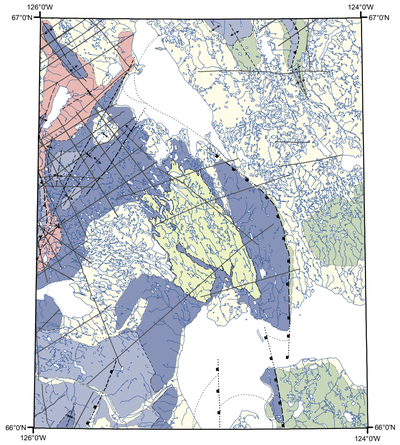


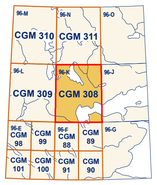

**Figure 1.** Lac des Bois map area (NTS 96-K) showing seismic lines (grey lines) on record with the National Energy Board (NEB) that were used to augment the bedrock geology interpretation. Line names are provided in the digital data files.


## 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 protérozoïque renferment des strates carbonatées et des strates siliciclastiques 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).


**National Topographic System reference and index to adjoining published Geological Survey of Canada maps**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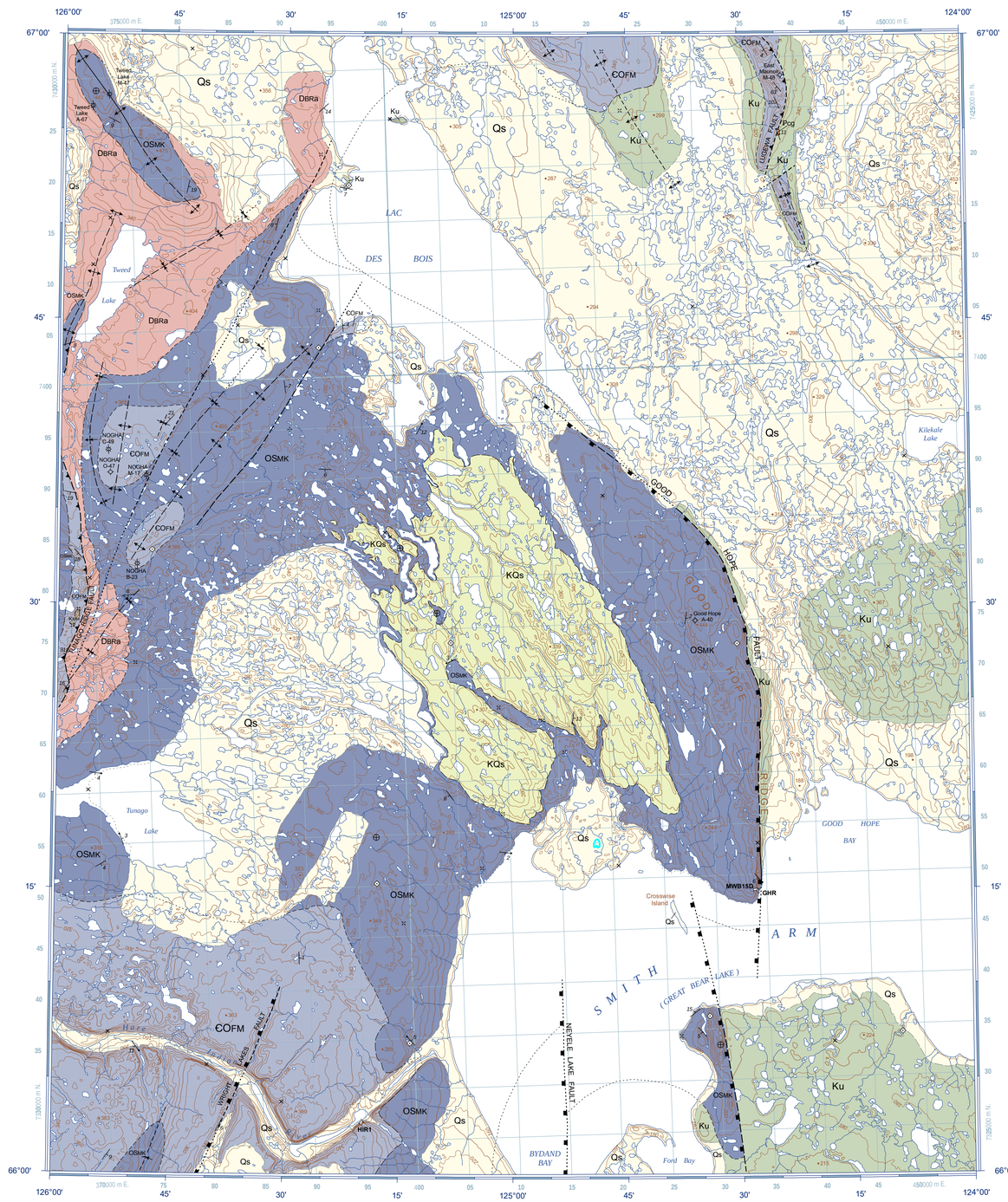
# CANADIAN GEOSCIENCE MAP 308

## BEDROCK GEOLOGY

# LAC DES BOIS

Northwest Territories

**1:250 000**




## QUATERNARY

**Qs** — **Quaternary sediment:** sand, gravel, and mud: sediment includes sedimentary, igneous, and metamorphic material; sandy deposits typically brown to light orange or pale tan, some grey mud layers; unconsolidated.

## CRETACEOUS TO QUATERNARY

**KQs** — **Cretaceous to Quaternary sand:** sand: quartz-rich, light grey, white-weathering, unconsolidated; may include weathered deposits of Martin House Formation sandstone and/or reworked deposits of glaciofluvial, glaciolacustrine, or eolian origin.

## PALEOGENE

**Pcg** — **Paleogene conglomerate:** conglomerate: polymict with clasts of chert, quartz arenite, and minor shale, hematitic cement, orange-brown- to rusty-weathering, granules to cobbles; and sandstone: quartzose, hematitic cement conglomeratic, dark red, dark-brown-weathering, very thick-bedded, crossbedded; likely equivalent to Summit Creek Formation of the Mackenzie Valley.

## CRETACEOUS

**Ku** — **Cretaceous undivided:** shale and mudstone: locally sulphurous or gypsiferous, sideritic concretions common, dark grey to brownish grey; and sandstone: light grey, light-brown-weathering, laminated to thin-bedded; unit very poorly exposed; may include equivalents of Martin House, Arctic Red, and Slater River formations.

### EARLY CRETACEOUS

**KMH** — **Martin House Formation:** sandstone: quartz arenite, patchy calcareous cement, locally oil-bearing, white to light grey or light brown on fresh and weathered surfaces but oil-bearing exposures have dark brown fresh surfaces, thin- to thick-bedded, crossbedded, friable, comminuted plant debris, rare interbeds of brown mudstone; overlain by shale or mudstone: sideritic concretions common, medium to dark grey, weathers grey or rusty-brown; shale may be equivalent to Arctic Red Formation.

## DEVONIAN

**DBra** — **Bear Rock assemblage:** limestone and dolostone: variably petroliferous, locally evaporitic (gypsum and/or anhydrite), commonly brecciated with angular clasts ranging from granule- to boulder-sized, greyish-brown to grey, weathers light grey, thin- to thick-bedded but massive and rubbly where brecciated, features include microbial laminae, fenestrae, peloids, and vugs; includes strata equivalent to Delorme Group, Bear Rock Formation, Arnica Formation, and Landry Formation documented in adjacent map areas.

## ORDOVICIAN TO SILURIAN

**OSMK** — **Mount Kindle Formation:** dolostone: dolowackestone to dolopackstone and dolofloatstone, siliceous and cherty, light to dark grey or brownish-grey fresh and weathered surfaces, locally colour-mottled, thin- to very thick-bedded, vuggy, recrystallized, bioturbated, and fossiliferous (mainly silicified corals, crinoids, orthocone cephalopods, and stromatoporoids); interbedded with dolomudstone: light grey or cream, laminated, unfossiliferous.

## CAMBRIAN TO ORDOVICIAN

**COFM** — **Franklin Mountain Formation:** dolostone: dolomudstone to dolograinstone, cherty in upper part, grey, cream, or light brown, weathers white to light grey, yellowish-grey, or orange-brown, very thin- to thick-bedded, typically recrystallized, locally vuggy, stromatolitic, bioturbated, oolitic, or intraclast-bearing; minor shale: greenish-grey or red, fissile, and laminated; shale found in basal part of unit; resistant.

Geological contact
- Approximate
- Inferred
- Concealed

Drift contact
- Approximate
- Concealed

Thrust fault, symbol on hanging-wall side
- Approximate
- Inferred
- Concealed

Reverse fault, symbol on hanging-wall side
- Defined
- Approximate
- Inferred
- Concealed

Fault, hanging wall undefined (steep dip)
- Approximate
- Inferred
- Concealed

Anticline, upright
- Defined
- Approximate
- Inferred
- Concealed

Syncline, upright
- Approximate
- Inferred
- Concealed

Monocline, anticlinal bend, shorter arrow on steeper limb
- Approximate

Visited locality (bedrock or surficial), no measurements

Locality observed remotely from aircraft

Bedding, horizontal

Bedding, horizontal, estimated

Bedding strike and dip, inclined, upright

Younging direction known

No evidence for younging direction or younging evidence unknown

MWB15D — Measured stratigraphic section with name of section

Fossil locality

Petroleum wells
- NOGHA C-48 — Gas, suspended
- NOGHA O-47 — Dry and abandoned

## 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 1966 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 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

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 co-ordinated. The author also thanks M.E. McMechan and L.S. Lane 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., 2004. Subsurface Proterozoic stratigraphy and tectonics of the western plains of the Northwest Territories; Geological Survey of Canada, Bulletin 575, 1 .zip file. 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 Maunoir, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 311, scale 1:250 000. https://doi.org/10.4095/306205

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 Keily Lake phases; Geological Survey of Canada, Paper 85-25, 19 p. https://doi.org/10.4095/122385

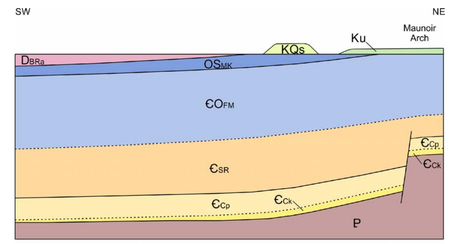
MacLean, B.C., 2011. Tectonic and stratigraphic evolution of the Cambrian basin of northern Northwest Territories; Bulletin of Canadian Petroleum Geology, v. 59, p. 172 194. https://doi.org/10.2113/gscpgbull.59.2.172

Morrow, D.W., 1991. The Silurian-Devonian sequence in the northern part of the Mackenzie Shelf, Northwest Territories; Geological Survey of Canada, Bulletin 413, 128 p. https://doi.org/10.4095/132170

Norford, B.S. and Macqueen, R.W., 1975. Lower Paleozoic Franklin Mountain and Mount Kindle formations, District of Mackenzie: their type sections and regional development; Geological Survey of Canada, Paper 74-34, 37 p. https://doi.org/10.4095/102525

Smith, I.R. and Lesk-Winfield, K., 2010. Seismic shothole drillers log-derived thematic GIS, Northwest Territories and northern Yukon: bedrock outcrop and subcrop, geohazards, and muskeg thickness; Geological Survey of Canada, Open File 6410, 1 .zip file. https://doi.org/10.4095/261784

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.


CSR Saline River Fm | CCk Mount Clark Fm | unconformable contact
CCp Mount Cap Fm | P Proterozoic strata | conformable contact

**Figure 2.** Schematic stratigraphic relationship diagram for the Lac des Bois map area (NTS 96-K). Subsurface relationships are based on public-domain reflection-seismic data and petroleum exploration wells.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CANADIAN GEOSCIENCE MAP 308


Celebrating 175 yrs

**Geological Survey of Canada**
**Canadian Geoscience Maps**

Canada


**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


BEDROCK GEOLOGY
LAC DES BOIS
Northwest Territories


**1:250 000**

5 0 5 10 15 20 km

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.

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CANADIAN GEOSCIENCE MAP 308
BEDROCK GEOLOGY
LAC DES BOIS
Northwest Territories