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# CANADIAN GEOSCIENCE MAP 310

BEDROCK GEOLOGY

## AUBRY LAKE

Northwest Territories



Map Information  
Document



Geological Survey of Canada  
Canadian Geoscience Maps

2018

Canada



## **MAP NUMBER**

Natural Resources Canada, Geological Survey of Canada  
Canadian Geoscience Map 310

## **TITLE**

Bedrock geology, Aubry Lake, Northwest Territories

## **SCALE**

1 :250 000

## **CATALOGUE INFORMATION**

Catalogue No. M183-1/310-2017E-PDF

ISBN 978-0-660-07651-5

<https://doi.org/10.4095/306203>

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## **RECOMMENDED CITATION**

Fallas, K.M., 2018. Bedrock geology, Aubry Lake, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 310, scale 1:250 000.

<https://doi.org/10.4095/306203>

## **ABSTRACT**

The Aubry Lake map area (NTS 96-M) 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 Cretaceous. These strata were deformed in

the Cretaceous to Eocene by folding and contractional faulting associated with Cordilleran deformation. Divergent structural trends are interpreted to be inherited from Proterozoic structures in the subsurface. A major unconformity between Devonian and Cretaceous strata is marked by tilted Paleozoic strata beneath the Cretaceous. Natural gas has been reported from petroleum exploration wells drilled into Mount Clark Formation (Cambrian) sandstone.

## **RÉSUMÉ**

La région cartographique d'Aubry Lake (SNRC 96-M) 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 Crétacé. 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 cordillèreenne. L'existence de tendances structurales divergentes serait un legs de structures du Protérozoïque présentes en profondeur. 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. 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).

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## **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, and M. Ayling, 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 9.  
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°27'E, decreasing 32.5' annually. Readings vary from 21°37'E in the NW corner to 21°14'E in the SE corner of the map.

This map is not to be used for navigational purposes.

Title photograph: View north-northwest along Belot Ridge in the Colville Hills, Northwest Territories. Bare peak is underlain by cherty dolostone of the Franklin Mountain and Mount Kindle formations in the hanging wall of the Belot Ridge Fault. Photograph by K.M. Fallas. 2017-043

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 Aubry Lake map area (NTS 96-M) 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). Bedrock units have been interpreted beneath significant Quaternary cover in an attempt to create a seamless bedrock interpretation.

The oldest bedrock units exposed in the area are the Franklin Mountain and Mount Kindle formations, recognized on Belot Ridge by Cook and MacLean (1993) where they had not previously been recognized (Aitken and Cook, 1970). Mount Kindle Formation is locally missing beneath Devonian strata on Belot Ridge ('Belot Arch' in Fig. 2). Morrow (1991) documents the lateral relationship between Devonian bedded carbonates of the Arnica and Landry formations and brecciated carbonate of the Bear Rock Formation. 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, though not as commonly as in the neighbouring map area to the south (Lac Belot, NTS 96-L; Fallas, 2018). Seasonal variations in lake levels and stream flow are likely affected by the diversion of surface water underground through the karst system (Van Everdingen, 1981).

Low-angle tilting and erosion of the Paleozoic units are evident beneath the sub-Cretaceous unconformity west of Belot Arch, with younger Devonian strata only present in the western part of the map area. Sandstone of the Martin House Formation overlies the unconformity with thicker preserved strata in the west, possibly including overlying shale of the Arctic Red Formation (equivalent to Langton Bay and Horton River formations of Anderson Plain to the north; Dixon, 1999). Quaternary deposits are significant throughout the map area, and locally may be indistinguishable from Cretaceous bedrock. Quaternary sediment on the map includes 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 steep dips ( $>60^\circ$ ) 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 evaporites of the Cambrian Saline River Formation on reflection-seismic data. Subtle folds associated with minor faulting northwest of Aubry Lake are based on images of reflection-seismic data in the area and are new to this compilation.

Petroleum exploration wells in the Aubry Lake area have targeted Cambrian sandstone of the Mount Clark Formation (Dixon and Stasiuk, 1998). Natural gas showings have been reported from the Tedji Lake K-24 and Ewekka C-11 wells. 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.

## ACKNOWLEDGMENTS

This work was carried out on lands within the Sahtu Settlement Area as identified in the Sahtu Dene and Métis Comprehensive Land Claim Agreement. The author gratefully acknowledges the gracious welcome and logistical support of the Behdzi Ahda First Nation (Colville Lake, Northwest Territories). Helicopter and fixed-wing transportation was provided by local service providers based in Norman Wells. Additional field assistance was cheerfully provided by B. Manuel, and the geology team was kept safe by the wildlife monitoring of F.J. Barnaby and C. Oudzi. C. Yakeleya reliably ensured that logistics were coordinated. The author also thanks L.D. Currie and G.S. Stockmal for critical reviews of the map.

## REFERENCES

- Aitken, J.D. and Cook, D.G., 1970. Geology, Colville Lake and Coppermine, District of Mackenzie; Geological Survey of Canada, Preliminary Map 12-1970, scale 1:500 000. <https://doi.org/10.4095/220386>
- Cook, D.G. and Aitken, J.D., 1971. Geology, Colville Lake map-area and part of Coppermine map-area, Northwest Territories; Geological Survey of Canada, Paper 70-12, 42 p. <https://doi.org/10.4095/102357>
- Cook, D.G. and MacLean, B.C., 1993. Revised bedrock geology of Belot Ridge, District of Mackenzie, Northwest Territories; Geological Survey of Canada, Paper 93-1B, p. 33-38. <https://doi.org/10.4095/134216>
- Cook, D.G. and MacLean, B.C., 2004. Subsurface Proterozoic stratigraphy and tectonics of the western plains of the Northwest Territories; Geological Survey of Canada, Bulletin 575, 91 p. <https://doi.org/10.4095/215739>
- Dixon, J., 1999. Mesozoic-Cenozoic stratigraphy of the northern Interior Plains and plateaux, Northwest Territories; Geological Survey of Canada, Bulletin 536, 56 p. <https://doi.org/10.4095/210800>
- Dixon, J. and Stasiuk, L.D., 1998. Stratigraphy and hydrocarbon potential of Cambrian strata, northern Interior Plains, Northwest Territories; Bulletin of Canadian Petroleum Geology, v. 46, p. 445–470.
- Fallas, K.M., 2018. Bedrock geology, Lac Belot, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 309, scale 1:250 000. <https://doi.org/10.4095/306202>
- Gouwy, S.A., MacNaughton, R.B., and Fallas, K.M., 2017. New conodont data constraining the age of the 'Bear Rock assemblage' in the Colville Hills, Northwest Territories; Geological Survey of Canada, Current Research 2017-3, 11 p. <https://doi.org/10.4095/306171>
- Hughes, O.L., 1987. Late Wisconsinan Laurentide glacial limits of northwestern Canada: the Tutsieta Lake and Kelly Lake phases; Geological Survey of Canada, Paper 85-25, 19 p. <https://doi.org/10.4095/122385>

MacLean, B.C., 2011. Tectonic and stratigraphic evolution of the Cambrian basin of northern Northwest Territories; Bulletin of Canadian Petroleum Geology, v 59, p. 172-194. <https://doi.org/10.2113/gscpgbull.59.2.172>

Morrow, D.W., 1991. The Silurian-Devonian sequence in the northern part of the Mackenzie Shelf, Northwest Territories; Geological Survey of Canada, Bulletin 413, 121 p. <https://doi.org/10.4095/132170>

Van Everdingen, R.O., 1981. Morphology, hydrology and hydrogeochemistry of karst in permafrost terrain near Great Bear Lake, Northwest Territories; Inland Waters Directorate, Environment Canada, Scientific Series No. 114 (NHRI Paper No. 11), Ottawa, 53 p.

Geological Survey of Canada Paleontological Reports (available from GSC Calgary):

Fritz, W.H., 1973. Report on 17 collections of Middle and Lower Cambrian fossils from the Mobil Colville E-15 well on west side of Colville Lake (67 14 18N; 126 18 25W) NWT, request for identifications by W.S. Mackenzie (NTS: 96M); Geological Survey of Canada, Paleontological Report C6-1973-WHF, 2 p.

Fritz, W.H., 1991. Report on Cambrian fossils in 23 core samples from the PEX Gulf Fina N. Colville L-21 well (15) and the B.P. et al. Losh Lake G-22 well (8), both wells being located in the northwestern part of N.W.T. The fossils are from the Mount Cap Formation and were submitted by I.A. McIlreath, Petro-Canada as part of project to which an earlier fossil report (C-2-WHF-1986) has been submitted. (PEX, 96M; 96G); Geological Survey of Canada, Paleontological Report C2-WHF-1991, 3 p.

Fritz, W.H., 1993. Report on one collection of Cambrian fossils from the Belot Hills M63 67-10 126-15 well, lat. 67 02 45, long. 126 27 45, sample depth 4010-4020, submitted by H. Wielens, Unocal Canada Exploration Limited; Geological Survey of Canada, Paleontological Report C1-WHF-1993, 1 p.

Gouwy, S.A., 2016. Report on conodonts and tentaculites from 12 Devonian samples from the Arnica, Landry, Bear Rock and Hare Indian formations, Colville Hills, NWT, NTS 96E, 96K, 96L, 96M, 96N & 97B collected and submitted by Karen Fallas and Robert MacNaughton (GEM-2 Shield to Selwyn) CON. NO. 1807; Geological Survey of Canada, Paleontological Report 2-SAG-2016, 13 p.

Hopkins, W.S., 1970. Palynology report on two samples from the Northwest Territories, collected by Don Cook, 1969 (NTS 96M); Geological Survey of Canada, Paleontological Report PZ-10 WSH 1970, 1 p.

Norford, B.S., 1969. Report on nineteen lots of fossils from northwest District of Mackenzie, collected by J.D. Aitken and D.G. Cook, Operation Norman, 1968 (NTS 96E, F, K, M, N; 97A; 106G, H); Geological Survey of Canada, Paleontological Report C-O 2 BSN 1969, 3 p.



Norford, B.S., 1992. Report on one collection of fossils from the Aubry Lake map-area, District of Mackenzie, collected by D.G. Cook (NTS 96M/2); Geological Survey of Canada, Paleontological Report O-6 BSN 1992, 1 p.

Norris, A.W., 1987. Report on sixteen lots of Devonian fossils from eight localities in the lower Mackenzie Valley area, District of Mackenzie; collected by R. L. McKellar and F. Monnier, 1986, Geologists of Canterra Energy Ltd., 505-5th Avenue S.W., Calgary T2P 2K7, NTS 92L, M, 96E, 106H; Geological Survey of Canada, Paleontological Report 6-AWN-1987, 7 p.

Nowlan, G.S., 1993. Report on one sample from Ordovician strata on Belot Ridge in Aubry Lake map-area, District of Mackenzie, collected by D.G. Cook of ISPG and submitted by Dr. B.S. Norford for conodont analysis, NTS 96M/02, Con No. 1322; Geological Survey of Canada, Paleontological Report 007-GSN-1993, 1 p.

Pedder, A.E.H., 1970. Report on 158 lots of Devonian fossils collected by W.S. Mackenzie and A.E.H. Pedder on Operation Norman, 1968, 1969 (NTS 95C-E, L, M, and 106A, G-J, O); Geological Survey of Canada, Paleontological Report WSM 18 AEHP 70, 39 p.

Pedder, A.E.H., 1987. Report on 12 lots of Middle Devonian fossils submitted by R.L. McKellar, Canterra Energy Ltd., from the District of Mackenzie, NTS 96E, 96F, 96L, 96M and 106H; Geological Survey of Canada, Paleontological Report RLM-128-AEHP-87, 6 p.

Uyeno, T.T., 1971. Report on 14 lots of conodont samples from the central Mackenzie District, collected by D.J. McLaren (1961) and A.E.H. Pedder and W.S. Mackenzie (1968) (NTS 96E, L, M; 97A; 106H, I); Geological Survey of Canada, Paleontological Report MP4 TTU 1971, 4 p.

Yochelson, E.L., 1992. Report on one collection of fossils from the Aubry Lake map area, District of Mackenzie, collected by Dr. D.G. Cook, 1992 (NTS 96M/2); Geological Survey of Canada, Paleontological Report Misc. 1 ELY 1992, 1 p.

#### **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.).

#### **AUTHOR CONTACT**

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### **COORDINATE SYSTEM**

Projection: Universal Transverse Mercator  
Units: metres  
Zone: 9  
Horizontal Datum: NAD83  
Vertical Datum: mean sea level

### **BOUNDING COORDINATES**

Western longitude: 128°00'00"W  
Eastern longitude: 126°00'00"W  
Northern latitude: 68°00'00"N  
Southern latitude: 67°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.