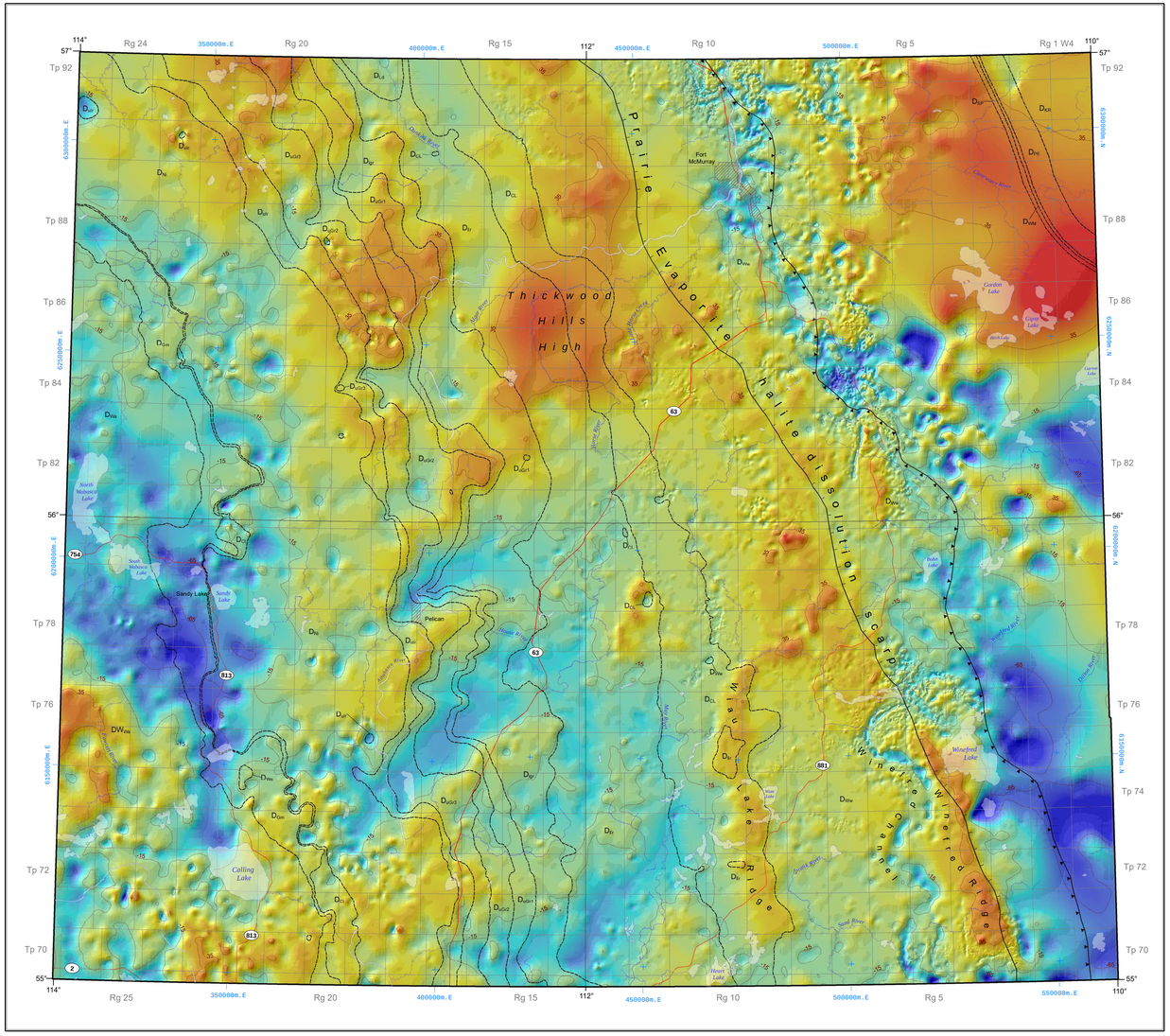
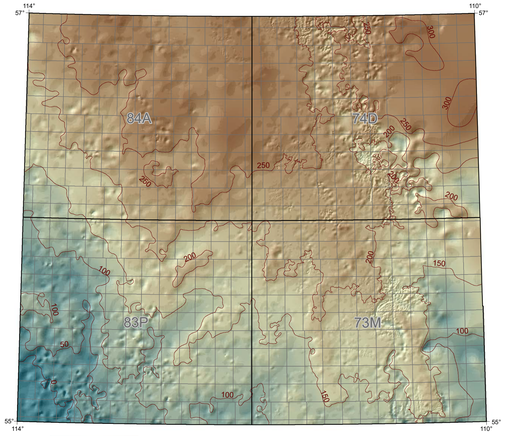
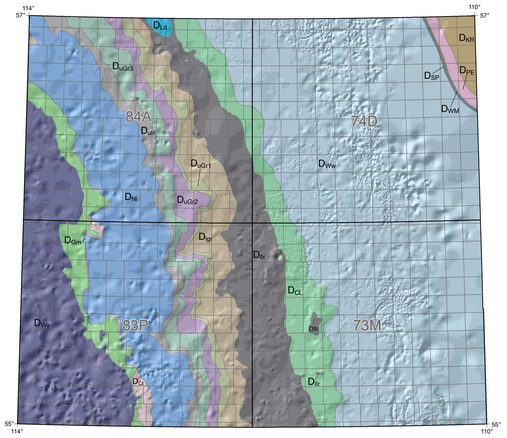
NTS 73M, 74D, 83P, 84A
SUB-CRETACEOUS PALEOTOPOGRAPHY



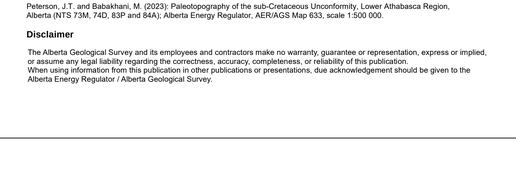


Elevation of the sub-Cretaceous unconformity.



D_{Wa} Wabamun Gp. D_{up} upper Ireton Fm. D_{uG} upper Grosmont unit D_{ww} Waterways Fm. D_{KR} Keg River Fm.
D_{Gm} Graminia Fm. D_{uG3} upper Grosmont 3 unit D_{lG} lower Grosmont unit D_{SP} Slave Point Fm.
D_{Cl} Calmar Fm. D_{uG2} upper Grosmont 2 unit D_{lr} Leduc Fm. D_{WM} Watt Mountain Fm.
D_{Ni} Nisku Fm. D_{uG1} upper Grosmont 1 unit D_{CL} Cooking Lake Fm. D_{PE} Prairie Evaporite Fm.

Distribution of stratigraphic units subcropping at the sub-Cretaceous unconformity.



Sub-Cretaceous unconformity data distribution (20 575 wells).

SYMBOL LEGEND

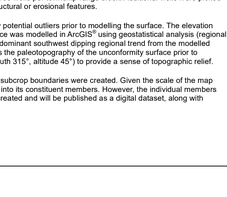
- Approximate boundary of subcropping stratigraphic unit
- D_{Wa} Wabamun Group
- D_{Gm} Graminia Formation
- D_{Cl} Calmar Formation
- D_{Ni} Nisku Formation
- D_{up} upper Ireton Formation
- D_{uG3} upper Grosmont 3 unit
- D_{uG2} upper Grosmont 2 unit
- D_{uG1} upper Grosmont 1 unit
- D_{lG} lower Grosmont unit
- D_{lr} lower Ireton Formation
- D_{Ld} Leduc Formation
- D_{CL} Cooking Lake Formation
- D_{ww} Waterways Formation
- D_{SP} Slave Point Formation
- D_{WM} Watt Mountain Formation
- D_{PE} Prairie Evaporite Formation
- D_{KR} Keg River Formation
- Start of Prairie Evaporite halite dissolution scarp
- Base of Prairie Evaporite halite dissolution scarp

Sub-Cretaceous paleotopography (height in metres relative to regional trend)
-116 to 83 m — Contour line

BASEMAP LEGEND

- 600000m.E UTM, Zone 12 grid
- Highway
- River
- Water body (lake or major river)
- City or Town

Schematic Stratigraphy
(Modified from Hauck et al., 2017)



Background

The sub-Cretaceous unconformity is an important regional surface across the Alberta Basin, which represents a significant period of non-deposition and erosion initiated after deposition of Upper Jurassic / lowermost Cretaceous sediments of the first foreland basin clastic wedge. In the investigated area, this major unconformity surface separates the basin into broad depositional sequences assigned to two distinct tectonic phases: an early passive margin basin phase and a subsequent foreland basin phase.

The paleotopography of the sub-Cretaceous unconformity was an important control on the deposition and preservation of the overlying Cretaceous succession. Major factors controlling this paleotopography include differential erosion, and intrastratal dissolution of evaporites of the Prairie Evaporite Formation along the eastern margin of the study area (Hauck et al., 2017). These factors led to the development of sediment transport pathways and increased accommodation for deposition of the overlying Lower Cretaceous Mannville Group of the Athabasca Oil Sands area.

Methodology

The study area is located in the Lower Athabasca region and covers NTS map sheets 73M, 74D, 83P, and 84A. The study builds upon previous work by Peterson et al. (2016) and Hauck et al. (2017) and employed geophysical wireline log correlation as the primary method for mapping the unconformity surface at a greater density of wells than previous publications (e.g., Hauck et al., 2017). Geophysical wireline logs for 20 585 wells were examined to assign picks identifying the depth of the unconformity, and in 18 082 of those wells the eroded formation at the unconformity surface was identified and assigned a lithostratigraphic designation. This was possible due to new picks and previous pick datasets that were made from deeper, more complete penetrations of Paleozoic strata below the unconformity surface across the study area (Hauck, 2018).

Where possible, the unconformity surface was picked at a minimum density of three wells per township-range block. Additional wells were picked to aid in the delineation of features such as subcrop boundaries and complex structural or erosional features.

The sub-Cretaceous unconformity picks were geostatistically analyzed to identify potential outliers prior to modelling the surface. The elevation surface was modelled in Petrel® at a 500 m grid-cell spacing, and the trend surface was modelled in ArcGIS® using geostatistical analysis (regional polynomial trend). The paleotopographic surface was derived by subtracting the dominant southwest dipping regional trend from the modelled sub-Cretaceous unconformity surface, creating a residual surface that represents the paleotopography of the unconformity surface prior to Mannville Group deposition. Paleotopography is displayed with a hillshade (azimuth 315°, altitude 45°) to provide a sense of topographic relief.

Using the pick data and the paleotopography surface as a guide, high resolution subcrop boundaries were created. Given the scale of the map publication, the Waterways Formation as presented in this publication is not split into its constituent members. However, the individual members were picked in detail and subcrop boundaries for all Waterways members were created and will be published as a digital dataset, along with elevation and paleotopography grids, and the pick dataset.

Acknowledgements

T. Hauck reviewed the map. G. Abinal provided GIS and cartographic services for the mapping project.
Digital base provided by Spatial Data Warehouse and Natural Resources Canada.

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URL <https://ags.aer.ca/publication/pra-2016-002> [January 2023].

Recommended Reference Format

Peterson, J.T. and Babakhani, M. (2023): Paleotopography of the sub-Cretaceous Unconformity, Lower Athabasca Region, Alberta (NTS 73M, 74D, 83P and 84A); Alberta Energy Regulator, AER/AGS Map 633, scale 1:500 000.

Disclaimer

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Map 633

Paleotopography of the Sub-Cretaceous Unconformity Surface, Lower Athabasca Region, Alberta (NTS 73M, 74D, 83P and 84A)

J.T. Peterson and M. Babakhani

Scale 1:500 000

10 5 0 10 20 30 40 50 kilometres
5 0 5 10 15 20 25 miles

Projection: Universal Transverse Mercator, Zone 12
Datum: North American Datum, 1983