

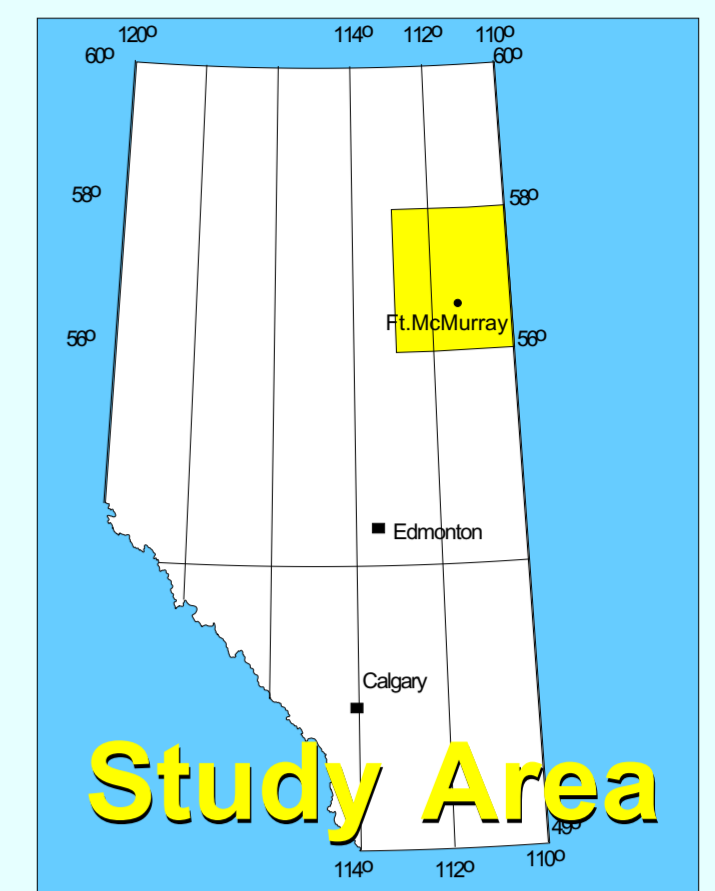
Bedrock Topography, Drift Thickness, and Buried Channels, Northeast Alberta

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In anticipation of increasing needs of the expanding heavy oil industry for surficial and Quaternary geology information, the Alberta Geological Survey has focussed its Quaternary geology mapping efforts in the northeast part of the province of Alberta. This poster presents the results of a study to map the bedrock topography, drift thickness, and Quaternary stratigraphy in the area defined by Latitude 56 degrees to 58 degrees, Longitude 110 degrees to 113 degrees. The study is a regional interpretation based on a review of data derived from the EUB oil and gas exploration logs, Alberta Environmental Protection water-well logs, numerous testhole logs from private-industry data holdings, and field investigations conducted by AGS staff. Because of the sparse and incomplete record of high-quality lithostratigraphic information, Quaternary stratigraphic interpretations could only be done from petrophysical logs run in uncased sections of boreholes drilled in areas of thick (>100m) drift. In many cases these correspond to areas above buried valleys or channels.

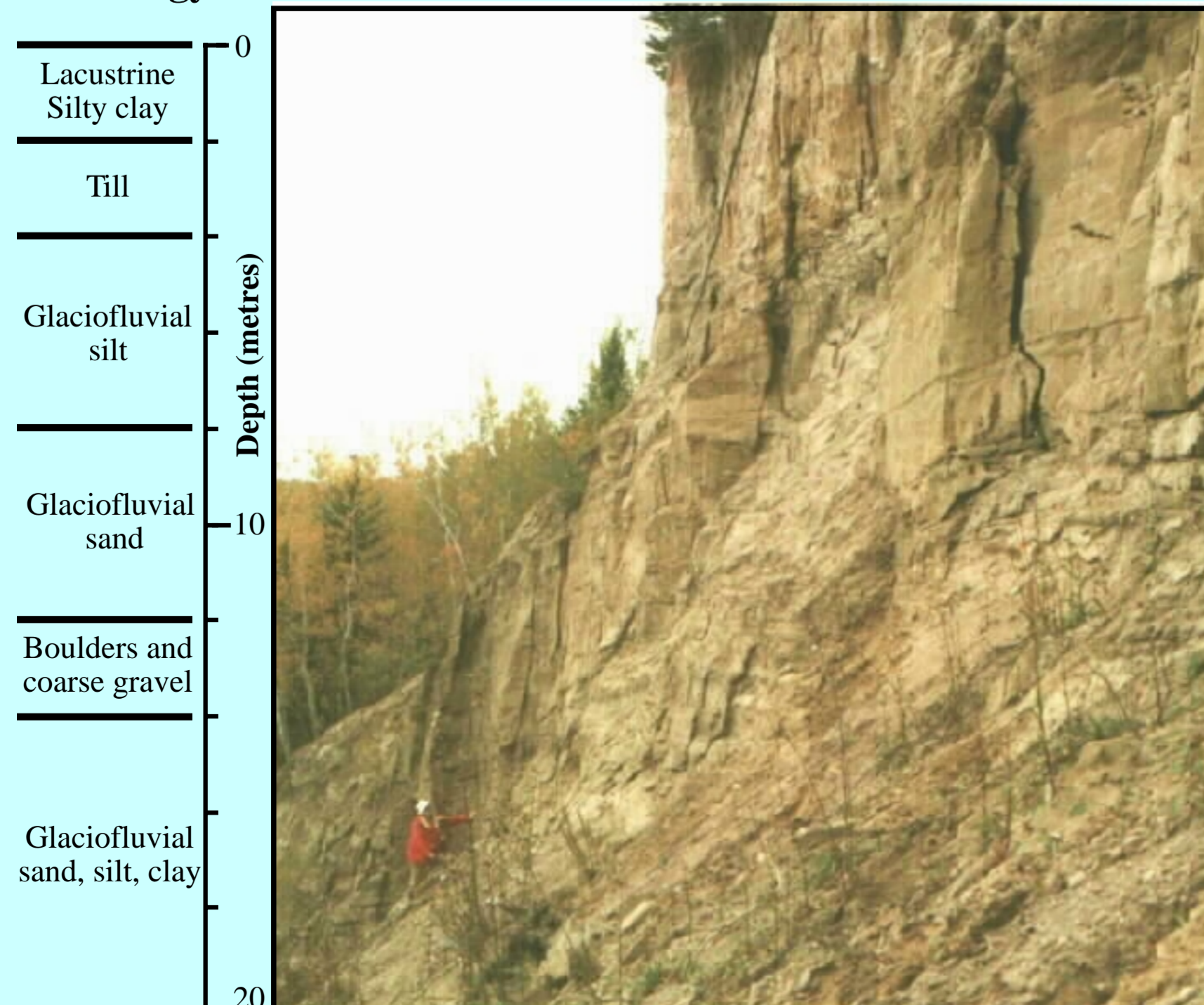
To a large degree, the topography of the bedrock surface reflects that of the present-day regional land surface. Of interest however, is the occurrence and distribution of erosional features on the bedrock surface. These are expressed in two forms: broad erosional valley systems, and deep, narrow channels. Buried erosional valleys, such as the complex of valleys that radiate from the Stony Mountain bedrock upland, possibly represent preglacial Tertiary drainage and fluvial erosion of the bedrock surface. These drainage systems coalesced south of Stony Mountain to form the Conklin Channel. Infill with stratified and nonstratified glacial sediment during successive glaciations in the region resulted in an accumulation of more than 250 m of drift above the deepest parts of the valleys.

The second type of buried fluvial erosional features consists of relatively narrow (1 to 1.5 km width) and deep (150 m) channels which are infilled almost entirely with coarse grained sediment interpreted to be glaciofluvial sand. These include the buried Birch, Willow, Kearl, Gregoire, and Clarke channels, all of which are inferred to have had a glacial meltwater source. All of these channels are generally characterized by: a relatively great depth to width ratio, very shallow valley floor gradients, linear, non-sinuuous channel morphology, relatively short channel lengths (which may reflect insufficient data), and relatively thick infill of uniform sediment, generally sand. For example, the floor of the buried Birch Channel shows almost no change in elevation over a distance of about 40 km, and contains in excess of 50 m of sand at the base. It is believed that all of these channels were formed in direct contact with glacial ice, perhaps even beneath the glacier, and that the channels were formed by the high energy release of meltwater, causing rapid erosion and infilling with coarse fluvial sediment. High energy and highly fluctuating fluvial regimes are supported by the occurrence of a 2 m thick bed of boulders (0.5 m in diameter) midway through the fluvial sand sequence in both the Birch and Willow channels, as seen in outcrops along the MacKay and Dover rivers. Steep valley walls are indicated not only by nearby petrophysical logs, but are also revealed in high resolution seismic surveys conducted on some of the oil sands leases.

There is very little lithologic information to characterize the sediments in these buried channels. Thus, our understanding of the history and origin of these buried channels remains speculative. From a groundwater resource perspective, however, the thick sequences of coarse permeable sediment within each of the channels make them favorable sources of water suitable for steam injection in enhanced oil recovery methods.

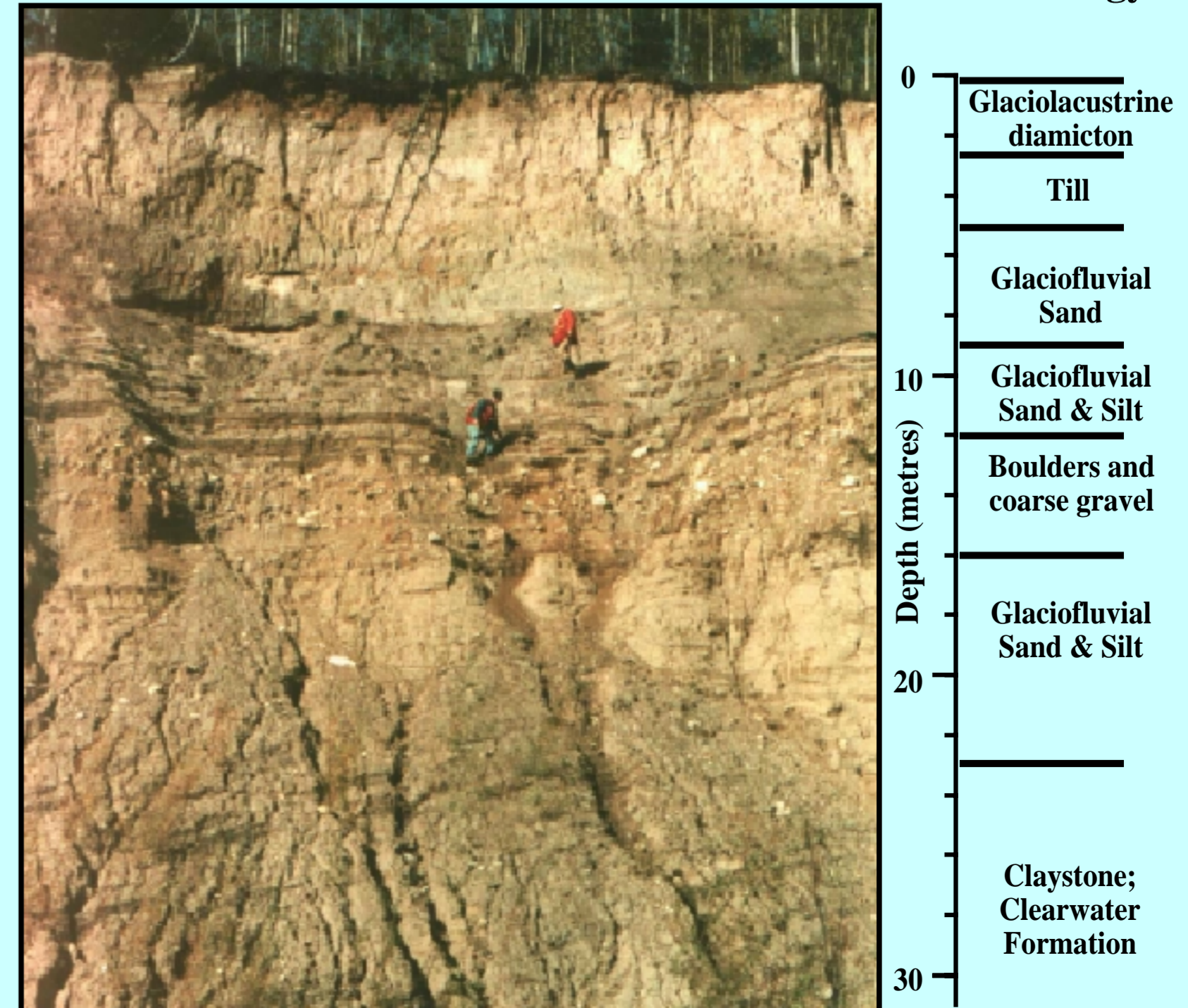
Birch Channel Outcrop along the Mackay River

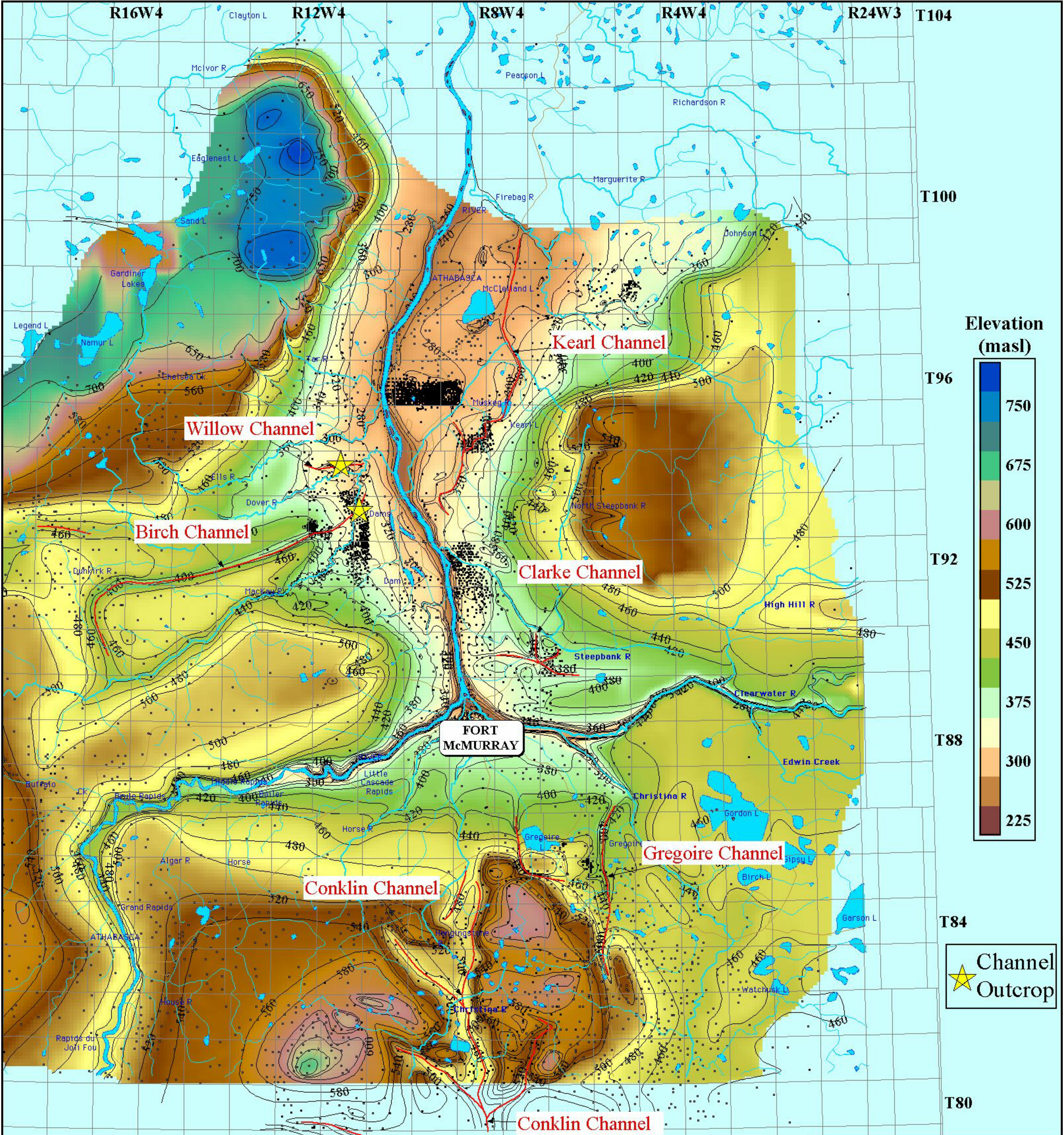
Lithology



Willow Channel Outcrop along the Dover River

Lithology

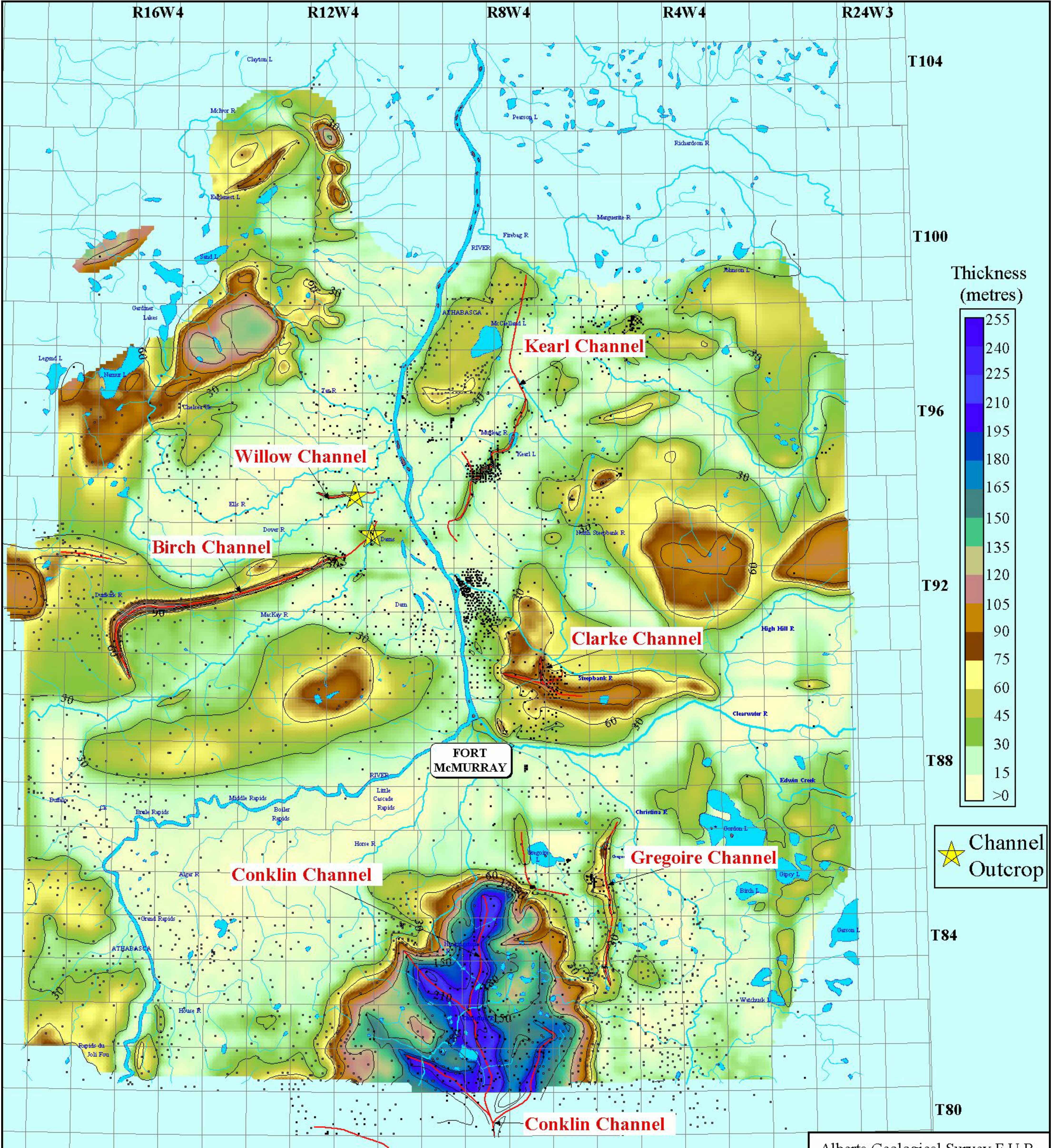




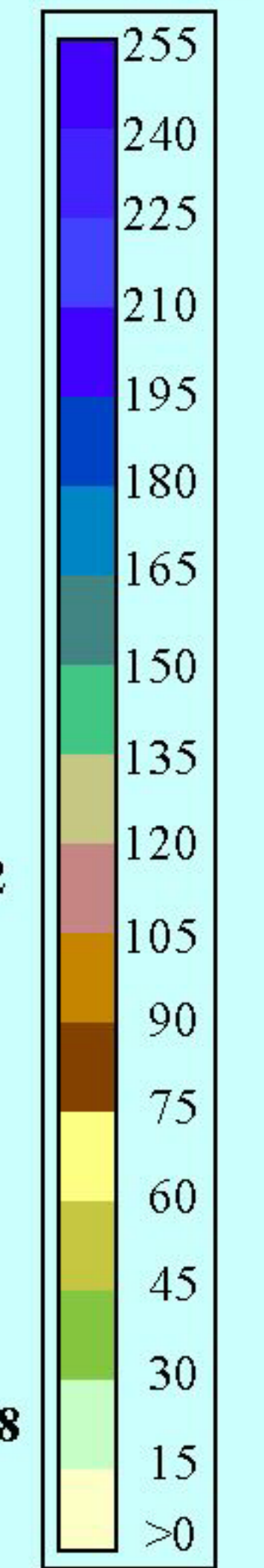
Bedrock Topography, NE Alberta

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Scale 1:400,000



Thickness (metres)

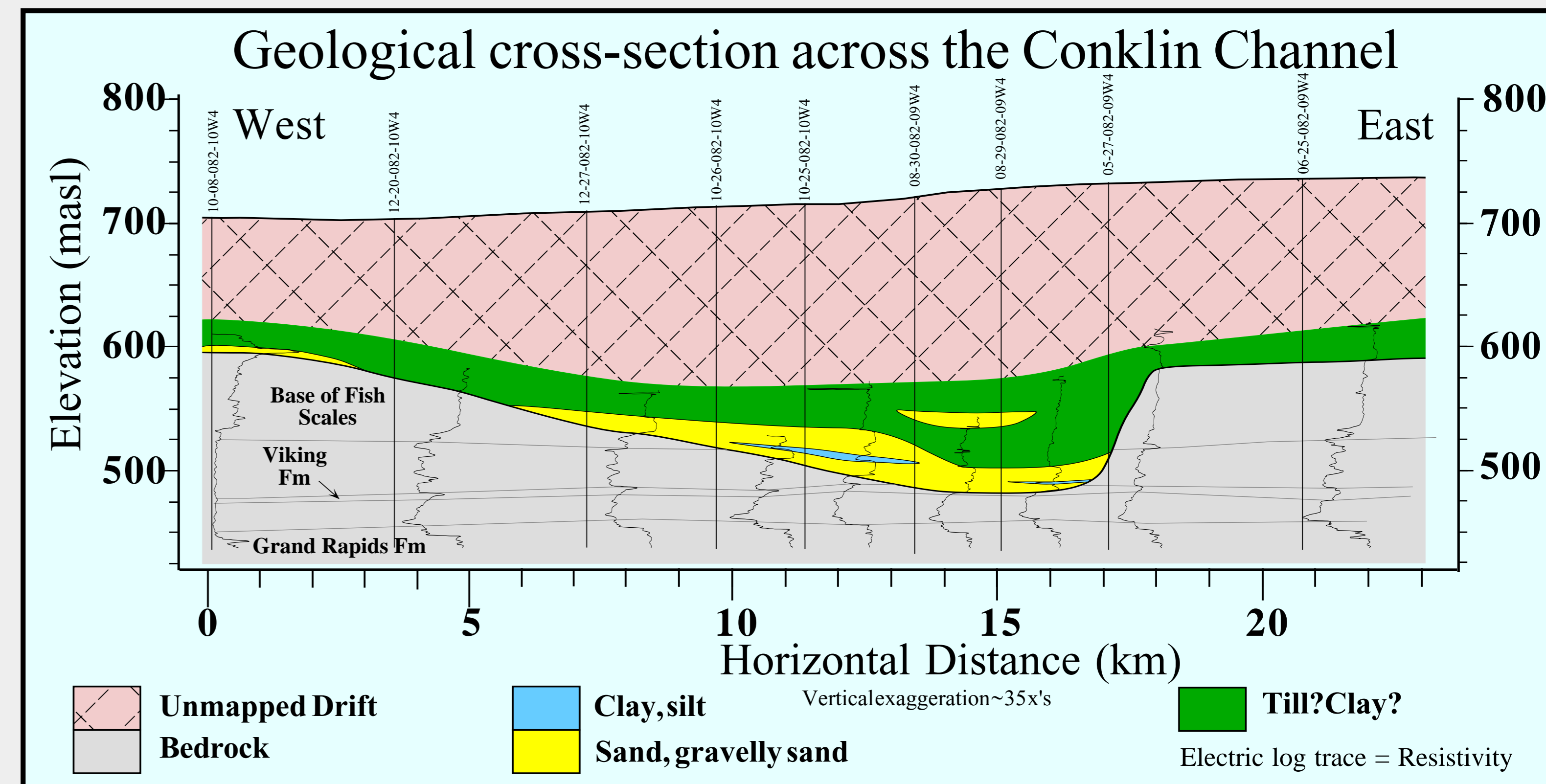
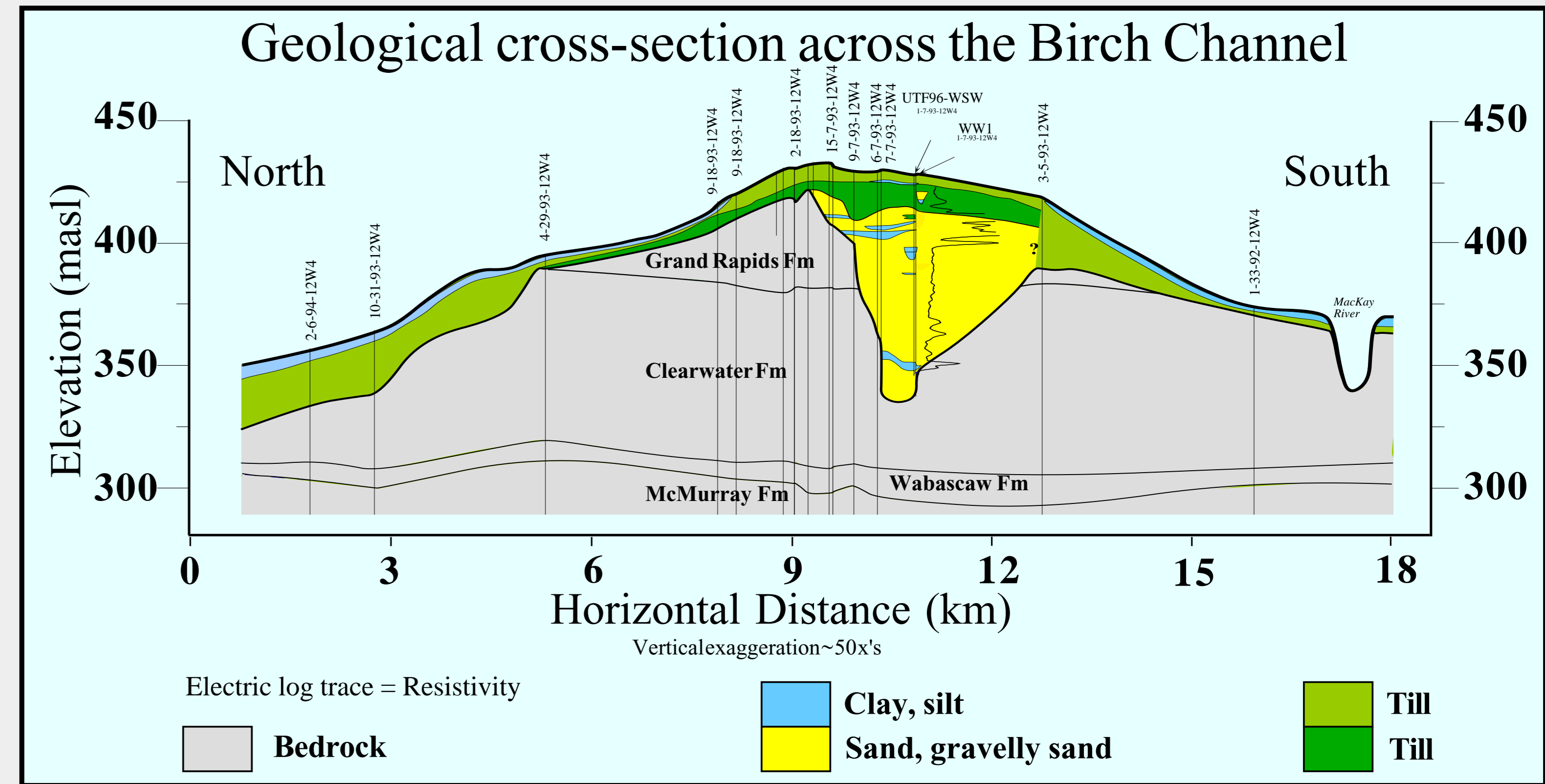
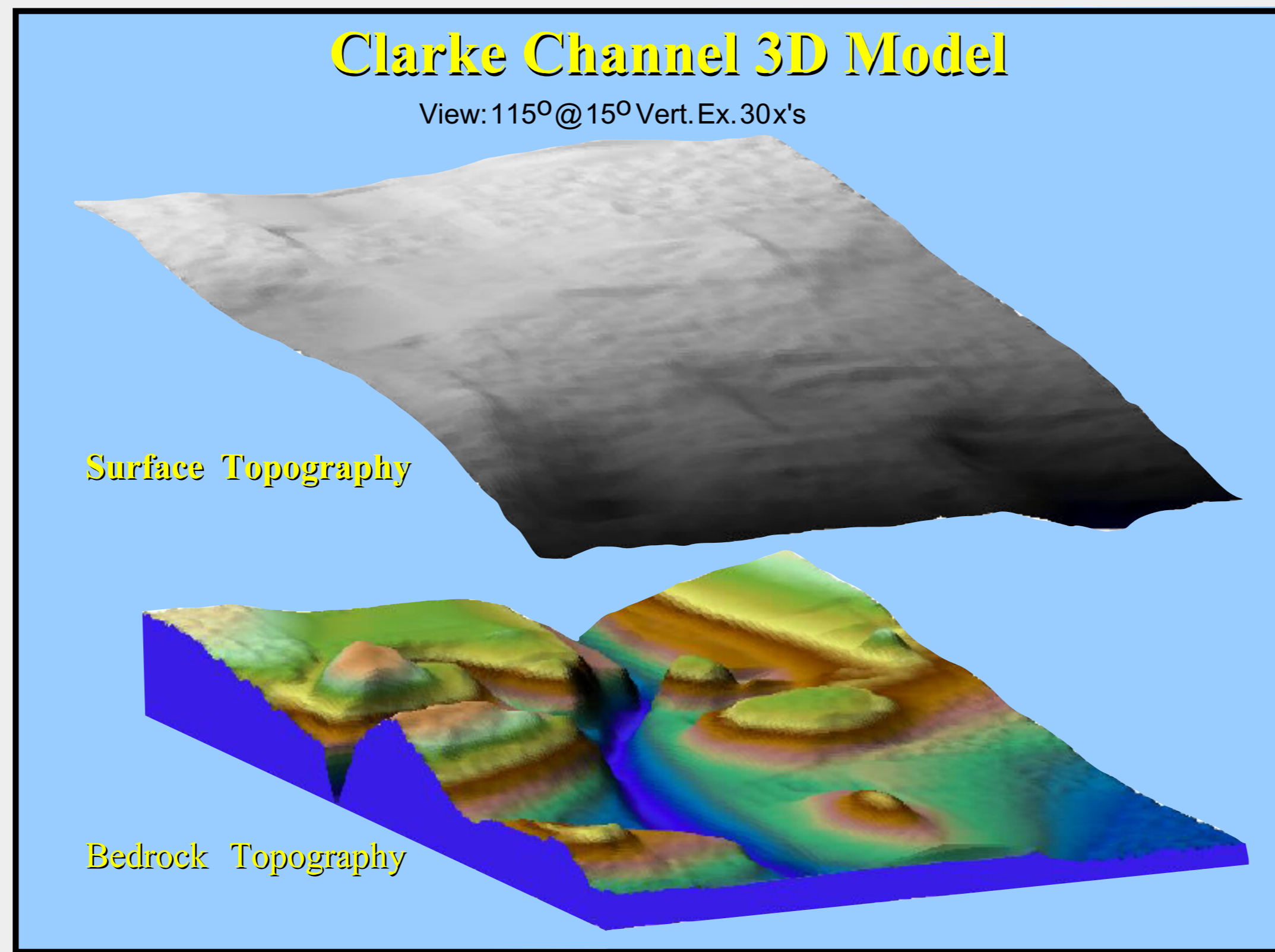
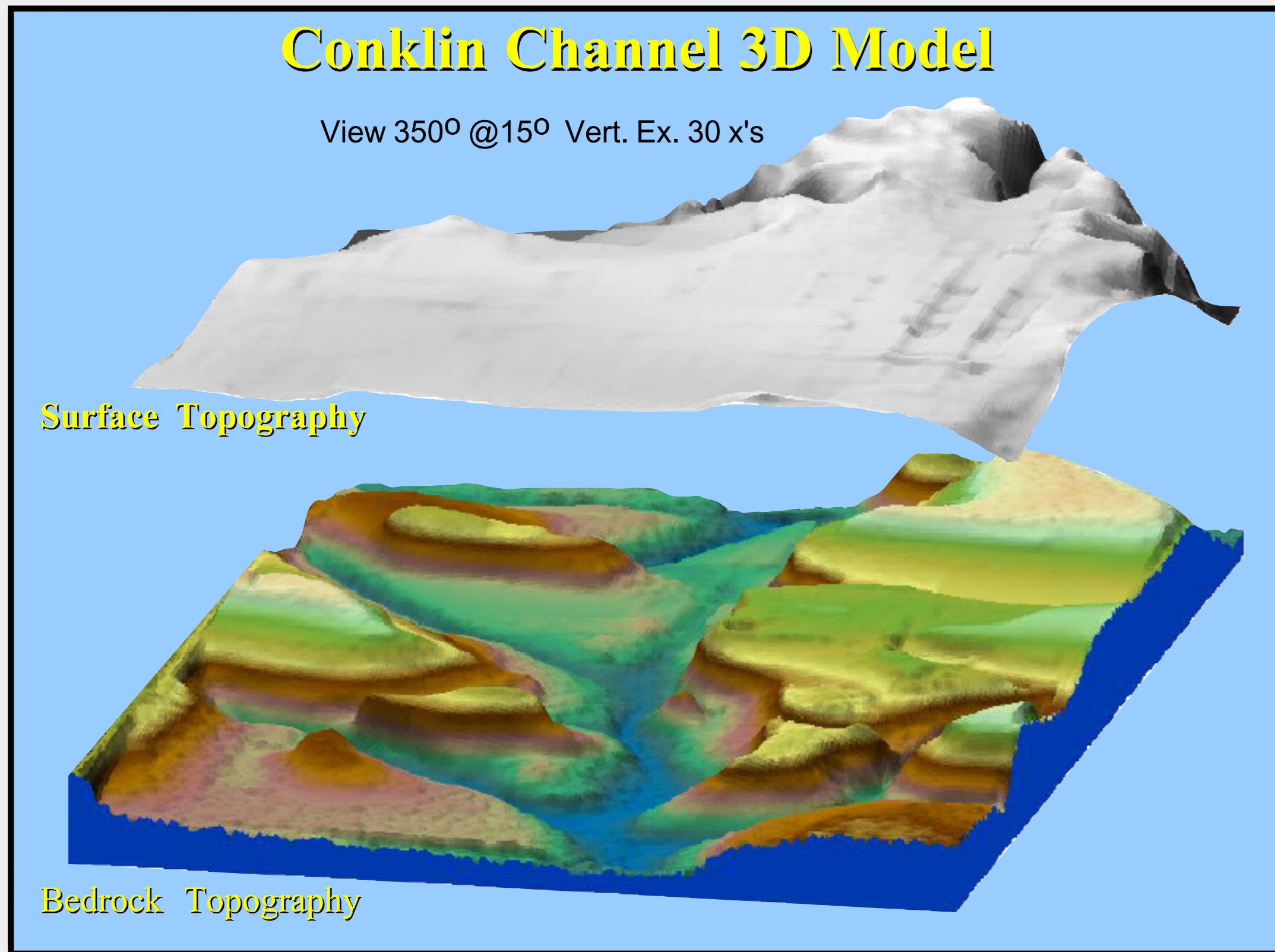
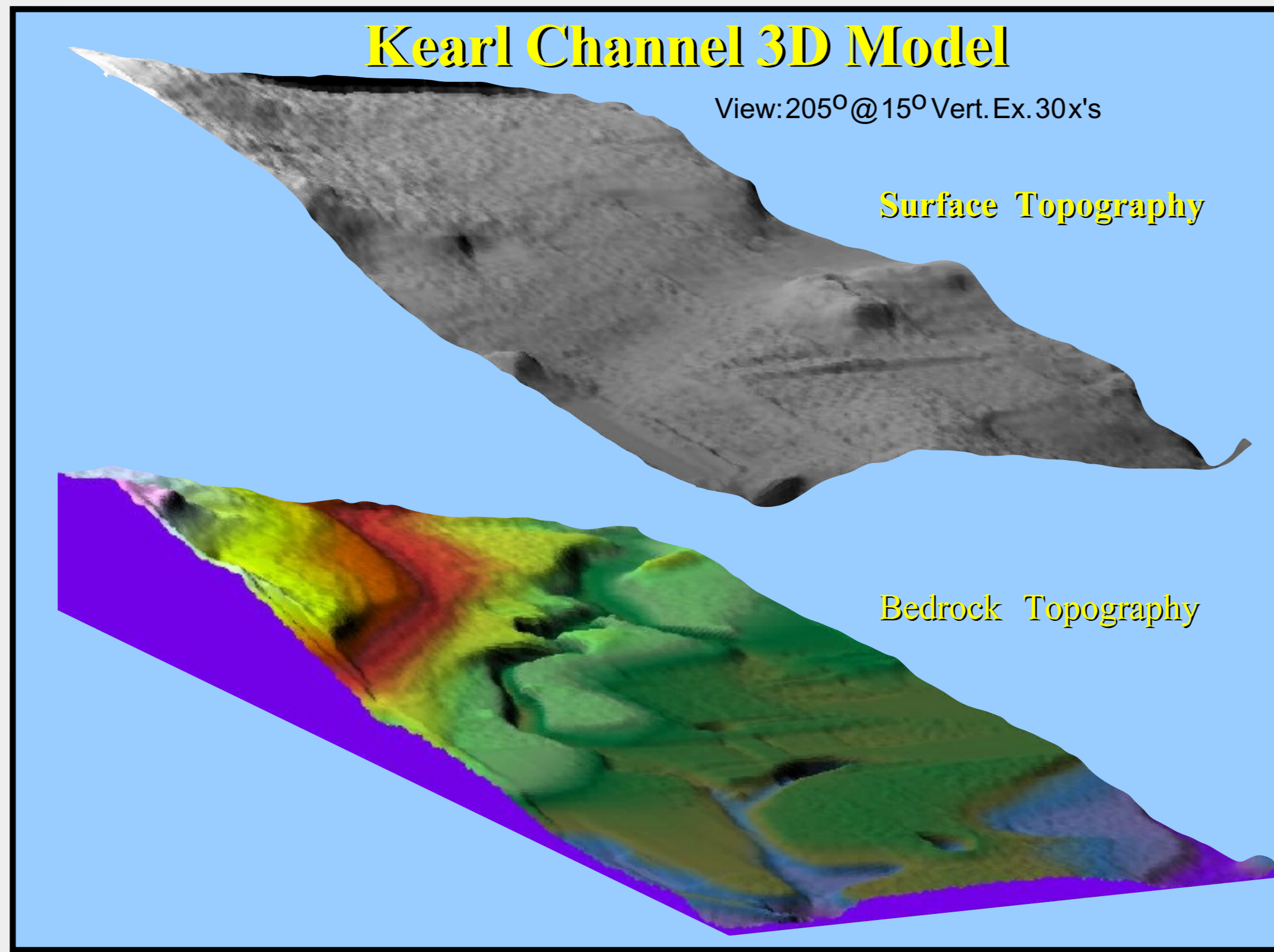
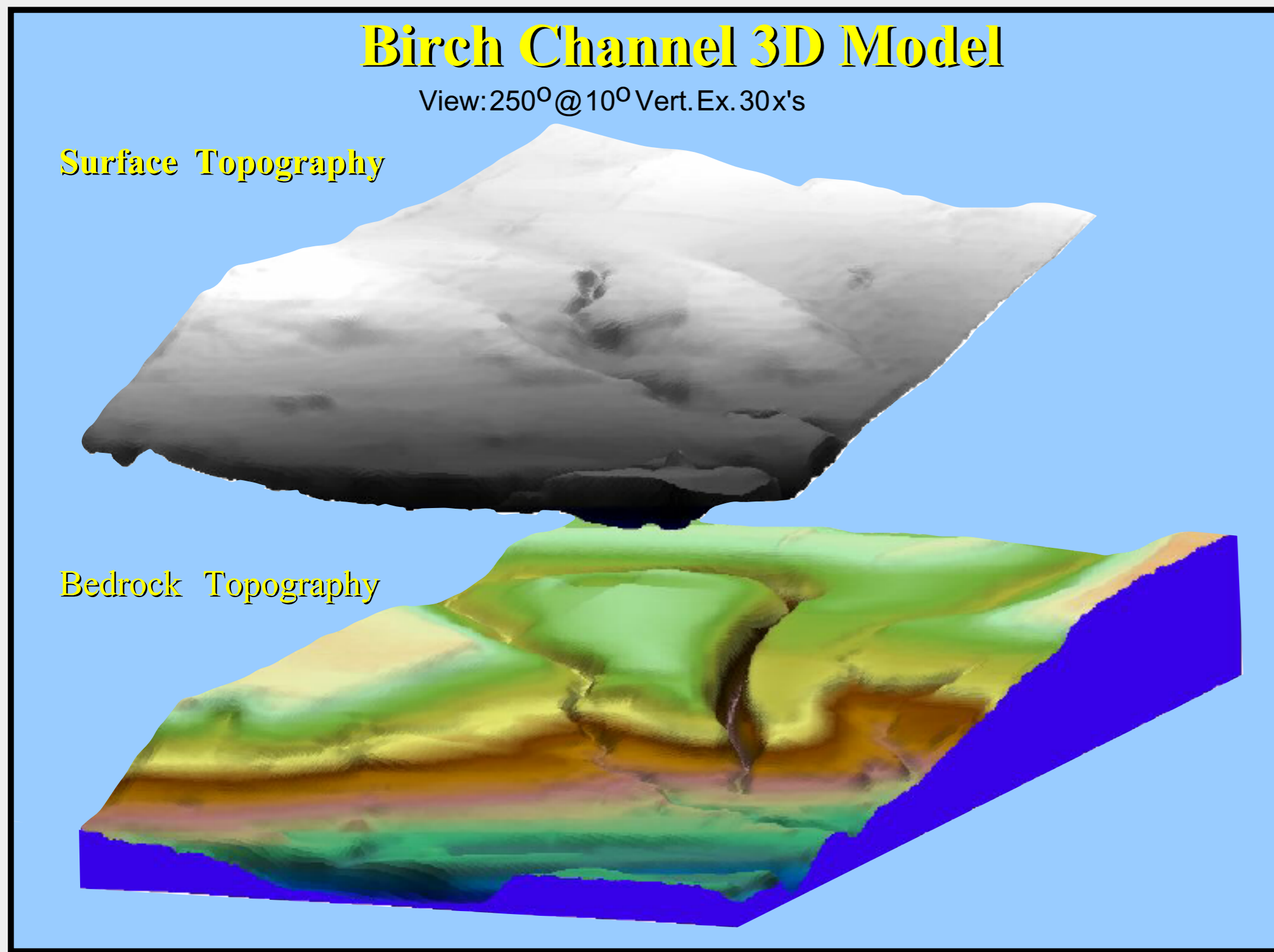


★ Channel Outcrop

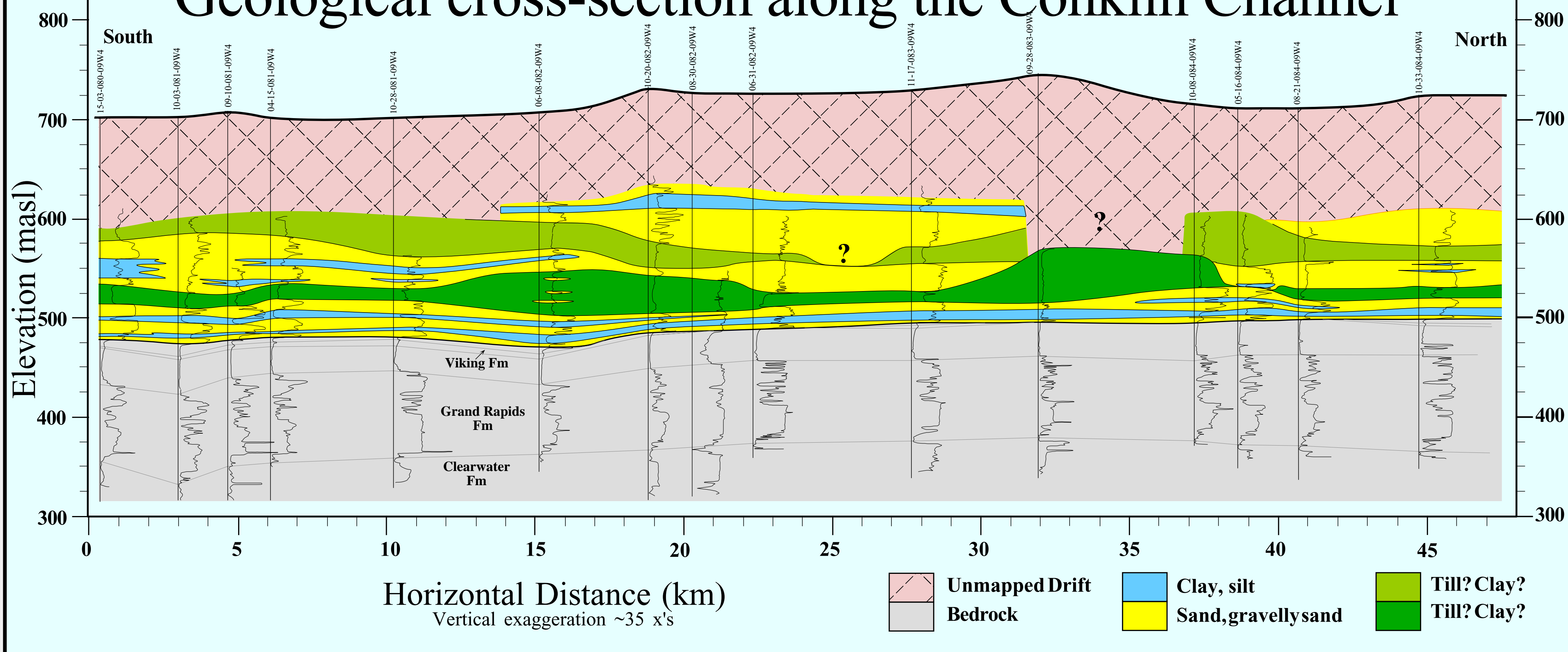
Alberta Geological Survey E.U.B.

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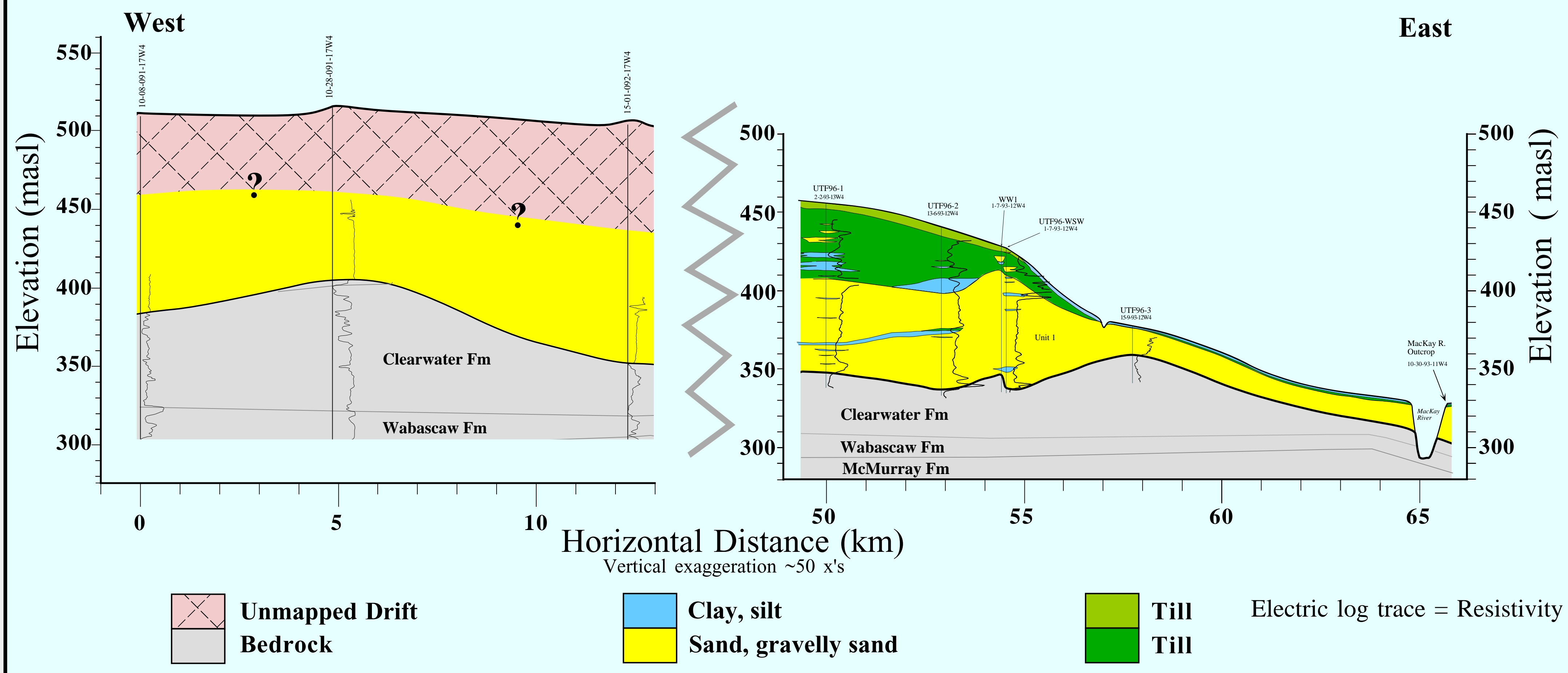
Quaternary Drift Thickness, NE Alberta



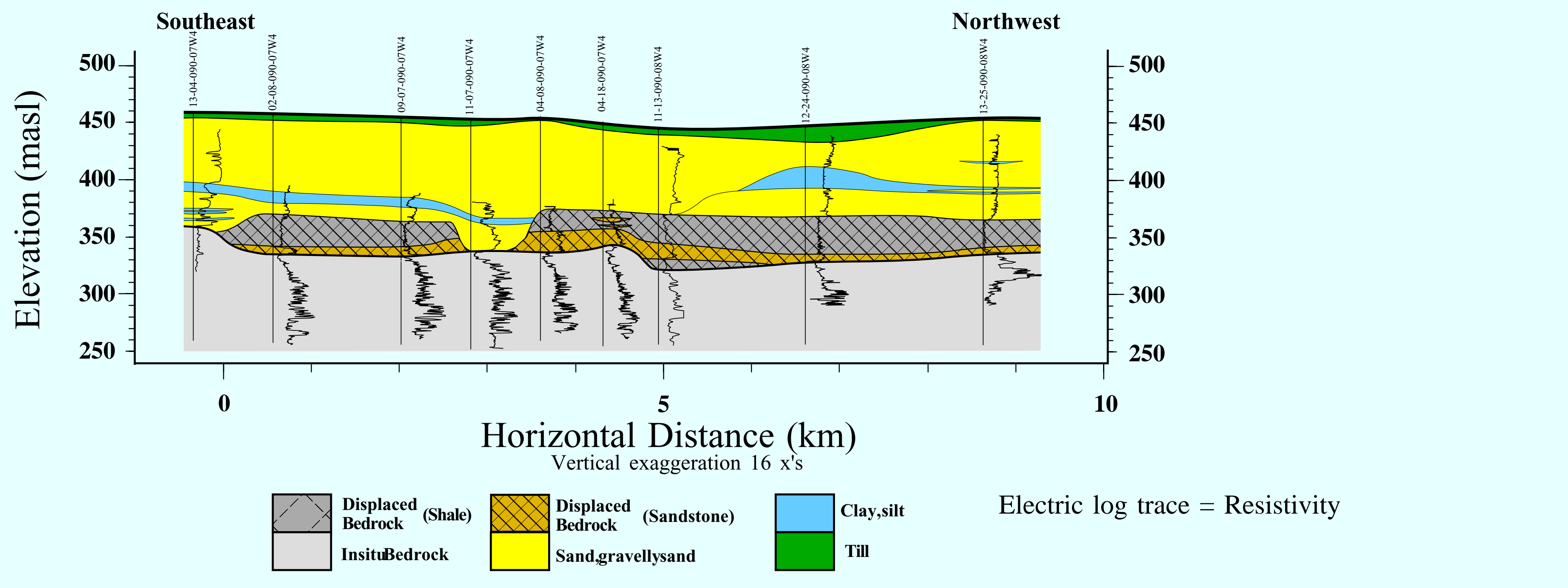
Geological cross-section along the Conklin Channel



Geological cross-section along the Birch Channel



Geological cross-section along the Clarke Channel



Geological cross-section along the Kearl Channel

