

Source Rocks And Reef Growth: Middle Devonian Keg River Formation, Rainbow And Zama Sub-Basins, Northwestern Alberta, Canada

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ABSTRACT

Isolated reefs of the Middle Devonian Keg River Formation in the Rainbow and Zama sub-basins are important oil and gas reservoirs in northwestern Alberta. Hydrocarbons in these reservoirs were sourced, in part, by organic-rich laminites in the ramp and reef foreslope successions of this formation. Integration of stratigraphy, sedimentology, and organic petrology facilitated interpretation of the depositional history, regional stratigraphic correlation, paleoenvironment, and paleoecology of the organic-rich laminites.

Three units of organic-rich laminites occur in the Keg River Formation of the Rainbow Sub-basin: (1) the lower Rainbow laminite (LRL) in the Lower Keg River Member carbonate ramp (2) the middle Rainbow laminite (MRL) at the base of Upper Keg River Member reefs, and (3) the upper Rainbow laminite (URL) near the base of the Upper Keg River Member in off-reef and foreslope positions. Two organic-rich laminites occur in the Keg River Formation of the Zama Sub-basin: (1) the lower Zama laminite (LZL) at the base of Upper Keg River Member reefs and (2) the upper Zama laminite (UZL) near the base of the Upper Keg River Member in off-reef and foreslope positions. Interpreted stratigraphic correlation between the Rainbow and Zama sub-basins suggests a correlation between the MRL and the LZL as well as between the URL and the UZL.

In both the Rainbow and Zama sub-basins the LRL, MRL, and LZL are all interpreted as primarily OF B, characterized by small, thin-walled alginites and acanthomorphic acritarchs. This evidence is indicative of accumulation and preservation of organic matter (OM) due to depth related anoxia. The URL and UZL in off-reef positions are interpreted as primarily OF B with secondary OF A signatures, characterized by dominant large, thick-walled alginites. These OF are indicative of OM accumulation and preservation due to depth related anoxia and episodic, elevated phytoplanktonic productivity (algal blooms). In contrast, the URL and UZL in reef foreslope positions are interpreted as primarily OF A,

characterized by dominant large, thick-walled alginites which indicate accumulation and preservation of OM due to algal blooms. The URL and UZL in foreslope positions were deposited coevally with reef growth in the Upper Keg River Member which may suggest that Middle Devonian reefs could tolerate or at least recover from episodic eutrophication which triggered algal blooms.