Regional-scale Modelling of the Paleozoic Succession Beneath the Athabasca and Cold Lake Oil Sands Areas: Devonian Paleogeography, Evaporite Dissolution, and Controls on Cretaceous Depositional Patterns on the Sub-Cretaceous Unconformity

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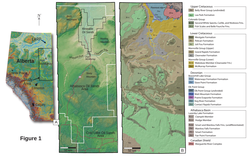
Introduction

The geology of northeastern Alberta accounts for a substantial percentage of hydrocarbon production within the province. Much of the geological focus in this area has been given to the Lower Cretaceous Mannville Group strata, in which vast bitumen and heavy oil deposits are found. With the exception of the carbonate-hosted bitumen deposits of the Grosmont Formation, less consideration has been given to the underlying Paleozoic succession, despite the fact that Devonian subcropping strata can form major aquifers in direct communication with the lower Mannville Group, and are a major control on the stratigraphic architecture of the overlying Cretaceous succession. The distribution and extent of Paleozoic strata, represented by Middle Cambrian to uppermost Devonian units, underlying 974 townships in northeastern Alberta have been updated based on detailed regional-scale lithostratigraphic mapping and modelling. Detailed correlation and modelling provide the basis to: 1) reassess regional paleogeography of the Keg River and Prairie Evaporite formations, 2) redefine the location of the Prairie Evaporite halite dissolution scarp, and assess the internal architecture therein, 3) model the sub-Cretaceous unconformity and delineate Paleozoic subcrop belts, and 4) demonstrate the control that various Paleozoic formations had on depositional patterns in the lower Mannville Group at the sub-Cretaceous unconformity.

Study Area


Alberta
Saskatchewan
Athabasca Oil Sands Area
Cold Lake Oil Sands Area
Peace River Oil Sands Area
Edmonton
Calgary
Lloydminster
Fort McMurray
Grande Prairie
Red Deer
Medicine Hat
Lethbridge
Wood Buffalo National Park
Canada
United States
Saskatchewan
Manitoba
British Columbia
Northwest Territories
Nunavut
Montana
Wyoming
Idaho
Utah
Colorado
Arizona
New Mexico
Nevada
Oregon
Washington
North Dakota
South Dakota
Nebraska
Kansas
Oklahoma
Texas
Minnesota
Iowa
Missouri
Arkansas
Louisiana
Mississippi
Alabama
Georgia
Florida
South Carolina
North Carolina
Tennessee
Kentucky
Illinois
Indiana
Ohio
West Virginia
Virginia
Pennsylvania
New York
Maryland
Delaware
New Jersey
Connecticut
Rhode Island
Massachusetts
Vermont
New Hampshire
Maine
Michigan
Wisconsin
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
Hudson Bay
Arctic Ocean
Alaska
Hawaii
Mexico
Cuba
Bahamas
Greenland
Iceland
Europe
Asia
Africa
Australia
South America
Antarctica
Arctic Archipelago
Baffin Island
Ellesmere Island
Victoria Island
Banks Island
Melville Island
Prince of Wales Island
Somerset Island
Devon Island
Axel Heiberg Island
Ellef Ringnes Island
Amund Ringnes Island
Cornwallis Island
Lancaster Sound
Parry Islands
Queen Elizabeth Islands
Beaufort Sea
Mackenzie Delta
Great Slave Lake
Great Bear Lake
Yellowknife
Whitehorse
Dawson City
Inuvik
Tuktoyaktuk
Churchill
Thompson
Winnipeg
Regina
Saskatoon
Prince Albert
Moose Jaw
Swift Current
Medicine Hat
Lethbridge
Calgary
Red Deer
Edmonton
Lloydminster
Grande Prairie
Peace River
Fort McMurray
Fort McMurray
Cold Lake
Lac La Biche
Athabasca
Wood Buffalo National Park
Peace River Oil Sands Area
Cold Lake Oil Sands Area
Athabasca Oil Sands Area
Study Area
Alberta Plateau
Precambrian Shield
Interior Plains
Rocky Mountains
Foothills
Boreal Forest
Grassland
Parkland
Tundra
Taiga
Permafrost
Glaciated
Unglaciated
Ice Sheet
Glacial Lake
Glacial River
Glacial Moraine
Glacial Drumlin
Glacial Esker
Glacial Kame
Glacial Outwash
Glacial Till
Glacial Lacustrine
Glacial Fluvial
Glacial Aeolian
Glacial Organic
Glacial Colluvial
Glacial Alluvial
Glacial Marine