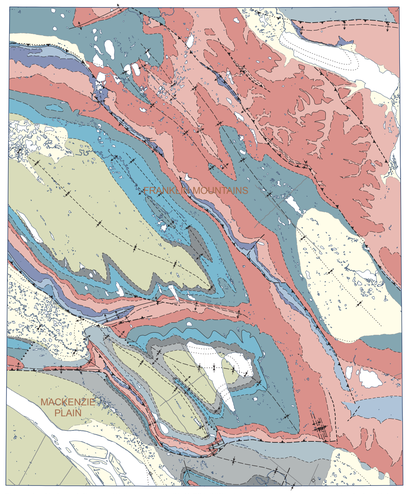


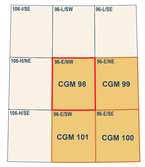
Figure 1. Northwest Norman Wells map area (NTS 96-E/NW) showing seismic lines on record with the National Energy Board that were used to augment the bedrock geology interpretation. Line names are provided in the data files.

Abstract

The northwest quadrant of Norman Wells map area (NTS 96-E) covers parts of the Franklin Mountains and Mackenzie Plain, Northwest Territories. The area varies from low-lying forested plain to high rocky ridges, with bedrock exposures concentrated along the mountainous ridges, stream banks, and lake shores. Cordilleran deformation from the southwest has uplifted Cambrian to Devonian strata along anticlinal folds and thrust faults in the Franklin Mountains. Cordilleran structures display two dominant trends, northwest-southeast and east-west, creating a trapezoid interference pattern in the Franklin Mountains. An unconformity at the base of Upper Cretaceous strata cuts more deeply into underlying Lower Cretaceous and Devonian strata to the northeast, a reflection of uplift along the Keele Arch before deposition of the Slater River Formation. Historical petroleum exploration activity in this map area targeted a potential reservoir in the Devonian Ramparts Formation.

Résumé

Le quadrant nord-ouest de la région cartographique de Norman Wells (SNRC 96-E) couvre des parties des monts Franklin et de la plaine du Mackenzie (Territoires du Nord-Ouest). La région passe d'une basse plaine boisée à de hautes crêtes rocheuses, où les affleurements du socle rocheux sont concentrés le long des chaînons montagneux, les berges de ruisseaux et les rives de lacs. La déformation cordillérienne en provenance du sud-ouest a soulevé les strates du Cambrien au Dévonien le long de plis anticlinaux ou de failles de chevauchement dans les monts Franklin. Les structures cordillériennes affichent deux orientations prédominantes, à savoir nord-ouest–sud-est et est-ouest, ce qui crée des figures d'interférence trapézoïdes dans les monts Franklin. Une discordance à la base de la succession du Crétacé supérieur s'enfonce plus profondément dans les strates sous-jacentes du Crétacé inférieur et du Dévonien au nord-est, ce qui témoigne d'un soulèvement le long de l'arche de Keele avant le dépôt de la Formation de Slater River. Par le passé, l'exploration par les compagnies pétrolières dans la région a ciblé un possible réservoir dans la Formation de Ramparts du Dévonien.



National Topographic System reference and index to adjoining published Geological Survey of Canada maps

Cover illustration
View looking northwest at large cliff of Franklin Mountain Formation dolostone faulted above Hume and Ramparts formations (lower cliffs) at Mount Thomas, Franklin Mountains, Northwest Territories. Photograph by K.M. Fallas. 2013-032

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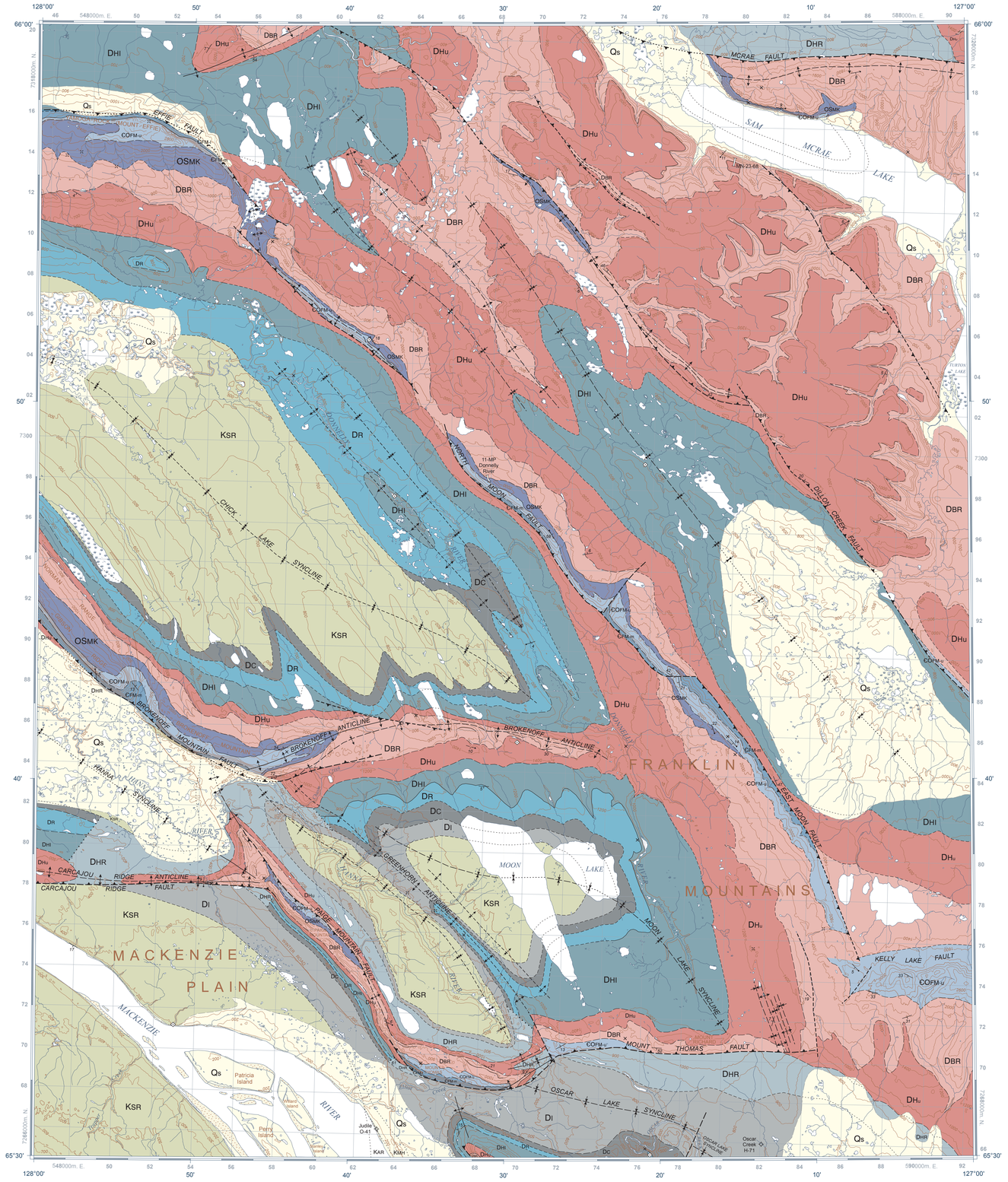

QUATERNARY

Qs — **Quaternary sediment:** mud, sand, and gravel: unconsolidated.

LATE CRETACEOUS

KSR — **Slater River Formation:** shale and mudstone: dark brown to dark grey, black, or rusty-brown, soft, crumbly, and fissile, sideritic concretions common, rare fish scales; minor bentonite and ash tuff: white to yellow, pale green, or orange-brown; and minor sandstone: lithic wacke, brown, grey, or rusty, very thin- to thin-bedded, crosslaminated, and bioturbated.

EARLY CRETACEOUS

KAR — **Arctic Red Formation:** shale and mudstone: locally gypsiferous, dark grey, weathers grey and rusty, variably fissile and soft, sideritic concretions fairly common. Under cover of quaternary sediment.

KMH — **Martin House Formation:** sandstone: quartz arenite, variably glauconitic, locally conglomeratic, beige to light grey, thin- to thick-bedded, crossbedded, friable, trace fossils common; interbedded with shale or mudstone: medium to dark grey, weathers grey or rusty-brown, proportion of shale and mudstone increases upsection. Under cover of quaternary sediment.

DEVONIAN

DI — **Imperial Formation:** shale: locally silty, dark grey to greenish-grey, fissile; interbedded with siltstone: locally micaceous or calcareous, greenish-grey to purplish-brown, laminated, bioturbated; and sandstone: lithic wacke to quartz arenite, micaceous, locally calcareous or glauconitic, grey to greenish-grey or brown, very thin- to medium-bedded, laminated and crosslaminated, abundant and diverse trace fossils; and minor limestone: bioclastic, grey to brown or orange, diverse fossil assemblage. Includes Jungle Ridge Member, comprising limestone: lime mudstone, silty, grey, weathers light yellow; very thin- to thin-bedded, laminated, shale partings, and rare fossils.

Horn River Group (Hare Indian, Ramparts, and Canol formations)

DHR — **Horn River Group:** shale: carbonaceous or petroliferous, calcareous to siliceous, locally silty, dark grey or black, weathers grey, black, brown, or rusty, locally fossiliferous; minor limestone: dark grey with tentaculitids, interbedded with shale at base of unit; cream to light grey stromatoporoid limestone (Ramparts Formation) may be present in the middle of the unit.

DC — **Canol Formation:** shale: siliceous, sulphurous, petroliferous, dark grey to dark brown or black, weathers grey, brown, or yellow, with pink or red patches where burnt and/or oxidized, laminated to very thin-bedded, platy, locally semiresistant.

DR — **Ramparts Formation:** limestone: wackestone to grainstone or rudstone, petroliferous, cream, beige, or light grey, weathers to light shades of grey, brown, yellow, and orange, medium- to very thick-bedded, very fossiliferous (stromatoporoids dominate).

DHI — **Hare Indian Formation:** shale: carbonaceous, calcareous, black, fissile, may contain tentaculitids or other fossils; interbedded with minor limestone: dark grey to black, thin-bedded, tentaculitids common. Basal Bluefish Member is calcareous and fossiliferous, unit becomes less carbonaceous, less calcareous, less fossiliferous, and increasingly silty upsection.

DHu — **Hume Formation:** limestone: wackestone to grainstone, floatstone, medium to dark grey or brownish-grey, typically weathers light grey, thin- to very thick-bedded, parallel to irregular or nodular bedded, fossiliferous with abundant and diverse assemblage. Unit is thicker bedded and cliff-forming in upper part.

DBR — **Bear Rock Formation:** limestone breccia: variably dolomitic and petroliferous, angular clasts range from granule- to boulder-sized, greyish-brown to grey, weathers light grey, massive and rubbly with minor bedded intervals, vuggy; and evaporite: gypsum or anhydrite, white, weathers light grey, laminated or massive.

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, thin- to very thick-bedded, vuggy, recrystallized, bioturbated, and fossiliferous (mainly silicified corals, crinoids, orthocone cephalopods, and stromatoporoids).

CAMBRIAN TO ORDOVICIAN

COFM-u — **Franklin Mountain Formation, upper member:** dolostone: crystalline dolostone, commonly cherty and siliceous, cream to beige or grey, weathers white to light grey, very thin- to thick-bedded, vuggy and nodular, locally stromatolitic, bioturbated, intraclast-bearing, or oolitic.

CAMBRIAN

ЄFM-m — **Franklin Mountain Formation, middle member:** dolostone: dolomudstone to dolograinstone, rarely calcareous or cherty, light grey to cream or beige, weathers light yellowish-grey to orange-brown, thin- to thick-bedded, typically recrystallized obliterating primary textures, locally vuggy, stromatolitic or thrombolitic, bioturbated, oolitic, crossbedded, or intraclast-bearing; rare shale partings. Alternation, at 1–2 m intervals, of ooid dolograinstone with dolomudstone produces a locally prominent striped appearance.

ЄFM-l — **Franklin Mountain Formation, lower member:** dolostone: dolomudstone, locally calcareous or silty, rare detrital chert grains, grey to greenish-grey or brown, weathers pale yellow to grey or orange-brown, very thin- to medium-bedded, parallel-laminated, locally includes intraclast rudstone, locally stromatolitic or bioturbated; interbedded with shale: dolomitic and silty, varicoloured, laminated, and fissile.

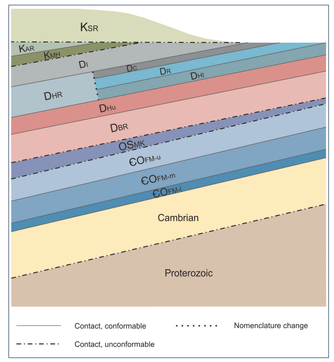

Figure 2. Schematic stratigraphic relationship diagram for northwest Norman Wells map area (NTS 96-E/NW). Subsurface relationships are constrained by well and seismic data. Truncation of Paleozoic and Lower Cretaceous strata beneath the unconformity below Slater River Formation reflects uplift on the Keele Arch preceding deposition in the Late Cretaceous.

Geological contact
- Defined
- Approximate
- Inferred
- Concealed
- Nomenclature change
- Marker bed, Landry Member

Drift contact
- Approximate

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

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

Anticline, upright
- Defined
- Approximate
- Inferred
- Concealed

Syncline, upright
- Defined
- Approximate
- Inferred
- Concealed

Inclined anticline, upright, shorter arrow on steeper limb
- Defined
- Approximate
- Concealed

Inclined syncline, upright, shorter arrow on steeper limb
- Inferred
- Concealed

Monocline, synclinal bend, shorter arrow on steeper limb
- Approximate
- Inferred

- Visited outcrop, no measurements
- Outcrop observed remotely from ground or air

Bedding strike and dip, inclined, upright
- Evidence for youngging direction known
- Evidence for youngging direction known, estimated measurement
- No evidence for youngging direction
- No evidence for youngging direction, estimated measurement

Bedding strike and dip, inclined, overturned
- Evidence for youngging direction known

- Fossil locality
- 11-MP Donnelly River — Measured stratigraphic section with name or number of section
- Judie O-41 — Petroleum well with well name
- Dry and abandoned

NOTES

The author has updated and revised map unit terminology from the Operation Norman map (Aitken and Cook, 1976). In general, terminology for Silurian and Devonian units follows that of Morrow (1991), and Cretaceous formation names are those of Dixon (1999). Cambrian to Ordovician units have recently undergone revision to their terminology, as outlined below.

Previous work by the Geological Survey of Canada in the Norman Wells map area (Aitken et al., 1973) subdivided the Cambro-Ordovician Franklin Mountain Formation into three informal units. In ascending order they are: Cyclic member, Rhythmic member, and Cherty member (Norford and Macqueen, 1975). On the present maps, these older unit names correspond, in ascending order, to informal lower, middle, and upper members of the Franklin Mountain Formation. These members correspond to the units 1, 2, and 3 respectively of the Franklin Mountain Formation described by Turner (2011).

Where shown as a marker bed within the Bear Rock Formation, the Landry Member represents a discontinuous, resistant, bedded limestone interval at or near the top of the Bear Rock Formation breccias. The assignment of this interval to the Landry Member follows Morrow (1991).

For detailed information on surficial deposits, here shown as "Quaternary sediment", *see* Duk-Rodkin (2002).

The names McRae Fault, Dillon Creek Fault, Kelly Lake Fault, East Moon Fault, North Moon Fault, Brokenoff Mountain Fault, Carcajou Ridge Fault, Paige Mountain Fault, Mount Thomas Fault, Oscar Lake syncline, Greenhorn anticline, Hanna syncline, Brokenoff anticline, Chick Lake syncline, and Moon Lake syncline have been introduced to facilitate discussion of these structural features. The names Effie Fault and Carcajou Ridge anticline have been extended from the adjoining Sans Sault Rapids map area (Aitken and Cook, 1979).

Cordilleran deformation in this map area has generated folds and thrust faults interpreted to be detached within evaporitic Middle Cambrian strata (Cook and MacLean, 1999). Faults and folds may also be locally detached within evaporite and carbonate breccia of the Lower Devonian Bear Rock Formation. The presence of both foreland-directed and hinterland-directed movement on faults is likely the result of the weak mechanical properties of the detachment layers. Although other causes may be a factor, Cook (1983) has suggested that the development of two major structural trends in this map area, northwest-southeast and east-west, can be attributed to dextral movement on steep, north-trending faults in the subsurface associated with detachment within a Cambrian evaporite unit.

Coverage of public-domain seismic-reflection data used to augment the map compilation and constrain stratigraphic relationships is shown in Figure 1. Surface and subsurface stratigraphic relationships within this map area are shown schematically in Figure 2.

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Canadian Geoscience Maps

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Author: K.M. Fallas

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Seismic data interpretation by B.C. MacLean, 2010–2012. Stratigraphic sections measured by M. Pope (Texas A&M University) and S. Leslie (James Madison University), 2011 and W.S. MacKenzie and A.E.H. Pedder, 1968

Geomatics by K.M. Fallas, S.D. Orzeck, and N. Raska

Cartography by S.D. Orzeck

Scientific editing by E. Inglis

CANADIAN GEOSCIENCE MAP 98
GEOLOGY
NORMAN WELLS (NORTHWEST)
Northwest Territories
1:100 000

2 0 2 4 6 8 km

Initiative of the Geological Survey of Canada, conducted under the auspices of the Mackenzie Delta and Corridor 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 02509 and 01310.

Map projection Universal Tranverse Mercator, zone 9.
North America Datum 1983

Base map at the scale of 1:50 000 from Natural Resources Canada, with modifications.
Elevations are in feet above mean sea level

Some geographic names on this map are not official and reflect local use as reported by the Sahtu Heritage Places and Sites Joint Working Group.

Mean magnetic declination 2013, 23°40'E, decreasing 32' annually. Readings vary from 23°48'E in the NW corner of the map to 23°31'E in the SE corner of the map.

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

Data may include additional features not portrayed on this map. *See* documentation accompanying the data.
Additional references are included in the map information document.

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