recovery energy environment economy
2011 CSPG CSEG CWLS Convention

Trend Mapping of Five Progradational Cycles in the Monteith Formation, NW Alberta

Hailey Doney*, Jesse Campbell**, Ross B. Kukulski, and Stephen M. Hubbard
Centre for Applied Basin Studies (CABS), Department of Geoscience, University of Calgary
*hkdoney@ucalgary.ca, **jgcampb@ucalgary.ca

Clastic sediments of the Late Jurassic-Early Cretaceous Nikanassin/Minnes Group were deposited into a rapidly subsiding retro-arc foreland basin and are a significant potential tight-gas reservoir unit in the Deep Basin. The Nikanassin/Minnes Group is represented by three formations, which from youngest to oldest include the Monteith, Beattie Peaks and Monach. The paleogeography and sediment distribution of the Monteith Formation has been broadly constrained (Miles, 2010), but a high resolution study has not yet been undertaken and is the primary objective of this work. The study area, between townships 58-70 and ranges R4-R13W6, has ~600 wells located east of the deformation front that completely penetrate the Monteith Formation and are used to define and characterize the subsurface deposit.

The Monteith Formation conformably overlies shales of the Fernie Formation and has been interpreted as a storm dominated delta system that prograded towards the north-west along the basin axis (Miles, 2010). The Monteith can be sub-divided into three intervals, informally defined as the Red Rock (lower), Wapiti (middle) and Knopcik (upper) members. The Red Rock and Wapiti members are investigated here and have been divided into five upwards coarsening sub-units, each capped by a semi-regional flooding surface. Net sandstone maps for each of the sub-units were created using a gamma ray cut-off of 60 API, with sandstone thickness typically falling between 5-15 m. The gross thickness of each sub-unit ranges from 5-30m.

Coarsening upwards trends characterize each sub-unit. These are consistent with facies observations of Miles (2010) who recognized fine-grained dominated prodelta units sharply overlain by coarse-grained mouthbar and distributary channel deposits. However, significant variations from this typical profile exist. For example, blocky, fining upward, mudstone-dominated, and heterolithic trends have also been identified that have been interpreted to represent sandstone and mudstone filled channel, prodelta, and interdistributary bay deposits respectively. Systematic evaluation and classification of each sub-unit in each well provides a high resolution framework to enhance subsurface correlations by allowing a paleo-environmental interpretation to be applied when constructing net sandstone maps.

In the western portion of the study area, coarsening upward profiles are typical, whereas in the eastern portion of the study area, over-thickened, blocky and amalgamated sandstone bodies are more common. This observation is interpreted to represent the preservation of prograding deltaic deposits in the west, and partial downcutting and re-distribution of contemporaneous deposits by fluvial distributary channels in the east. Identification and mapping of these thick gas saturated channel trends and related paleogeographic features highlights and defines the expected reservoir heterogeneity in the Monteith Formation.

References

Miles, B.D., 2010, Unraveling the stratigraphic architecture of the Jurassic-Cretaceous Nikanassin Group, northwestern Alberta, Canada, unpublished MSc. Thesis submitted to the University of Calgary, p.128