

Atlas 2027: Upper Triassic Charlie Lake Maps

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Summary

Further to the effort to update and refresh the Western Canada Sedimentary Basin (WCSB) Atlas for 2027 target date, additional drilling and research data from the Upper Triassic Charlie Lake Formation has been compiled and integrated into new maps, and cross sections.

Post-1994, new information and mapping is available which includes detailed outcrop mapping and sampling in northeastern BC (Zonneveld 1999; Zonneveld, Carrelli, & Reidiger, 2004; Dixon 2009; Zonneveld, Ferri, Beatty & Gingras 2010; Fefchak 2011; Nordheimer 2012; Booker 2019), extending to the north through the Yukon (Yarnell, Stanley, & Hart 1999, McMechan, Ferri & Matthews 2018; Kellett, Coutand, Zagorevski, Grujic, & Dewing 2022). The 2027 Atlas update expands the scope of coverage by integrating Triassic formations in the WCSB with those in the Yukon. In addition, the Charlie Lake will be included in the standalone Middle/Upper Triassic chapter along with the Baldonnel, Pardonet, Halfway and Doig formations.

In the subsurface of NW Alberta and NE British Columbia the Charlie Lake consists of three major lithostratigraphic units: the lower Charlie Lake, the Boundary Lake, and the upper Charlie Lake. The lower and upper Charlie Lake Formation are separated by a regional angular unconformity known as the Coplin unconformity. Deposition of these units were likely influenced by syn-depositional tectonism and basin geometry during the Carnian (Caplan & Moslow 1997; Davies 1997; Greene, Scoates, Weis, & Israel 2005; Zonneveld, Ferri, Beatty, & Gingras 2010; Fefchak 2011; Nordheimer 2012; Golding 2014). These intervals (informal/formal members) have not been expressly identified in the Spray River and Liard sub-basins or in the outcrop belt where units of the Ludington and Whitehorse formations are the regional equivalents to Charlie Lake.

The lower Charlie Lake represents a change in depositional regime across the predominantly conformable boundary from the Halfway/Laird Formation sandstones below into evaporitic dolomites and anhydrites immediately below the Coplin angular unconformity above.

The Boundary Lake Member of the Charlie Lake is readily recognizable at the Coplin unconformity by a marked increase in fine grained clastic input across the contact. The Boundary Lake Member grades upwards into a massive anhydrite towards the north and west which is capped by locally preserved dolomitic units/reservoirs immediately below the Boundary Lake disconformity.

Towards the southeast, the upper Boundary Lake depositional regime shifts towards carbonate from anhydrite.

The upper Charlie Lake shows a significant shift in deposition across the Boundary Lake disconformity into predominantly fine-grained sands and siltstones with varying amounts of carbonate and anhydritic cements throughout. The upper Charlie Lake is conformably overlain by the Baldonnel Formation to the west and unconformably by the Worsley member in the East.

The division of the Charlie Lake into three large-scale unconformity bounded units provides an initial basis for mapping across the full extent of the project. Variations to these divisions are made in the relevant sub-basins and outcrop belts as required to complete a coherent map of the Charlie Lake. Structural and thickness mapping from well tops database and edges provides insights into depositional fairways and timing of major tectonic events such as reactivation of faults within the Peace River Embayment (Barclay, Krause, Campbell & Utting 1990; O'Connell, Dix, & Barclay 1990).

Locations of outcrop belts are included from digital GIS datasets with Triassic polygons and used in mapping units and integrating the recent outcrop mapping projects. These projects are important in that they confirm a shift in provenance from the west for both Middle and Upper Triassic sediments in contrast to the traditional stable Laurentia craton model of the past (Zonneveld, Ferri, Beatty & Gingras 2010, Nordheimer 2012; Golding, Mortensen, & Ferri, Zonneveld, and Orchard 2015).

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