Highstand and Transgressive Deposits of the Lower Cretaceous Glauconitic Sandstone in the Jenner Upper Mannville "E" Pool, Southeast Alberta

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ABSTRACT

In the Jenner Upper Mannville "E" Pool, Glauconitic Sandstone strata comprise 3 facies associations consisting of prograding shoreface to shallow shelf (FA1), upper estuary channel fill (FA2) and tidally-influenced abandoned channel fill/interchannel (FA3) deposits. The primary reservoir occurs in transgressive FA2 deposits.

FA1 comprises two upward-shoaling parasequences separated by a marine flooding surface. The lower parasequence begins with interstratified, planar- to wave-ripple laminated siltstone and mudstone overlain sharply by hummocky cross-stratified very fine sandstone. The upper parasequence grades from bioturbated mudstone to silty sandstone with common soft-sediment deformation structures. The lower parasequence is interpreted to represent storm-dominated, incised lower shoreface deposits (forced regression) overlain by prograding distal delta front deposits (normal regression).

An amalgamated transgressive surface of erosion/Type-1 sequence boundary, resulting from fluctuations in relative sea level and locally demarcated by trace fossils of the *Glossifungites* ichnofacies, erosionally juxtaposes highstand FA1 deposits from overlying transgressive deposits of FA2 and FA3 (basinward shift in facies). Lowstand deposits are absent in the study area and are interpreted to have fed slope and basin-floor fans, bypassing the shelf through incised valleys.

Reservoir FA2 strata are composed of 3 primary facies: 1) dune cross-stratified fine to medium sandstone; 2) interstratified massive medium sandstone and contorted muddy siltstone; and 3) chert pebble conglomerate. Deposits of FA2 are interpreted to have been deposited seaward of the maximum tide limit in an upper estuary environment. This is suggested by: 1) abrupt lateral and vertical facies changes; 2) the distribution of coarse- and fine-grained facies at opposite ends of the pool; 3) a brackish water trace fossil assemblage; and 4) a conformable contact between FA2 and overlying tidally-influenced strata of FA3.

FA3 gradationally overlies FA2 and consists of interstratified carbonaceous sandstone, siltstone, mudstone and coal. The grain size, sand/mud ratio and scale of sedimentary structures decrease upwards within strata of FA3 and is interpreted to represent deposition in abandoned channel and floodbasin environments. The presence of tidal sedimentary structures, a brackish water

ichnofossil suite and the common coexistence of siderite and pyrite in FA3 strata supports an abandoned estuarine channel interpretation and suggests the continued incursion of tidally-transported seawater during and after the abandonment phase.

FA3 represents the uppermost stratigraphic unit of the Glauconitic Sandstone in the study area and is unconformably overlain by feldspathic to lithic sandstone of the undifferentiated Upper Mannville. These fluvial channel sandstones separate estuarine Glauconitic strata from non-marine, coal-bearing Upper Mannville strata. The framework composition of the Glauconitic Sandstone, which is dominated by quartz and chert, differs significantly from the Upper Mannville, suggesting different sediment provenance. Quartzose sand of the upper estuary channel fill (FA2) was likely sourced from a northern paleotopographic high where little or no Lower Mannville or Glauconitic sediment was preserved. Feldspathic to lithic channel sandstones of the undifferentiated Upper Mannville succession, on the other hand, are interpreted to have derived from a southwestern Cordilleran source.