plain mudstone, coal, palaeosol, crevasse splay, crevasse delta, interdistributary bay-fill, and tidally-reworked sand-mud facies. Channel-fill sandstones change laterally and vertically into different overbank and bay-fill sediments suggesting lateral shifts of distributary channels. The facies types, lateral and vertical facies changes, crevasse splaying and lateral shifting of distributary channels point to a fluvially-dominated delta with a mixed sand-mud sediment supply. Tidal currents influenced the delta during its abandonment phases.

The stacking pattern of facies in the Hibernia reservoir indicates the occurrence of two main genetic sequences of strata. These sequences are separated by a laterally-extensive 4-20 m thick transgressive marine mudstone interval. Each genetic sequence is bounded by a distinct basal erosional surface and a top transgressive surface. The lower sequence consists essentially of stacked delta plain facies successions commonly with basal erosional boundaries. These successions overly thin prodelta mudstones in proximal positions and change laterally into river mouth bar sandstones in distal positions. The facies successions are frequently separated by a thin interval of simple alluvial/glee palaeosols overlain by transgressive mudstones. The stacking pattern of facies successions reflects the successive additions of accommodation space, high sediment supply and a progradational to aggradational delta. The repetitive erosional events suggest short-term base-level falls (decreasing accommodation space to sediment supply ratio) and consequent basinwards shifts in facies as well as stepwise progradational incidents.

The upper genetic sequence is divided into a lower progradational-aggradational facies tract and an upper retrogradational facies tract. The lower facies tract comprises stacked delta plain facies successions similar to those in the lower genetic sequence. This facies tract is capped in proximal positions by a mature composite ferruginous palaeosol which suggests maximum deltaic progradation. The retrogradational facies tract consists of lower delta plain facies changing distally into lagoonal mudstones and backbarrier sandstones. This facies tract marks the final abandonment of the Hibernia delta.

Reservoir depositional heterogeneities developed due to both sedimentary processes in the depositional environments and stratigraphic processes which affected the stacking patterns of genetic sequences and facies successions. Crevasse splaying and lateral shifting of distributary channels produced mudstone heterogeneities encasing reservoir sandbodies, e.g. in the B-27 well. Successive additions of accommodation space repeatedly halted the delta progradation and deposited transgressive mudstone permeability barriers in between reservoir sandbodies. The most laterally-extensive permeability barrier separates the two genetic sequences.