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CANADIAN GEOSCIENCE MAP 308

BEDROCK GEOLOGY

LAC DES BOIS

Northwest Territories

Map Information Document

Celebrating 175 yrs

Geological Survey of Canada
Canadian Geoscience Maps

2018

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MAP NUMBER

Natural Resources Canada, Geological Survey of Canada
Canadian Geoscience Map 308

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1:250 000

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ABSTRACT

The Lac des Bois map area (NTS 96-K) lies within the Colville Hills region of the Northwest Territories. Sparse bedrock exposures in the area include carbonate and siliciclastic strata ranging from Cambrian to Paleogene. These strata were deformed in

the Cretaceous to Eocene by folding and contractional faulting associated with Cordilleran deformation. A pre-Cordilleran set of approximately north-trending extensional faults are preserved within subsurface Proterozoic and Cambrian strata, and were locally reactivated by Cordilleran deformation. A major unconformity between Devonian and Cretaceous strata is marked by tilted Paleozoic strata beneath the Cretaceous, and the absence of Devonian strata in the eastern part of the map area. Natural gas has been reported from petroleum exploration wells drilled into Mount Clark Formation (Cambrian) sandstone.

RÉSUMÉ

La région cartographique de Lac des Bois (SNRC 96-K) se situe dans la région des collines Colville des Territoires du Nord-Ouest. Dans la région, des affleurements clairsemés du socle rocheux renferment des strates carbonatées et des strates silicoclastiques rapportées à l'intervalle du Cambrien au Paléogène. Ces strates ont été déformées dans l'intervalle du Crétacé à l'Éocène par des plis et des failles de compression associés à la déformation cordillérienne. Des failles de distension de direction à peu près nord appartenant à un ensemble pré-cordillérien sont conservées en profondeur dans les strates du Protérozoïque et du Cambrien et ont été réactivées localement par la déformation cordillérienne. Une discordance majeure entre les strates du Dévonien et celles du Crétacé est révélée par l'inclinaison des strates du Paléozoïque sous celles du Crétacé ainsi que par l'absence de strates du Dévonien dans la partie est de la région cartographique. On a signalé la présence de gaz naturel dans des puits d'exploration pétrolière forés dans le grès de la Formation de Mount Clark (Cambrien).

LICENCE AGREEMENT

ACCORD DE LICENCE

SHEET 1 OF 1, BEDROCK GEOLOGY

GENERAL INFORMATION

Author: K.M. Fallas

Geological compilation by K.M. Fallas, 2015–2016

Geology conforms to Bedrock Data Model v. 4.0

Geological field observations by K.M. Fallas, R.B. MacNaughton, and M.J. Sommers, 2015; J.D. Aitken, D.G. Cook, R.W. Macqueen, and M. Ayling, 1968

Stratigraphic sections measured by R.B. MacNaughton and E.C. Turner (Laurentian

University), 2015; R.W. Macqueen, 1968

Reflection-seismic data interpreted by B.C. MacLean and K.M. Fallas, 2015. Petroleum exploration well-picks selected by J. Dixon, 2016

Geomatics by K.M. Fallas and D.A. Lemay

Cartography by D.A. Lemay

Initiative of the Geological Survey of Canada, conducted under the auspices of the Mackenzie Project as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program

Logistical support provided by the Polar Continental Shelf Program as part of its mandate to promote scientific research in the Canadian North. PCSP 05415

Map projection Universal Transverse Mercator, zone 10.
North American Datum 1983

Base map at the scale of 1:250 000 from Natural Resources Canada, with modifications.
Elevations in metres above mean sea level

Mean magnetic declination 2018, 21°00'E, decreasing 30.2' annually. Readings vary from 21°14'E in the NW corner to 20°42'E in the SE corner of the map.

This map is not to be used for navigational purposes.

Title photograph: Fossilized corals and stromatoporoids in dolostone of the Mount Kindle Formation, southwest shore of Tunago Lake, Northwest Territories. Photograph by K.M. Fallas. 2017-041

The Geological Survey of Canada welcomes corrections or additional information from users.

Data may include additional observations not portrayed on this map. See map info document accompanying the downloaded data for more information about this publication.

This publication is available for free download through GEOSCAN (http://geoscan.nrcan.gc.ca/).

Map Viewing Files

The published map is distributed as a Portable Document File (PDF), and may contain a subset of the overall geological data for legibility reasons at the publication scale.

DESCRIPTIVE NOTES

Initial bedrock mapping and stratigraphic studies by the Geological Survey of Canada in the Lac des Bois map area (NTS 96-K) were conducted in 1968 as part of Operation Norman. This operation led to the release of a report and preliminary map of the area (Aitken and Cook, 1970; Cook and Aitken, 1971). Observations from the 1968 field activities have been incorporated into this compilation along with observations collected in 2015 as part of the Geo-mapping for Energy and Minerals (GEM) Program. Petroleum exploration wells and reflection-seismic data drilled or collected since 1970 have also helped constrain the map interpretation and geological relationships in the subsurface (Fig. 1, 2). Despite significant areas of unconsolidated Quaternary sediment cover, the bedrock units have been interpreted beneath that cover in an attempt to create a seamless bedrock interpretation.

Starting with the oldest bedrock units, changes to the stratigraphic map units from Aitken and Cook (1970) include the subdivision of the obsolete Ronning Group into the Franklin Mountain and Mount Kindle formations (Norford and Macqueen, 1975). The Ordovician-Silurian boundary within Mount Kindle Formation exposed on Good Hope Ridge was previously documented using biostratigraphic evidence from corals (Cook and Aitken, 1971). Samples collected in 2015 and analyzed for conodonts have verified the presence of the boundary and refined the location within the section (additional details are available in the digital data accompanying this map). Morrow (1991) documents the lateral relationship between Devonian bedded carbonates of the Arnica and Landry formations and brecciated carbonate of the Bear Rock Formation. Limited outcrop exposure combined with irregular brecciation of this interval encouraged the adoption of ‘Bear Rock assemblage’ in this area to encompass lithologies found in each of these units as well as postulated occurrences of Delorme Group strata (Gouwy et al., 2017). The carbonate strata of the above-mentioned units are prone to the development of karst features in this area, and sinkholes are particularly noticeable where these units are at surface (Van Everdingen, 1981). Seasonal variations in lake levels and stream flow are likely affected by the diversion of surface water underground through the karst system.

Low-angle tilting and erosion of the Paleozoic units are evident beneath the sub-Cretaceous unconformity, with Mount Kindle and Bear Rock formations missing beneath the Cretaceous northeast of Good Hope Ridge (‘Maunoir Arch’ in Fig. 2). Limited exposure of the Cretaceous units makes it difficult to map formation boundaries; however, biostratigraphic evidence from isolated outcrops indicates the presence of Lower Cretaceous strata equivalent to Martin House and Arctic Red formations of Mackenzie Plain, Langton Bay and Horton River formations of Anderson Plain (Dixon, 1999), and Upper Cretaceous strata equivalent to the Slater River Formation. An outcrop of Upper Cretaceous strata on the northwest shore of Lac des Bois is curious in that underlying Lower Cretaceous strata that should be present between Paleozoic carbonate and the outcrop are not seen. This suggests either the existence of an unrecognized fault adjacent to the Upper Cretaceous outcrop or this outcrop is a transported block of bedrock embedded in Quaternary glacial deposits. Weathering of outcrops of Cretaceous sandstone has produced surface accumulations of loose sand, which complicate the separate identification of Cretaceous bedrock and Quaternary deposits (R.B. MacNaughton et al., work in progress); such deposits are shown as the KQs unit on the map. An isolated outcrop of iron-stained sandstone, in the footwall of the Lugewa Fault, is correlated with Paleogene iron-stained conglomerate and

sandstone found to the northwest on Maunoir Ridge (Lac Maunoir map area, NTS 96-N; Fallas, 2018). Areas shown as Quaternary sediment on the map include substantial areas of glacial deposits left behind by the Laurentide ice sheet (Hughes, 1987).

Proterozoic deformation of sedimentary strata in this map area is documented from reflection-seismic data (Cook and MacLean, 2004). No dominant structural trend is interpreted from the Proterozoic contractional features. Subsequent to Proterozoic deformation, extensional faults developed in the Cambrian (MacLean, 2011) with a dominant north to northeast trend. During Cordilleran deformation in Cretaceous to Eocene time, the pre-existing structures in the subsurface influenced the location and trend of Cordilleran structures, in some cases through reactivation of older structures. Reactivated structures typically have steeper dips on the fault plane cutting into Proterozoic strata and are therefore shown as reverse faults rather than thrust faults. In contrast, thrust faults show evidence of detachment in evaporite of the Cambrian Saline River Formation on reflection-seismic data. In comparison to Aitken and Cook (1970) both faults and folds have been added to the map interpretation, mainly based on evidence from reflection-seismic data.

Petroleum exploration wells in the Lac des Bois area have targeted Cambrian sandstone of the Mount Clark Formation (Dixon and Stasiuk, 1998). Natural gas showings have been reported from wells in the Nogha and Tweed Lake areas. ‘Oil seeps’ have been documented along the northwest shore of Lac des Bois (Cook and Aitken, 1971), and were re-examined in 2015. The patchy, oil-saturated sand found in one exposure lacks bedding and is intermixed with carbonate rubble from an adjacent Devonian outcrop, suggesting possible emplacement with Quaternary glacial deposits. The lack of oil in the associated Devonian carbonate argues against a local bedrock source. Analysis of an oil sample from this location showed it is very biodegraded, and likely has been exposed to surface conditions for an extended period of time (D. Jiang, pers. comm., 2016). In agreement with the statement in Cook and Aitken (1971), 2015 field activities did not observe the presence of any metallic minerals of economic significance in the map area. Deposits of sand and gravel within the KQs and Quaternary units (Smith and Lesk-Winfield, 2010) may be useful for infrastructure development, but more detailed study of the surficial materials found in this area is required to identify suitable deposits.

Acknowledgments

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Additional Information

The Additional Information folder of this product's digital download contains figures and tables that appear in the map surround as well as additional geological information not depicted on the map, nor this document, nor the geodatabase.

-PDF of each figure/table that appears in the CGM surround.
-Excel file of the Master Legend Table (legend symbols, descriptions, headings, etc.).

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Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 10
Horizontal Datum: NAD83
Vertical Datum: mean sea level

Bounding Coordinates

Western longitude: 126°00'00"W
Eastern longitude: 124°00'00"W
Northern latitude: 67°00'00"N
Southern latitude: 66°00'00"N

Software Version

Data has been originally compiled and formatted for use with ArcGIS™ desktop version 10.2.2 developed by ESRI®.

Data Model Information

Bedrock (Calgary)

Surface bedrock data are organized into feature classes and themes consistent with logical groupings of geological features. All field observation point data are related through the Station_ID property of the Station theme. These feature attribute names and definitions are identical in the shapefiles and the XML files.

Consult PDFs in Data folder for complete description of the feature classes, feature attributes, and attribute domains.

The Bedrock Data Model and the Bedrock Domains documents are intended to describe all bedrock features which may be compiled at the 1:50 000 scale. Therefore, some of the feature classes and feature attributes described in these documents may not be present.