

Chronostratigraphic framework and reservoir facies of the lower Cretaceous Bluesky Formation, Valhalla area, northwestern Alberta

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The Lower Mannville (Aptian) Bluesky and underlying Gething formations of northwestern Alberta were deposited during the transgressive phase of a third order sequence. In northwestern Alberta the Bluesky Formation forms a relatively thin succession of mostly shallow-marine strata that overlies a thick succession of non-marine to coastal plain coal, shale and sandstone of the Gething Formation. At the end of Bluesky time a marine basin covered much of Alberta, and in the study area this period of sea level highstand is characterized by a thick, generally northward prograding succession of marine shale and sandstone that make up the Wilrich, Falher and Notikewin formations of the Spirit River Group.

The study area is located in northwestern Alberta and is bounded north-south by Townships 74-76, and east-west by Ranges 7-9 west of the 6th meridian. Here the Bluesky Formation consists of a complex succession of marine and fluvial strata that were deposited during high order fluctuations of relative sea level (RSL). In this study these strata have been subdivided into three sequences each consisting of a single upward-shoaling succession (PS1-PS3) capped by a transgressive deposit. Upward-shoaling successions are typically of the order of 4-15 metres thick and consist of shelf mudstone overlain gradationally by lower shoreface, and rarely upper shoreface sandstone. Transgressive deposits, on the other hand, tend to be thin, generally < 50 cm thick, but are areally extensive and composed of glauconitic shaley sandstone. These strata were deposited by wave ravinement processes that coincided with periods of rising relative sea level and southward (landward) migration of the paleoshoreline. Landward migrating barrier island complexes were reworked into transgressive lag deposits, but in some cases were partly preserved or reworked into subtidal-shoal complexes. These latter units are only locally developed but range from 3-12 m thick and within the study area form the principal gas reservoir unit. The second major reservoir unit consists of sandstone that was deposited in a narrow (3-5 km wide), northwest-flowing fluvial system. These strata range from 5-15 m thick and overlie one of the sequence boundaries identified in the study area, and, therefore, most probably represent the preserved basal part of an incised valley fill.

The complex stratal succession of the Bluesky Formation in the study area is most probably the result of short-term changes of relative sea level that were superimposed on a longer-term episode of rising relative sea level. These short-term changes may be the result of variations in accommodation space associated with movement along pre-existing faults. It is important to note that the study area is located on the southern flank of the Peace River Arch, which during the Cretaceous was subsiding locally. These movements may have been partly(?) controlled by reactivated tectonic lineaments, for example Early Carboniferous northeast-southwest-trending grabens, which in turn would have had an profound effect on the location of some(?) of the Bluesky gas reservoirs in the Valhalla area.