Death of a Delta: The Transgressive Systems Tract of the Pliensbachian to Aalenian 2nd Order Sequence, Sverdrup Basin, Canadian Arctic Archipelago

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The Rhaetian (latest Triassic) to Valanginian (Early Cretaceous) 1st order sequence of the Sverdrup Basin contains thick sandstone units in the lower portion (Heiberg Formation/Group) and these reflect the cratonic uplift that accompanied the earliest Rhaetian tectonic event. Sediment supply to the basin was very high from Rhaetian through Sinemurian (Early Jurassic) and a major delta occupied the eastern and central Sverdrup Basin during this time. The strata in these areas consist mainly of sandstone-dominant and coal-bearing delta plain deposits (Fosheim Mbr, Heiberg Fm). In the western Sverdrup Basin, westward-extending tongues of delta front deposits with laterally equivalent barrier systems (Maclean Strait and King Christian formations) and intervening shale and siltstone units (Grosvenor Island and Lougheed Island formations) comprise the Rhaetian to Sinemurian succession.

A tectonic event in the earliest Pliensbachian created a 2nd order sequence boundary throughout the basin and affected the cratonic source areas such that sediment supply to the basin was greatly reduced. The high subsidence rates combined with the very low rates of sediment supply resulted in the cessation of deltaic sedimentation and a transgression across the former delta plain. The overall transgressive interval lasted throughout the entire Pliensbachian and a maximum flooding surface was generated in earliest Toarcian (late Early Jurassic) at the height of transgression. Thus the Pliensbachian strata comprise a 2nd order transgressive systems tract (TST) (within the 2nd order Pliensbachian to Aalenian sequence) over the basin.

In the western Sverdrup Basin the deposits of this TST overlie marine deposits and consist almost exclusively of shale and siltstone and rare oolitic ironstone. Sandstone is a very minor component and it is usaully very fine grained and burrowed with low porosity and permeability. Eastward, where the delta plain was transgressed, the TST consists of a lower unit of delta plain strata, followed by shallow marine sandstones with a prominent shoreline ravinment surface separating the two facies. Offshore marine shales and siltstones conformably overlie the sandstones and comprise the uppermost portion of the TST.

The transgressive shallow marine sandstones form a blanket sandstone unit (upper King Christian Fm; Remus Mbr, Heiberg Fm) over all of the central and eastern Sverdrup Basin. In the southern and eastern portions of this area the

sandstones have very good porosity and permeability and are the reservoirs for structurally-trapped, major gas deposits in the Ellef Ringnes and King Christian islands area. In more central areas of the basin, where the strata were more deeply buried and affected by Cretaceous diabase sills, quartz cementation has significantly lowered the porosity and permeability of these sandstones. The overlying shales and siltstones in the uppermost TST and the overlying RST act as a seal for the petroleum traps. Examples of both good and poor reservoir development in the shallow marine sandstones of the Pliensbachian TST will be on display.