Descriptive Notes

The Mount Raymond 1:50 000 scale map area lies within the Eagle River map area (Norris, 1981) on the western margin of the Richardson anticlinorium. Targeted fieldwork augmented by new biostratigraphy and airphoto analysis has refined the map distribution of stratigraphic units and clarified the location and significance of major structures. The exposed stratigraphy consists of two Paleozoic successions.

In the east, the Richardson trough contains strata of Cambrian to Devonian age. The oldest strata present in the map area comprise sandstone, siltstone, and shale of the Slats Creek Formation of early and middle Cambrian age (Fritz, 1997) derived largely from a western source (reviewed in Lane and Gehrels, 2014). This unit is overlain gradationally by a deep-water succession dominated by limestone and graptolitic shale of the Road River Group, originally the Road River Formation (Jackson and Lenz, 1962). Here, we use the nomenclature previously used informally, in part, by Morrow (1999, based on Cecile, et al., 1982), as revised by Cecile (in press).

In the Mt. Raymond map area, an informal basal member of the Cronin Formation was mapped. It consists of interbedded shale and limestone, with minor siltstone, and is distinguished from the rest of the Cronin Formation by its darker, more recessive weathering character. This unit is presumably equivalent to the CDRD unit of Norris (1981) in that it occurs between the more resistant carbonate-dominated overlying beds and the underlying clastic beds of the Slats Creek Formation (e.g., Fritz, 1985, 1997). In the northeast, the outcrop width of this unit is nearly 5 km. However, in the southeast, this basal shaly interval is very thin or absent, and the Cronin Formation carbonate rocks appear to lie more or less directly on sandstone succession of the Slats Creek Formation. Accordingly, the shaly basal member of the Cronin is inferred to pinch out southward. Given the known tectonic environment during middle Cambrian time, characterized by block faulting in Richardson trough and local disconformities at the top of the Slats Creek Formation in this vicinity (Fritz, et al., 1991, p. 169-170), the significant thickness change in the basal Cronin member within the map area may reflect this active tectonic setting.

In the western part of the map area, exposed strata comprise deposits of the Ellesmerian orogenic foredeep succession, dominated by siltstone, shale, and turbiditic fine sandstones of the Late Devonian Imperial Formation (Braman and Hills, 1992), the overlying coarse clastic strata of the Tuttle Formation, comprising more proximal channelized slope deposits of latest Devonian and Early Carboniferous age (Lane, 2013a), and finally by shale and siltstone of the Ford Lake Formation, of Early Carboniferous age.

The (informal) lower member of the Imperial Formation predominantly consists of shale and siltstone. Exposures are largely confined to river cutbanks. The overlying middle member contains abundant prominent sandstone-rich units that commonly form distinct topographic ribs. Individual sandstone units are readily traceable for several kilometres; however, only a few of the the larger units are traceable for more than ~10 km. The persistent sandstone unit that defines the base of the middle member in the adjacent Mount Hare map area to the north becomes indistinct southward, presumably due to thinning and fining of the unit. Accordingly, the base of the middle member is mapped southward at the base of the next overlying sandstone unit, which persists for some 12 km until it is truncated by a fault.

Three major thrust faults transect the map area from north to south. The most westerly fault, Deception Fault, is a moderately east-dipping structure (Lane, 2013a) that juxtaposes rocks of Frasnian to Early Famennian (Late Devonian) age in the east against strata of Famennian to Visèan age in the west. As is the case in the adjacent map areas to the north (Lane, 2013a, 2013b), thermal maturities on the east side of the fault are distinctly higher than on the west; however, this effect diminishes southward as displacement diminishes in that direction. A minor splay in the footwall of the Deception Fault, the Vyàh K'it Gwinjik Fault, extends westward into adjacent map areas. An associated footwall syncline (Vyàh K'it Gwinjik syncline) is locally preserved beneath the fault.

The Mount Raymond Fault is oblique to the strike of other structures, cutting upsection (southward) from the Road River Group into the Imperial Formation. It juxtaposes Ordovician to Devonian strata in the hanging wall against Late Devonian Imperial Formation in the footwall. This fault appears to die out northward, within the Road River Group a few kilometres into the adjacent Mount Hare map area. In the hanging wall of the strike-oblique section of the fault, the map width of the Road River Group broadens, and the succession displays abundant minor folds. The Mount Raymond Fault merges southward with the Canyon Creek Fault, which continues southward parallel to structural strike.

The Canyon Creek Fault also appears to die out northward, a short distance into the adjacent map area. Previous reconnaissance mapping indicated that the Deception fault deflects eastward to link with the Canyon Creek Fault (Norris, 1981). However, the Deception anticline in the hanging wall of the Deception Fault appears to be continuous across the map, implying that the two faults remain distinct, subparallel structures in this area. Also, faunally dated Carboniferous Ford Lake strata in the west (locality F15; also Lane, 2013a) are abruptly juxtaposed against Late Devonian strata, requiring that a fault must lie to the west of Deception anticline. Thus, from north to south, as displacement diminishes on the Deception Fault, the regional shortening is increasingly accommodated on the Mount Raymond and Canyon Creek faults. These regional-scale structures are products of Late Cretaceous-Cenozoic regional orogenesis (Lane, 1998).

Trending north-south near the eastern edge of the map are two steeply east-dipping faults mapped as reverse faults, with associated splays. They appear to have east-side-up stratigraphic separation; however, their kinematics are unstudied. Although they define distinct lineaments on airphoto imagery, their displacement magnitudes appear to be modest. Possibly, they may be linked to reactivation of deeper faults, related to the middle Cambrian rifting in Richardson trough.

Diamond-drill cores were recovered from several mineral-exploration bore holes in the southern part of the map area, with the permission of the claimholder. These cores, penetrating lowermost Imperial and Canol formations, and uppermost Road River Group, provided valuable information about the age, mineralogy, thermal maturation, and organic carbon (TOC) content in relation to targeted studies of the regional hydrocarbon potential (Allen et al., 2011; Fraser et al., 2012).

Acknowledgments

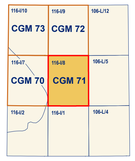
This map is a product of the Geo-mapping for Energy and Minerals (GEM) program, 2009–2013. The final compilation of the map benefitted from additional outcrop information at various localities by T.L. Allen, D.A. Huntley, and K.M. Bell. Also, archival outcrop and aerial observation data collected during Operation Porcupine (1962–1982) have been incorporated into the compilation and are included in the GIS database. Able field assistance was provided by University of Calgary students Mike McQuilkin in 2009 and Adam Hayman and Kimberley Bell in 2010; and by Vuntut Gwichin First Nation participants Shawn Bruce and Douglas Frost in 2009, and Myranda Charlie, and Yudi Mercredi in 2010. Helicopter support in 2009 was provided by Fireweed Helicopters, Dawson; and in 2010 by Gwichin Helicopters, Inuvik.

Abstract

The Mount Raymond map area incorporates the western limb of the Richardson anticlinorium, southern Richardson Mountains, northern Yukon. It is underlain by four Paleozoic sedimentary successions: middle Cambrian Slats Creek Formation, Cambrian to Early Devonian Road River Group, Devonian Canol Formation, and Late Devonian to Carboniferous Imperial and Tuttle formations. The Richardson trough depositional setting of the first three successions is succeeded by a deep-marine, turbiditic, Ellesmerian, orogenic foredeep setting for the Imperial-Tuttle succession. Several major thrust faults and related folds transect the map area from north to south. The carbonate-dominated Road River Group defines a west-dipping homocline, modified by the Mount Raymond thrust fault together with minor folds in its footwall. In the overlying Imperial-Tuttle succession, map-scale folds are defined where shales are interbedded with persistent sandstones. Steep reverse faults in the east may have reactivated Cambrian rift faults. The structural geometry reflects Late Cretaceous–Cenozoic regional Cordilleran tectonism.

Résumé

La région cartographique de Mount Raymond comprend le flanc ouest de l'anticlinorium de Richardson, dans la partie sud des monts Richardson (nord du Yukon). Elle renferme quatre successions sédimentaires du Paléozoïque : la Formation de Slats Creek du Cambrien moyen, le Groupe de Road River du Cambrien-Dévonien précoce, la Formation de Canol du Dévonien et les formations d'Imperial et de Tuttle du Dévonien tardif-Carbonifère. Au cadre sédimentaire de la cuvette de Richardson dans lequel se sont mises en place les trois premières successions sédimentaires a succédé le cadre de milieu marin profond à dépôt turbiditique de l'avant-fosse de l'orogenèse ellesmérienne dans lequel s'est déposée la succession d'Imperial-Tuttle. Plusieurs importantes failles de chevauchement et des plis apparentés traversent la région cartographique du nord au sud. Le Groupe de Road River, à prédominance de roches carbonatées, définit un homoclinal à pendage ouest, modifié par la faille de chevauchement de Mount Raymond ainsi que par des plis mineurs présents dans le mur de la faille. Dans la succession d'Imperial-Tuttle sus-jacente, des plis à l'échelle de la carte sont définis là où des grès persistants sont interstratifiés dans les shales. Des failles inverses abruptes à l'est ont pu réactiver des failles de rift du Cambrien. La géométrie structurale est un reflet du tectonisme régional de la Cordillère au Crétacé tardif-Cénozoïque.



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

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CANADIAN GEOSCIENCE MAP 71

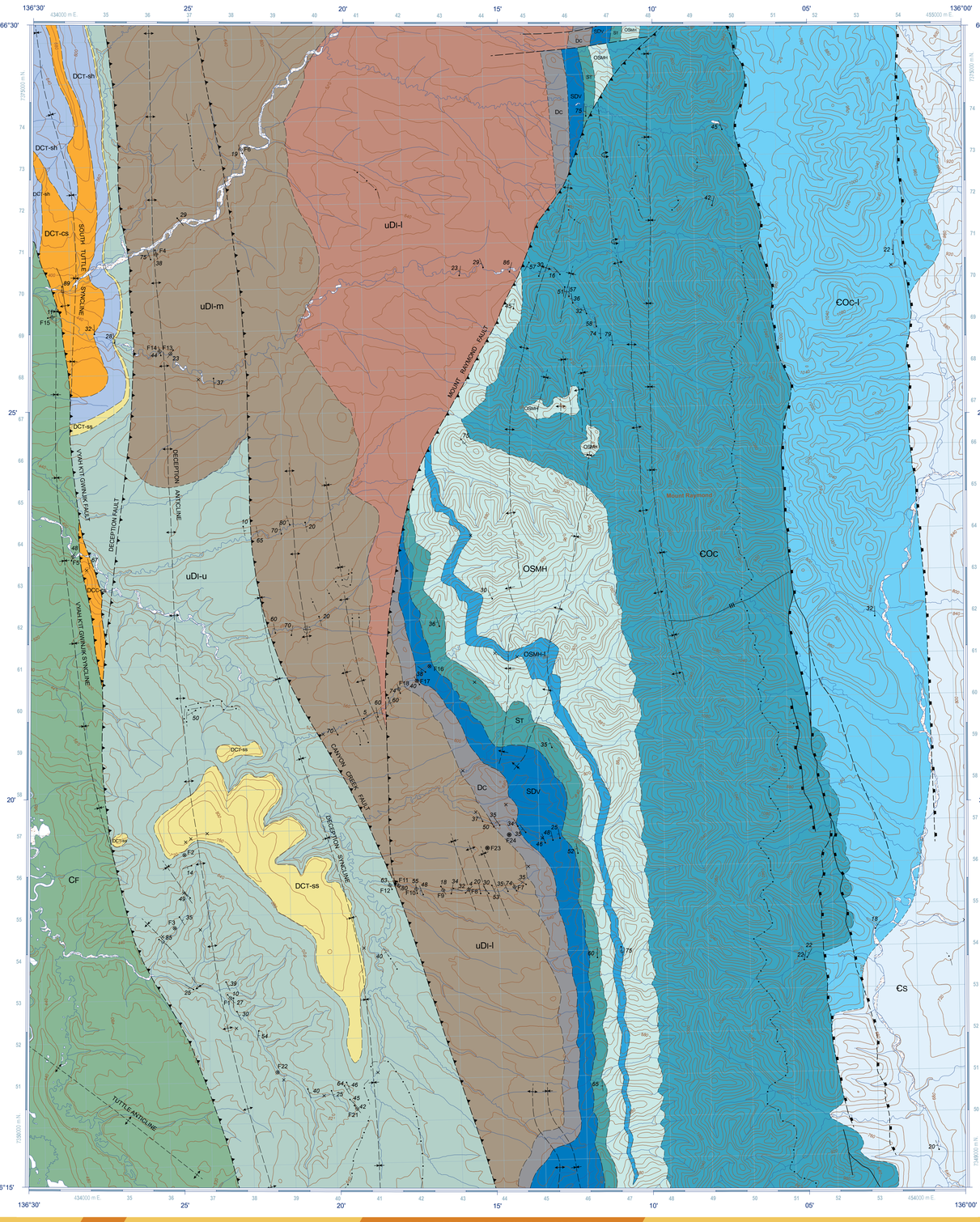
BEDROCK GEOLOGY

MOUNT RAYMOND

Yukon

NTS 116-I/8

1:50 000



CARBONIFEROUS

CF — **FORD LAKE FORMATION:** shale, calcareous, pyritic; locally contains thin sandstone or siltstone beds. Locally, basal beds may be Upper Devonian.

DEVONIAN AND CARBONIFEROUS

TUTTLE FORMATION: Conglomerate, sandstone, and shale; three lithofacies distinguished with no stratigraphic significance; rapid lateral thickness changes; erosional bases and channel geometry observed in seismic-reflection profiles.

DCT-sh — **TUTTLE FORMATION (shale unit):** shale-dominated lithofacies: dark grey, locally with siltstone beds.

DCT-ss — **TUTTLE FORMATION (sandstone unit):** sandstone-dominated lithofacies: quartz- and chert-dominated, chert commonly tryolitic, light grey to white, local woody debris, porous.

DCT-cs — **TUTTLE FORMATION (sandstone and conglomerate unit):** sandstone- and conglomerate-dominated lithofacies: quartz and chert, light grey to white, local woody debris, lacks fine-grained matrix.

DEVONIAN

IMPERIAL FORMATION: Shale and siltstone, laminated; sandstone, turbiditic; divisible into three informal members.

uDlu — **IMPERIAL FORMATION (upper member):** shale, dark grey, laminated; weathers medium grey; siltstone, dark grey; minor sandstone, pyritic.

uDlm — **IMPERIAL FORMATION (middle member):** shale, dark grey; siliceous; siltstone, dark grey, laminated and ripple crosslaminated, weathers rusty; sandstone, dark grey, fine-grained, poorly sorted, turbiditic.

uDll — **IMPERIAL FORMATION (lower member):** shale, dark grey to black, siliceous; siltstone, dark grey, laminated, weathers rusty; sandstone, rare.

Dc — **CANOL FORMATION:** shale, black, siliceous, locally cherty, weathers light grey.

LATE CAMBRIAN TO MIDDLE DEVONIAN

ROAD RIVER GROUP:

SDv — **VITTREKWA FORMATION:** shale, black, may be pyritic, calcareous, siliceous, or cherty; graptolitic, locally bioturbated; limestone, locally shaly, locally ripple crosslaminated; dolostone, black, pyritic.

ST — **TETLIT FORMATION:** argillite, green, grey, weathers brown; dolostone, light grey, weathers orange, local bioturbation and traces.

OSMH — **MOUNT HARE FORMATION:** chert, black, thin- to thick-bedded, locally brecciated, graptolitic; shale, siliceous, locally calcareous or pyritic, graptolitic; limestone, grey, medium- to thick-bedded calcarenite, locally shaly or cherty, locally ripple crosslaminated, locally intraclast conglomerate.

OSMH-l — Light-weathering limestone marker.

COc — **CRONIN FORMATION:** limestone, grey to black, weathers yellow, thin- to thick-bedded, locally chert nodules or discontinuous beds, locally ripple crosslaminated; limestone, black, thin-bedded, shaly; fauna – brachiopods, conodonts, sponge spicules, graptolites, bioturbation.

COcl — **CRONIN FORMATION (lower member):** shale, black, laminated; limestone, medium grey, beds 2 to 20 cm thick; siltstone.

CAMBRIAN

CS — **SLATS CREEK FORMATION:** sandstone, weathers reddish brown to orange; maroon and orange siltstone; shale; local solitary beds of sandy chert-pebble conglomerate; few scattered limestone mounds.

Contacts:
- *Defined*
- *Approximate*
- *Inferred*

Traces:
- *Lineament, defined*

Faults:
- *Motion undefined, defined*
- *Motion undefined, approximate*
- *Thrust fault, approximate*
- *Thrust fault, inferred*
- *Reverse, defined*
- *Reverse, approximate*
- *Reverse, inferred*

Folds:
- *Anticline, upright, defined*
- *Anticline, upright, approximate*
- *Anticline, upright, inferred*
- *Anticline, overturned, inferred*
- *Monocline, anticlinal bend, upright, approximate*
- *Monocline, synclinal bend, upright, approximate*
- *Syncline, upright, approximate*

Thin Lithologies:
- *Marker bed*

Station

Drillhole

Bedding:
- *Inclined, measured, younging known*
- *Inclined, measured, younging unknown*
- *Inclined, estimated, younging known*
- *Inclined, estimated, younging unknown*
- *Overturned <180, measured, younging known*
- *Horizontal, estimated*

Fossil Locality:
- *Fossil*

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Table 1. Outcrop fossil localities

Label	Curation	Sample Name	Sample Type	Easting	Northing	Unit Name	Report	Age
F1	C-029997	64NC-1mf	Hand Sample	437536	7353024	upper Imperial	W. W. Brideaux, GSC Paleontological Report 3.(Gen.), 1974	Paleozoic, Devonian?
F2	C-486281	2008LHA008C01	Hand Sample	436483	7356469	upper Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Early Famennian
F3	C-486289	2008LHA012A01	Hand Sample	436214	7354721	upper Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Early Famennian
F4	C-486294	2008LHA016B01	Hand Sample	436092	7370884	Imperial Fm	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Frasnian
F5	C-486307	2008LHA027A01	Hand Sample	433959	7363680	Ford Lake Shale	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Visèan
F6	C-486310	2008LHA029B01	Hand Sample	438162	7373364	Imperial Fm	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	indeterminate
F7	C-486323	2008LHA043A01	Hand Sample	444386	7355556	Imperial Fm	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Frasnian-early Famennian
F8	C-486325	2008LHA048A01	Hand Sample	443284	7355506	Imperial Fm	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	indeterminate
F9	C-486326	2008LHA052A01	Hand Sample	442672	7355506	upper Imperial ?	J. Utting, unpub. Paleontological Report JU-2009-06, 2009	Frasnian or early Famennian
F10	C-486327	2008LHA054A01	Hand Sample	442030	7355552	upper Imperial	J. Utting, unpub. Paleontological Report JU-2009-06, 2009	Frasnian or early Famennian
F11	C-486329	2008LHA055A02	Hand Sample	441609	7355634	lower Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Frasnian-early Famennian
F12	C-486330	2008LHA056A01	Hand Sample	441400	7355651	upper Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	early Famennian
F13	C-491873	2010LHA101B01	Hand Sample	436384	7368498	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2011	indeterminate
F14	C-491875	2010LHA102D01	Hand Sample	436127	7368564	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2011	Frasnian
F15	C-491877	2010LHA105A01	Hand Sample	433561	7369430	Tuttle	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2011	late Tournaisian
F16	C-491888	2010LHA113A01	Hand Sample	442452	7360882	Road River Gp	B.S. Norford, unpub. GSC Paleontological Report 0-1-BSN-2011, 2011	Ludlow
F17	C-491890	2010LHA115A01	Hand Sample	442140	7360540	Canol	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2011	probably Middle Devonian
F18	C-491891	2010LHA116A01	Hand Sample	441699	7360352	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2011	Devonian
F19	C-491893	2010LHA118D01	Hand Sample	441168	7359800	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2013	middle Frasnian
F20	C-491894	2010LHA121B01	Hand Sample	439865	7359302	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2013	middle Frasnian
F21	C-542104	2010TLA-ET-19-1A	Hand Sample	440507	7350304	Tuttle?	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2011	indeterminate
F22	C-542109	2010TLA-ET-19-8A	Hand Sample	438615	7351226	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2011	late Famennian

Table 2. Diamond-drill hole fossil localities

Label	Curation	Sample Name	Sample Type	Easting	Northing	Interval (m)	Unit Name	Report	Age
F23	C-486467	DDH-R08-24-1	Core	443753	7366495	565	Canol	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle Devonian
F23	C-486468	DDH-R08-24-2	Core	443753	7366495	548.5-549	Canol	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle Devonian
F23	C-486475	DDH-R08-24-7	Core	443753	7366495	507.7	Canol	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle Devonian
F23	C-486474	DDH-R08-24-8	Core	443753	7366495	494.5	Canol	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle Devonian
F23	C-486477	DDH-R08-24-11A	Core	443753	7366495	472-473.75	Canol	Gouwy, 2017" use "S.A. Gouwy, unpub. GSC Paleontological Report 4-SAG-2017, 2017	late Frasnian
F23	C-486478	DDH-R08-24-11B	Core	443753	7366495	470.75-471	Canol	Gouwy, 2017" use "S.A. Gouwy, unpub. GSC Paleontological Report 4-SAG-2017, 2017	Frasnian
F23	C-486481	DDH-R08-24-14	Core	443753	7366495	425	Canol	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle to Late Devonian
F23	C-486483	DDH-R08-24-16	Core	443753	7366495	401.7	Canol/Imperial transition	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle to Late Devonian
F23	C-486485	DDH-R08-24-18	Core	443753	7366495	384.3	Canol/Imperial transition	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle to Late Devonian
F23	C-486486	DDH-R08-24-19	Core	443753	7366495	378.2	Canol/Imperial transition	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Middle to Late Devonian
F23	C-486487	DDH-R08-24-20	Core	443753	7366495	366.8	Canol/Imperial transition	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Late Devonian
F23	C-486488	DDH-R08-24-21	Core	443753	7366495	360	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Late Devonian
F23	C-486493	DDH-R08-24-26	Core	443753	7366495	302.8	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Late Devonian
F23	C-486497	DDH-R08-24-30	Core	443753	7366495	246.1	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Late Devonian
F23	C-491506	DDH-R08-24-37	Core	443753	7366495	184.5	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Late Devonian
F23	C-491508	DDH-R08-24-41	Core	443753	7366495	126.9	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Late Devonian
F23	C-491512	DDH-R08-24-45	Core	443753	7366495	66.9	Imperial	C. Dolby, unpub. GSC Paleontological Report MISC 1, 2010	Late Devonian
F24	C-491523	DDH-R07-07A-9	Core	444283	7366805	66.2-66.45	Canol	Gouwy, 2017" use "S.A. Gouwy, unpub. GSC Paleontological Report 4-SAG-2017, 2017	early Frasnian

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CANADIAN GEOSCIENCE MAP 71

Geological Survey of Canada
Canadian Geoscience Maps

Canada

Author: L.S. Lane

Geology by L.S. Lane in 2011 to 2014, based on new mapping by L.S. Lane (2009 and 2010), evaluation of archival field data and fossil identifications from Operation Porcupine (1962–1976), additional field data from T.L. Allen (2009 and 2010), and K.M. Bell and D.A. Huntley (2012), new fossil identifications by J. Utting, G. Dolby, and S.A. Gouwy, and analysis of air photos and satellite imagery (2008–2018).

Geology conforms to Bedrock Data Model v. 4.0.

Geomatics and cartography by L.E. MacDonald, D. Lemay, F. Hardjowirogo, and K. Rentmeister.

Scientific editing by A. Weatherston

BEDROCK GEOLOGY
MOUNT RAYMOND
Yukon
NTS 116-I/8
1:50 000

1 0 1 2 3 4 km

Initiative of the Geological Survey of Canada, conducted under the auspices of the Yukon Sedimentary Basins project as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program

Map projection Universal Transverse Mercator, zone 8 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

Magnetic declination 2020, 19°50'E, decreasing 28.9' annually

This map is not to be used for navigational purposes.

Title photograph: Southern Richardson Mountains, view northwestward from Cambrian Shales in the core of the Richardson Mountains toward west-dipping Ordovician and Silurian limestones of the Road River Group forming the western slopes of the range, Yukon. Photograph by L.S. Lane. NRCan photo 2019-531

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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