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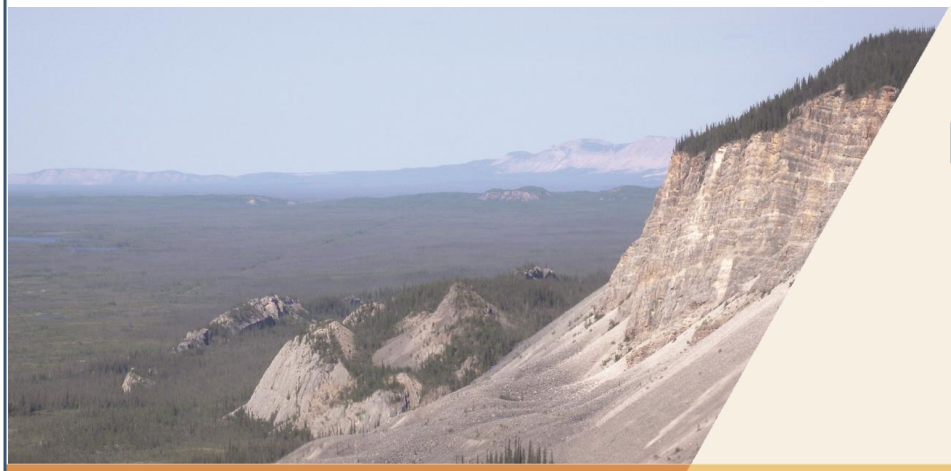
# CANADIAN GEOSCIENCE MAP 98

## GEOLOGY

# NORMAN WELLS (NORTHWEST)

Northwest Territories



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### 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

## 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-shaped 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 potential reservoir in the Devonian Ramparts Formation.

## RÉSUME

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.


## ABOUT THE MAP

### General Information


Author: K.M. Fallas


Geological compilation by K.M. Fallas, 2011–2012

Geological field observations by K.M. Fallas and R.B.MacNaughton, 2009–2010 and D.G. Cook, M.E. Ayling, and J.D. Aitken, 1968–1969

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


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.

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

## *ABOUT THE GEOLOGY*

### Descriptive 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.

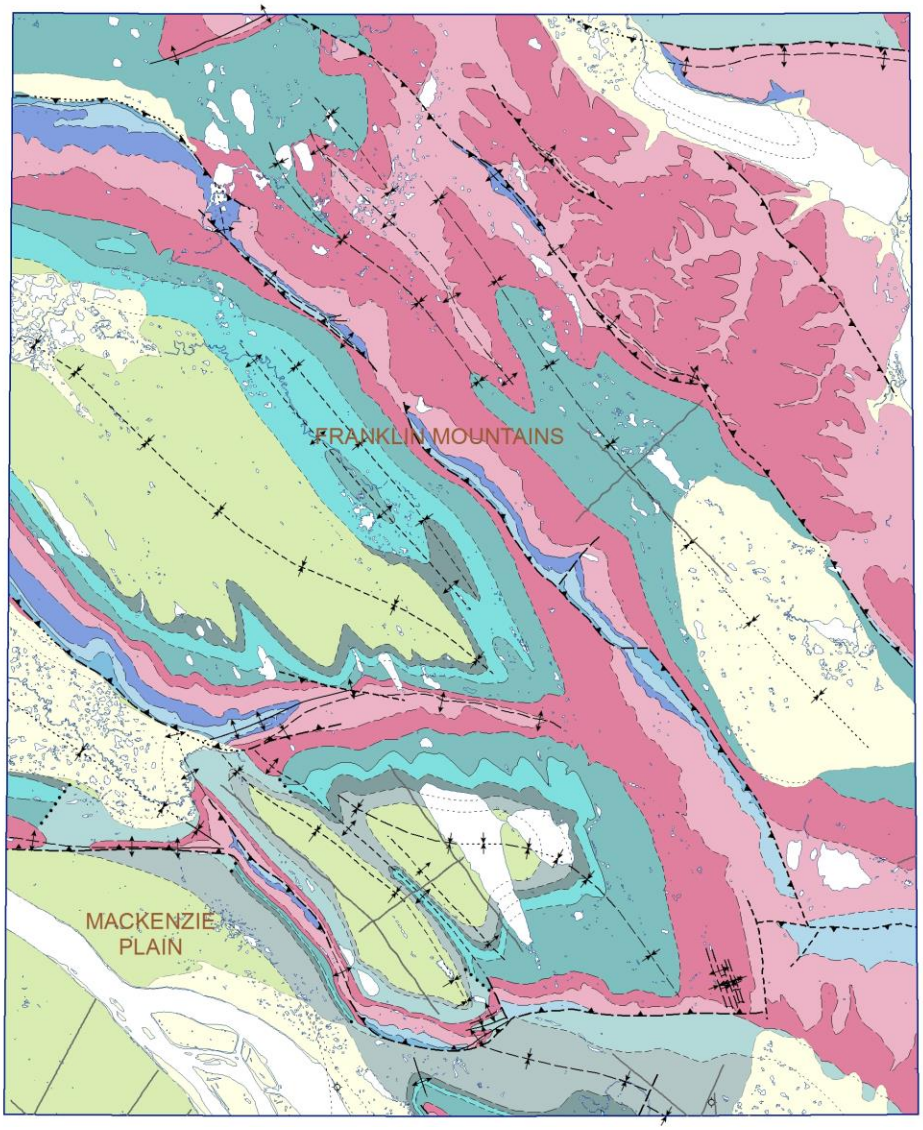


**Figure 1.** Northwest Norman Wells map area (NTS 96-E/NW) showing seismic lines on record with the National Energy Board that were used to augment the bedrock geology interpretation. Line names are provided in the data files.

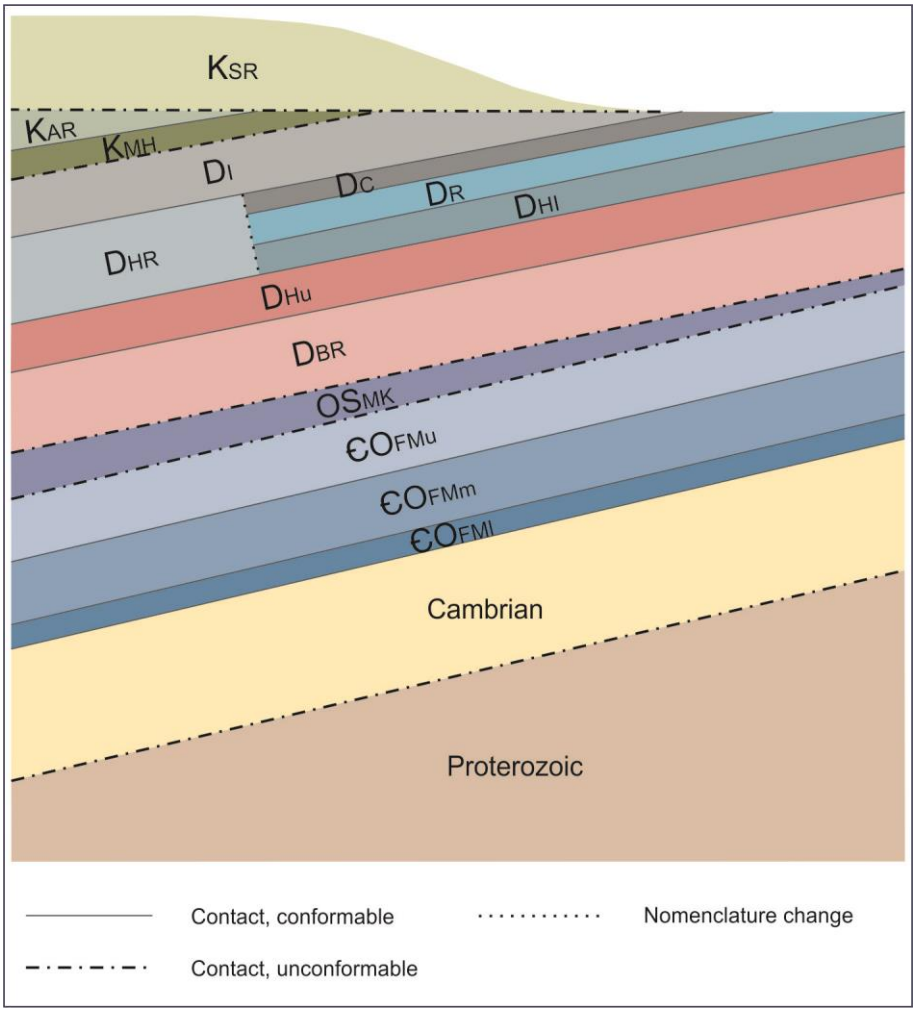


**Figure 2.** Schematic stratigraphic relationship diagram for northwest Norman Wells map area (NTS 96-E/NW). Subsurface relationships are constrained by well and seismic data. Truncation of Paleozoic and Lower Cretaceous strata beneath the unconformity below Slater River Formation reflects uplift on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

## Acknowledgments

Field transportation for 2009–2010 was provided from Norman Wells by Sahtu Helicopters (Great Slave Helicopters) and Canadian Helicopters. The author wishes to thank K. Montgomery, T. Proks, and M. Sommers for capable field assistance and J. Ayah, and D. Widow for providing wildlife monitoring. The author wishes to thank M. McMechan and D. Morrow for critical review of the map.

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096D/05, D/11, D/12, D/13, 096E/04, E/05, E/07, E/08, E/09, E/13, E/14; Geological Survey of Canada, Paleontological Report 3-ADM-2011, 13 p.

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## Author Contact

Questions, suggestions, and comments regarding the geological information contained in the data sets should be addressed to:

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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: 127°00’00” W
Northern latitude: 66°00’00” N
Southern latitude: 65°30’00” N

## Data Model Information

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.

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2. À la fin du premier terme, cet Accord sera automatiquement renouvelé pour des termes successifs d'un (1) an, en vertu de la section 6.0 qui suit.

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1. 6.1 Nonobstant la section 5.0, cet Accord peut être résilié :

   i. automatiquement et sans préavis, si le Détenteur de licence manque à ses engagements ou obligations selon cet Accord;

   ii. par un préavis écrit de résiliation émis par le Détenteur de licence, en tout temps, et cette résiliation prendra effet trente (30) jours suivant la réception d'un tel préavis par le Canada; ou

   iii. par consentement mutuel des parties.

2. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, les obligations qui incombent au Détenteur de licence en vertu de la section 4.0 continueront de s'appliquer et les droits du Détenteur de licence en vertu de la section 2.0 cesseront immédiatement.

3. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, le Détenteur de licence devra immédiatement effacer ou détruire toutes les Données obtenues en vertu de cet Accord, ou à l'intérieur d'un délai raisonnable lorsque les Données sont nécessaires pour terminer la livraison de Produits dérivés commandés avant la résiliation de cet Accord.

## 7.0 GÉNÉRAL

1. **Lois d'application**
   Le présent Accord est régi et interprété en vertu des lois en vigueur dans la province de l'Ontario. Les parties acceptent de tomber sous la juridiction de la Cour supérieure de la Province de l'Ontario.

2. **Totalité de l'Accord**
   Le présent Accord constitue l'intégralité de l'entente conclue entre les parties relativement à l'objet du présent Accord. Toute modification à cet Accord ne peut être que par écrit, doit porter la signature de chaque partie et exprimer clairement l'intention de modifier cet Accord.

3. **Solution des litiges**
   Si un litige survient à propos de cet Accord, les parties tenteront de le résoudre par des négociations de bonne foi.