

PS Regional-Scale Modelling of the Sub-Cretaceous Unconformity Surface in Northern and Central Alberta: Elevation, Subcrop Zero-Edge Delineation, and Paleotopographic Reconstruction*

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Abstract

Creating a 3-dimensional geological framework model of the Alberta subsurface is a major project currently underway at the Alberta Geological Survey. One major component of this model is the “sub-Cretaceous” unconformity surface, which represents a significant period of non-deposition and erosion in the Alberta foreland basin initiated after deposition of Upper Jurassic/lowermost Cretaceous sediments. This unconformity surface formed a major control on the accommodation space and subsequent deposition of the overlying Lower Cretaceous Mannville Group and equivalent strata in the Athabasca, Peace River and Cold Lake Oil Sands areas due to varying and complex topography generated on the angular unconformity.

Previous sub-Cretaceous unconformity models were built using datasets from multiple sources, resulting in a variable quality surface due to inconsistent picking criteria between sources, co-located data, and clustered data distribution. In order to decrease uncertainty in this important regional surface, a new dataset was created using high quality log picks with a good spatial distribution. This dataset was geostatistically analyzed to identify any potential outliers prior to modelling the elevation of the unconformity surface. Stratigraphic picks of formations underlying the unconformity were used to create independently modelled surfaces which were intersected with the unconformity surface to define subcropping unit boundaries. Paleotopography of the unconformity surface was generated by removing the dominant regional trend from the elevation surface, which created a residual surface that represents the topography of the unconformity surface prior to the deposition of Mannville Group and equivalent strata. Previously completed modelling of the sub-Cretaceous unconformity surface, zero-edge delineation of subcropping units, and paleotopographic reconstruction in the west-central and Slave Lake – Peace River regions of Alberta has been combined with recently completed detailed work on Paleozoic strata in the lower Athabasca region, providing an expanded regional view of the sub-Cretaceous unconformity in the subsurface of the Alberta Basin.