

## **Stratigraphic Characterization of Deposits that Record Foreland Basin Initiation, Jurassic-Early Cretaceous Outcrop Belt, Great Falls, Montana**

*Garrett M. Quinn*

*University of Calgary*

Foreland basins are characterized by orogen parallel zones of subsidence, the fill of which contains a record of orogen uplift, accommodation development and denudation. Deposition and erosion in foredeep, forebulge and backbulge zones shift in response to thrust-belt propagation. In west-central Montana, well exposed stratigraphy that records foreland basin initiation in the Jurassic, to the first major flooding event in the Early Cretaceous, is present in the vicinity of Great Falls. As such, the area provides an excellent opportunity to evaluate the evolution of accommodation and sediment supply. Overall, Jurassic and Early Cretaceous strata are dominated by channel-fill deposits that accumulated in a low accommodation and/or sediment supply limited setting in the incipient foreland basin. Jurassic accommodation space is attributed to either the distal foreland or backbulge depozone, and the Early Cretaceous to a distal foredeep setting.

Outcropping strata include Jurassic channel-fill deposits that unconformably overlie Mississippian carbonates of the Madison Formation. These strata are coal-bearing and non-marine in origin. These deposits are overlain disconformably by the Lower Cretaceous Kootenai Formation. This unconformity may be a record of forebulge migration through this area. The Kootenai Formation is equivalent to the Mannville Group of Alberta and is approximately 70 m thick. From base to top the lithostratigraphic members include the Cutbank, Sunburst, Red Sandstone, Ostracod Limestone and Upper Kootenai. Channel-fill deposits in the Cutbank consist of medium-grained, cross-bedded sandstone. Associated overbank deposits are characterized mudstone interbedded with calcite concretions and limestone beds up to 2 m thick. Exposures of the Sunburst include sandstone channel-fills, a shale-filled channel, and tabular sandstone bodies approximately 5 m thick. The sandstone filled channels are non-marine in origin while the shale-filled channel and tabular sandstone bodies likely reflect the first marine influence in this part of the basin. The Red Sandstone unit is also dominated by channel-fill deposits surrounded by interbedded sandstone and mudstone overbank facies. The deposits could record marine-influenced

or non-marine processes although an abundance of trace fossils in the overbank deposits are suggestive of marine influence. The Ostracod limestone is a regional marker that is interpreted as lacustrine in origin. The Upper Kootenai is characterized by channel-fill deposits with abundant mudstone draped cross-beds that are interpreted to reflect a tidal influence. The Blackleaf Formation of the Colorado group caps the succession. Sandstones in this shale-dominated unit are tabular and marine in origin. These deposits are associated with flooding of this part of the foreland and are possibly related to the eastward migration of deeper water zones in the basin.

The stratigraphic framework is plausibly tied to accommodation and sediment supply fluctuations as the basin evolved. Future work will consider the evolution of sediment source areas through this time period using petrographic analysis and detrital zircon geochronology.