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CANADIAN GEOSCIENCE MAP 420

BEDROCK GEOLOGY

SANS SAULT RAPIDS SOUTHWEST

Northwest Territories

NTS 106H/SW



Map Information Document

**Geological Survey of Canada
Canadian Geoscience Maps**

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ABSTRACT

The southwest Sans Sault Rapids map area (NTS 106-H/SW) lies at the junction between the northern Mackenzie Mountains, Mackenzie Plain, Franklin Mountains, and Peel Plateau of the Northwest Territories. Bedrock exposures in the area include carbonate and siliciclastic strata ranging from Neoproterozoic (Tonian) to Cretaceous age. These strata were deformed in Cretaceous to Eocene time by folding and contractional faulting associated with Cordilleran deformation. Major structures include the Tawu, Stony, and Imperial anticlines. A minor pre-Cordilleran set of approximately north-trending extensional faults are preserved within strata of the Neoproterozoic Mackenzie Mountains Supergroup, and are locally associated with mafic dykes of the Gunbarrel event (~780 Ma). Neoproterozoic strata are truncated beneath a major unconformity at the base of the Cambrian strata, and another major unconformity truncates Devonian strata beneath the Cretaceous units.

RÉSUMÉ

La partie sud-ouest de la région cartographique de Sans Sault Rapids (SNRC 106-H/SW) se situe à la rencontre de la partie nord des monts Mackenzie, de la Plaine Mackenzie, des monts Franklin et du Plateau Peel, dans les Territoires du Nord-Ouest. Dans la région, les affleurements du substratum rocheux comprennent des strates carbonatées et des strates silicoclastiques dont les âges s'étendent du Néoprotérozoïque (Tonien) au Crétacé. Ces strates ont été déformées lors du Crétacé à l'Éocène par la formation de plis et de failles de compression que l'on peut associer à la déformation cordillérienne. Les anticlinaux de Tawu, de Stony et d'Imperial constituent des structures d'importance. Dans les strates néoprotérozoïques du Supergroupe de Mackenzie Mountains, subsiste un ensemble d'importance secondaire de failles d'extension de direction à peu près nord antérieures à la déformation cordillérienne, auxquelles sont associés par endroits des dykes de diabase ou de gabbro attribués à l'épisode magmatique de Gunbarrel (env. 780 Ma). Les strates néoprotérozoïques sont tronquées sous une importante discordance marquant la base de la succession cambrienne. Une seconde discordance d'importance rend compte d'une ablation des strates dévoniennes sous les unités crétacées.

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SHEET 1 OF 1, BEDROCK GEOLOGY

GENERAL INFORMATION

Authors: K.M. Fallas and R.B. MacNaughton

Geological compilation by K.M. Fallas and R.B. MacNaughton, 2016–2019

Geological field observations by K.M. Fallas, R.B. MacNaughton, G.S. Stockmal, and P. Kabanov, Geological Survey of Canada, 2016; Y. Lemieux, Geological Survey of Canada, 2006 and 2007; T. Hadlari, Northwest Territories Geological Survey, 2006 and 2007; J.D. Aitken, H.R. Balkwill, D.G. Cook, and C.J. Yorath, Geological Survey of Canada, 1968–1971

Stratigraphic sections measured by R.B. MacNaughton, P. Kabanov, S.A. Gouwy, and K.M. Fallas, Geological Survey of Canada, 2016; L.P. Gal, T. Hadlari, D. Thomson, and W. Zantvoort, Northwest Territories Geological Survey, 2006–2012; L.J. Pyle, contractor, 2006–2012; D.G.F. Long, W.S. MacKenzie, D.W. Morrow, A.E.H. Pedder, T.T. Uyeno, and C.J. Yorath, Geological Survey of Canada, 1969–1977.

Reflection-seismic data interpreted by B.C. MacLean and K.M. Fallas, 2015–2018.

Geological data conforms to Bedrock Data Model v. 4.0

Geomatics by K.M. Fallas and M. Le

Cartography by M. Le

Scientific editing by A. Weatherston

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

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Map projection Universal Transverse Mercator, zone 9
North American Datum 1983

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

Mean magnetic declination 2020, 20°09'E, decreasing 27.4' annually.

Readings vary from 20°12'E in the NW corner to 20°06'E in the SE corner of the map.

This map is not to be used for navigational purposes.

Title photograph: View looking southeast at anticline developed in Devonian Hume Formation limestone and Hare Indian Formation shale within the Houdini Synclinorium. This structure is located in the Canyon Ranges of the northern Mackenzie Mountains, NWT. Photograph by G.S. Stockmal. NRCan photo 2019-004

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

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

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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.

DEFINITION QUERIES USED ON MAP

This map utilizes definition queries in order to customize the display for visualization on the PDF of the map only and does not affect the digital data. The following features have a definition query applied:

- Fossils
- Stations
- Planar
- Linear
- Traces
- MeasuredSections

DESCRIPTIVE NOTES

Initial bedrock mapping and stratigraphic studies by the Geological Survey of Canada in the Sans Sault Rapids map area (NTS 106-H) were conducted in 1968 as part of Operation Norman. This operation and subsequent stratigraphic work up to 1977 led to the release of a GSC Memoir and 1:250 000 scale map of the area (Aitken et al., 1982). In the present compilation, observations collected in 2016 to 2018 as part of the Geo-mapping for Energy and Minerals (GEM) Program were combined with observations from Operation Norman, along with observations from the Peel Project of the Northwest Territories Geological Survey collected in 2006 to 2007 (Pyle and Jones, 2009; Pierce and Jones, 2009). Stratigraphic information from additional reports of the Northwest

Territories Geological Survey is also incorporated (Pyle and Gal, 2007, 2013). Petroleum exploration wells and reflection-seismic data drilled or collected since 1970 also helped constrain the map interpretation. Bedrock units are interpreted beneath local Quaternary cover to provide a seamless bedrock interpretation.

Formal stratigraphic nomenclature used for the Operation Norman maps in the area (Aitken et al., 1982) is largely still in use, although more recent stratigraphic work has added new formal terms for previously informal units found in southwest Sans Sault Rapids map area. An outline of updated stratigraphic relationships in the northern Mackenzie Mountains was provided by Fallas et al. (2016), and schematic relationships within southwest Sans Sault Rapids map area are illustrated in Figure 1. Within the Mackenzie Mountains Supergroup, the informal H1 unit is formalized as the Tabasco Formation (Turner and Long, 2012). The Katherine Group is subdivided into seven formations (Long and Turner, 2012), replacing the “lower” and “upper” subdivisions of Aitken et al. (1982). Although typically not well exposed, these seven formations have been mapped within this map area as outlined by Fallas (2019). Strata formerly assigned to the informal H5 unit of Aitken et al. (1982) are now assigned to Dodo Creek and Stone Knife formations of the Little Dal Group (Turner and Long, 2012). A gabbro sill that intrudes strata of the Mackenzie Mountains Supergroup southeast of the Sans Sault Rapids map area was dated at 779.5 Ma by Harlan et al. (2003) and assigned to the Gunbarrel mafic magmatic event. Similar intrusions within the Sans Sault Rapids map area are also assigned to the Gunbarrel suite.

Within the Cambrian succession, the Nainlin Formation of MacNaughton and Fallas (2014) is introduced in place of the “basal red beds” of the Franklin Mountain Formation. Nainlin Formation is a clastic-dominated unit beneath the Franklin Mountain dolostone, and lies unconformably on Neoproterozoic (Tonian) strata of the Katherine or Little Dal groups. Aside from the exclusion of the basal red beds, Franklin Mountain Formation follows the usage of Aitken et al. (1982), as does Mount Kindle Formation. The unnamed Siluro-Devonian unit of Aitken et al. (1982) has since been identified as Peel and Tatsieta formations along the north slope of the Mackenzie Mountains by Morrow (1999) and Pyle and Gal (2007), whereas Morrow (1991) identifies the Siluro-Devonian unit as Tsetso Formation further south within the Mackenzie Mountains. The map interpretation presented here applies either set of terminology based on the nearest published measured section. Younger Devonian units in the southwest Sans Sault Rapids map area follow the usage of Aitken et al. (1982), with some refinement to the relationships between Bear Rock, Arnica, and Landry formations as noted by Morrow (1991).

Unconformably overlying the Devonian succession, the Cretaceous succession was treated as an undivided package of Arctic Red River and Trevor formations by Aitken et al. (1982), largely following the work of Yorath and Cook (1981). Subsequent work by Dixon (1999) and Thomson et al. (2011) provided a basis for subdividing the Cretaceous into four units: the Lower Cretaceous Martin House and Arctic Red formations, and Upper Cretaceous Slater River and Trevor formations. Subsurface data from petroleum exploration wells and reflection-seismic surveys helped constrain the distribution of these units.

Subsurface data and stratigraphic refinements allow for the revision of structural features identified by Aitken et al. (1982). The northeast-trending segment of the Southbound Fault is interpreted in part from reflection-seismic data, and the fault may link to the Whirlpool Fault in the subsurface. The fault segment identified as the

Deadend Fault in Aitken et al. (1982) is here renamed the Houdini Fault (after the informal “Houdini Lake” at 65°03’N, 129°16’W) because this thrust fault does not appear to connect with the thrust fault mapped as Deadend Fault on the adjacent Ramparts River map of Aitken et al. (1982). The likely continuation of the Deadend Fault lies to the north on the southwest flank of the Stony anticline. Some minor revisions are made to the fold train in the core of the Houdini synclinorium, along with the addition of previously unrecognized Ramparts Formation exposed in the same structure. In the extreme southwest corner of the map area, Aitken et al. (1982) showed an anomalous stratigraphic relationship, with Arnica Formation lying directly upon Franklin Mountain Formation. Identification of a previously unrecognized fault just south of the map boundary, in NTS map 106–A (Mount Eduni), eliminates the requirement for this relationship, and strata are now interpreted entirely as Franklin Mountain Formation. Other additions within the map area include steeply dipping normal faults and north-northwest-trending mafic dykes of the Gunbarrel suite locally cutting Katherine Group strata.

NOTE: The names Stony and Tawu anticlines were introduced by Aitken et al. (1982) to indicate the broad culminations cored by Tsezotene Formation and Katherine Group, without differentiating individual anticlinal hinges. As refined mapping has revealed that these structures comprise multiple en échelon anticlinal hinges along their full strike length, these are herein differentiated as segments named on the basis of a geographic feature in close proximity to the segment named.

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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: 9
Horizontal Datum: NAD83
Vertical Datum: mean sea level

BOUNDING COORDINATES

Western longitude: 130°00'00"W
Eastern longitude: 129°00'00"W
Northern latitude: 65°30'00"N
Southern latitude: 65°00'00"N

SOFTWARE VERSION

Data has been originally compiled and formatted for use with ArcGIS™ desktop version 10.6 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.