

Sequence Biostratigraphy of the Upper Palliser, Exshaw, and Lower Banff formations, southern Alberta

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ABSTRACT

The integration of sequence stratigraphic, biostratigraphic, and organic geochemical techniques at both subsurface and outcrop locations provide new insights into the Upper Devonian-Lower Mississippian petroleum system. This system is represented by the upper Palliser, Exshaw, and lower Banff formations, and includes both reservoir and hydrocarbon source-rock units. Many oil families in southern Alberta have been linked to their source; an exception is oil Family M. Biomarker data for these oils indicate a source of Mississippian age capable of producing relatively large quantities of oil. One probable source for these oils is the lower Banff Formation, predominantly a Type II kerogen with TOC values from immature samples in excess of 10%.

Sequence stratigraphic techniques and conodont biostratigraphic data are combined to aid in the correlation of surfaces within this Upper Devonian to Lower Carboniferous interval. Stratigraphic relationships are complex, with dramatic lateral thickness variations observed from outcrop to subsurface and along strike within the outcrop belt, that imply potential basement tectonic controls during deposition. The contact between the Palliser and Exshaw formations at outcrop is conformable whereas locally in the subsurface it can be unconformable with common karsted surfaces developed on uplifted blocks. The Exshaw Formation is a relatively continuous package, containing some locally mappable parasequences. The contact between the Exshaw Formation and the mudstones of the lower Banff Formation is conformable and gradational at outcrop and throughout most of the subsurface. However, this contact is not always conformable and in some cases mudstones of the lower Banff Formation are nonexistent.