Descriptive Notes

Previous reconnaissance mapping (Norris, 1982) effectively captures the key characteristics of the map area. With limited fieldwork, additional imagery analysis (Zhao, 2015), and the incorporation of subsequent stratigraphic and paleontological data (e.g. Dixon, 1992; Bell, 2018), we have refined the distribution of map units and structures. Some of the significant findings are highlighted here.

This map area straddles the transition from the north-south-trending Nahoni range in the west, in which Paleozoic successions are widely exposed, to the more gently deformed Eagle Plain to the east, where Cretaceous strata are exposed at surface. Immediately to the south of the map area, the east-west-trending Taiga range of the Ogilvie Mountains also exposes Paleozoic strata. Both ranges developed more or less contemporaneously in Late Cretaceous to Paleogene time. The dome and basin fold geometry evident in this and adjacent map areas is due to the interference of these two orthogonal deformation trends (Lane, 1998). Although major structures are well outlined by resistant Paleozoic carbonate and Cretaceous sandstone units, many details of the structural geometry are obscured by poor outcrop. Subsurface data in adjacent Eagle Plain demonstrate that the exposed structures are detached on décollement surfaces at depth (e.g. Lane, 1996; Hall and Cook, 1998).

The exposed stratigraphy consists of alternating competent intervals (early Paleozoic carbonates, late Paleozoic carbonates, and Cretaceous sandstones) interbedded with substantial thicknesses of incompetent, shale-dominated intervals (the Devonian to early Carboniferous Canol-Ford Lake-Hart River succession, and the Albian-Cenomanian Whitestone River and Parkin formations). This alternating arrangement permits the competent intervals to deform disharmonically, creating more complex map patterns.

In short, the outcrop geometry derives from three related factors: the eastward-decreasing deformation intensity toward the Cordilleran foreland, the mutual interference of two orthogonal deformation trends, and the alternating mechanical characteristics of the layers.

Competent limestones of the Carboniferous Ettrain Formation form strongly asymmetric anticlines with sharp hinges and planar limbs. The eastern limbs have steep to vertical dips, whereas the western limbs have shallow to moderate dips. The anticlines tend to be left-stepping en échelon structures. In contrast, the Upper Cretaceous sandstone-dominated Fishing Branch and Cody Creek formations define broad symmetrical synclines that tend to be continuous at this scale. Taken together, these observations imply that some degree of structural disharmony between the Carboniferous and Upper Cretaceous successions is required to accommodate these differing structural styles.

A minor tight anticline is mapped adjacent to the east limb of North Cluett anticline near the south bank of Whitestone River. This fold, previously interpreted as accommodating two en échelon segments of the Huley syncline (Norris, 1982), is here interpreted as lying above a local back-thrust fault. In the absence of evidence to the contrary, the Huley syncline is interpreted as being continuous across the Whitestone River valley. Also, we have established that the sandstone rib outlining the anticline is Permian in age, therefore it is mapped as Jungle Creek Formation and the underlying strata are presumed to be Ettrain Formation. The sandstone unit also defines a prominent rib on the adjacent east limb of the Huley syncline, both north and south of Whitestone River. Thin section examination of samples from both limbs of the syncline supports this interpretation. Accordingly, this Permian sandstone unit, a thin erosional remnant between the Ettrain Formation and the Cretaceous succession, persists across much of the north-central part of the map area. It pinches out in the southeast, near the south nose of North Huley anticline, but appears to persist northward along its west limb into the adjacent 116-J map area. On previous regional maps, this unit was included within the Lower Cretaceous succession (mapped largely as Mount Goodenough; Norris, 1984).

In the south-central area of the map, six small transverse faults disrupt the continuity of the Fishing Branch Formation, which underlies a long north-trending ridge on the east limb of the South Huley anticline. The faults' orientations vary and their kinematics are undefined. However, the strike separation of bedding in all cases is consistent with an important component of north-south shortening.

Acknowledgments

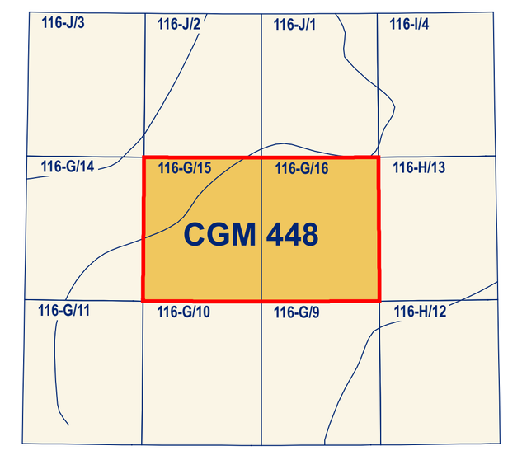
This map is a product of the Geo-mapping for Energy and Minerals (GEM) program, 2009–2013. Final compilation benefitted from additional outcrop data by K.M. Bell and D.H. Huntley in 2012. Also, archival outcrop and aerial-observation data collected during Operation Porcupine (1962–1982) were incorporated into the compilation and the GIS database. Contributions by M. Francis (administration) and R. Fontaine (curation) facilitated the compilation. 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 Gwich'in First Nation participants Shawn Bruce and Douglas Frost in 2009, and Myranda Charlie, and Yudii Mercredi in 2010. Helicopter support was provided by Fireweed Helicopters, Dawson; and by Gwich'in Helicopters, Inuvik.

Abstract

This map encompasses two 1:50 000 scale map areas at the southwestern margin of Eagle Plain sedimentary basin, in the northern Canadian Cordillera. The eastern part is underlain by the Upper Cretaceous Parkin, Fishing Branch, Burnthill Creek, and Cody Creek formations of the Eagle Plain Group, where shale and sandstone beds dip gently eastward to northward. The western part of the map contains three large anticline-syncline pairs trending north-northwest–south-southeast that expose Lower Cretaceous Whitestone River Formation lying unconformably on Paleozoic strata of Middle Devonian to Permian age, comprising Ogilvie, Hart River, Ettrain, and Jungle Creek formations. The folds define domes and basins reflecting the influence of two orthogonal fold-thrust events during Cretaceous-Paleogene Cordilleran deformation. At the level of the Cretaceous units, the synclines define symmetrical continuous structures, whereas the anticlines, exposing Paleozoic strata, define asymmetric en échelon structures suggesting that pre-existing structural or stratigraphic trends influenced their deformation.

Résumé

Cette carte s'étend à deux feuillets cartographiques à l'échelle 1/50 000 situés à la marge sud-ouest du bassin sédimentaire d'Eagle Plain, dans le nord de la Cordillère canadienne. Le sous-sol de la partie est constitué des formations de Parkin, de Fishing Branch, de Burnthill Creek et de Cody Creek du Groupe d'Eagle Plain du Crétacé supérieur, où les couches de shale et de grès sont légèrement inclinées dans une direction variant de l'est au nord. La partie ouest de la carte présente trois grands couples anticlinaux-synclinaux d'orientation nord–nord-ouest—sud–sud-est qui exposent la Formation de Whitestone River du Crétacé inférieur. Celle-ci surmonte en discordance des strates paléozoïques s'échelonnant en âge du Dévonien moyen au Permien, qui appartiennent aux formations d'Ogilvie, de Hart River, d'Ettrain et de Jungle Creek. Les plis définissent des structures en dômes et bassins qui rendent compte de l'influence de deux événements de plissement-chevauchement orthogonaux pendant la déformation de la Cordillère au Crétacé-Paléogène. Au niveau des unités du Crétacé, les synclinaux définissent des structures continues et symétriques, tandis que les anticlinaux, qui exposent des strates du Paléozoïque, définissent des structures asymétriques en échelon, ce qui laisse supposer que des alignements structuraux ou stratigraphiques préexistants ont influencé leur déformation.



National Topographic System reference

Catalogue No. M183-1/448-2023E-PDF
ISBN 978-0-660-47470-0
https://doi.org/10.4095/329451

© His Majesty the King in Right of Canada, as represented by the Minister of Natural Resources, 2023

CANADIAN GEOSCIENCE MAP 448

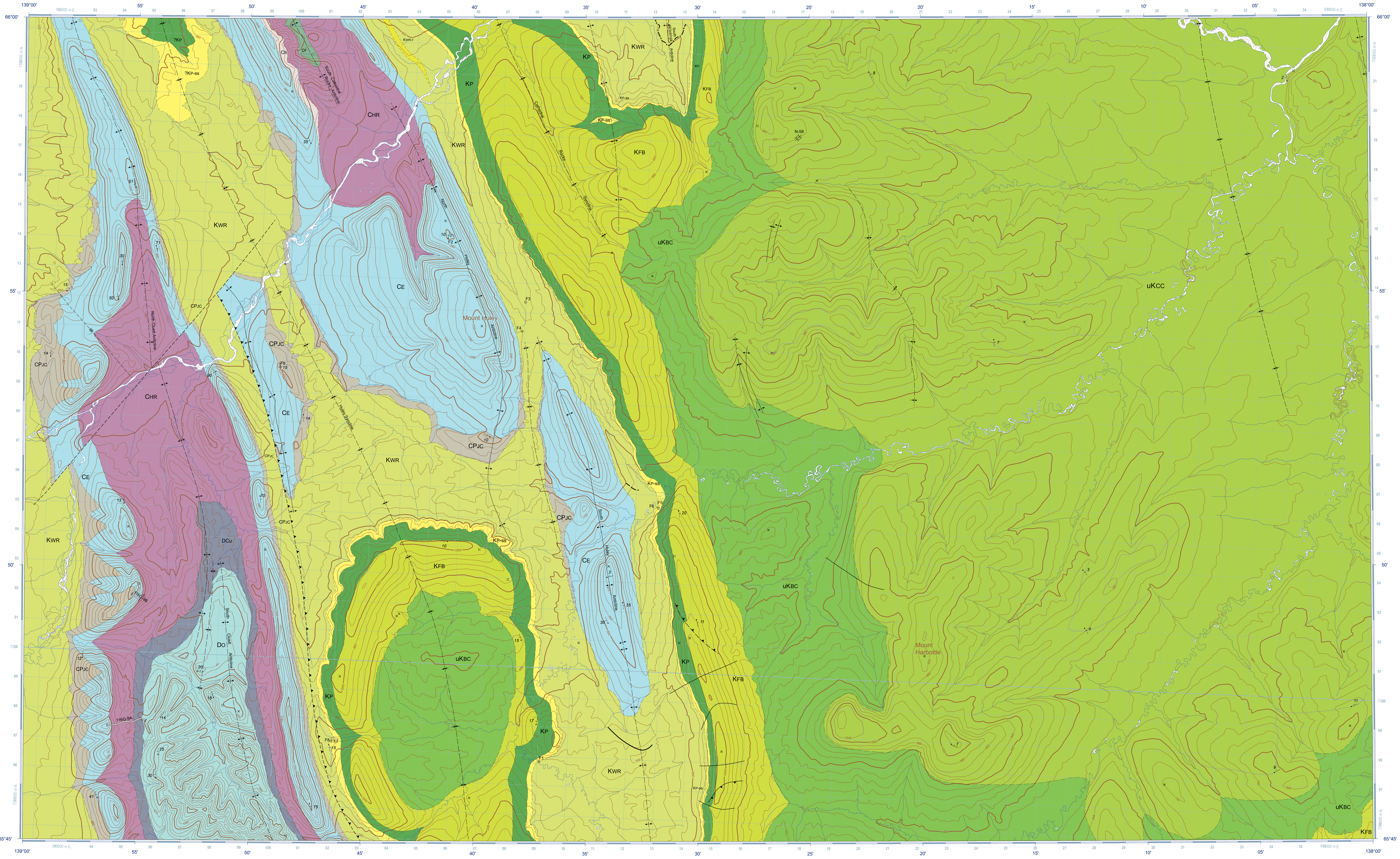
BEDROCK GEOLOGY

MOUNT HULEY AND MOUNT HARBOTTLE

Yukon

NTS 116-G/15 and 16

1:50 000



CRETACEOUS

EAGLE PLAIN GROUP

- uKCC — **Cody Creek Formation:** sandstone; shale; minor siltstone; coal; marine and non-marine.
- uKBC — **Burnthill Creek Formation:** shale; dark grey to black; siltstone laminae; minor sandstone; marine.
- KFB — **Fishing Branch Formation:** sandstone; siltstone; shale; interbedded; marine shelf.
- KP — **Parkin Formation:** shale; siltstone; sandstone; conglomerate; marine.
  - KP-ss — **Sandstone member (informal):** sandstone; conglomerate; siltstone; marine.
- KWR — **Whitestone River Formation:** shale; siltstone; sandstone; marine (Albian).
  - KWR-r — **Resistant beds within the Whitestone River Formation:** sandstone, siltstone.

PERMIAN

- CPJC — **Jungle Creek Formation:** lower part: sandstone, conglomerate, shale, siltstone with minor thin-bedded limestone; upper part: limestone and shale interbedded.

CARBONIFEROUS

- CE — **Ettrain Formation:** limestone: grey, skeletal, micritic; shale; sandstone: calcareous, locally present at the base; marine.
- CB — **Blackie Formation:** sandstone, brown weathering; conglomerate; limestone, skeletal; marine.
- CHR — **Hart River Formation:** limestone; dolostone; chert; brown weathering; marine.
- CF — **Ford Lake Shale:** shale, calcareous, pyritic; locally contains thin sandstone or siltstone beds. Locally, basal beds may be Upper Devonian.

DEVONIAN AND CARBONIFEROUS

- DCu — **Devonian-Carboniferous Shale:** shale, black, hard, siliceous, recessive; minor soft black shale; weathers grey or silvery grey; includes strata equivalent to Canol Formation, McCann Hill Chert, and Nation River Formation; may include strata equivalent to Imperial and Ford Lake formations.

DEVONIAN

- DO — **Ogilvie Formation:** limestone, brown to grey, weathers light grey, in part skeletal and reefal, cliff-forming; local dolomite, argillite, siltstone, and chert.

Geological contact:
Defined
Approximate
Inferred

Faults:
Motion undefined, defined
Motion undefined, inferred
Thrust fault, defined
Thrust fault, approximate
Thrust Fault, Inferred

Folds:
Anticline, upright, defined
Anticline, upright, approximate
Monocline, anticlinal bend, upright, approximate (short arrow is steeper limb)
Syncline, upright, defined
Syncline, upright, approximate

Thin Lithologies:
Thin unit, defined
Thin unit, approximate
Discontinuous thin unit

Traces:
Bedding form line, defined
Bedding form line, approximate
Lineament, inferred. Possibly a small fault, displacement undefined.

116G-9A — Measured section (with number, *see* Table 3)

Station

Remote observation

Bedding:
10 — *Inclined, measured, younging known*
23 — *Inclined, estimated, younging known*
90 — *Vertical, estimated*

F1 — Fossil locality (with number, *see* Table 1)

N-58 — Petroleum well, dry and abandoned (with number, *see* Table 2)

References

Bamber, E.W., 1972. Description of Carboniferous and Permian stratigraphic sections, northern Yukon Territory and northwestern District of Mackenzie (NTS 106-M; 116-C, F, G, H, I, J, P; 117-A, B, C); Geological Survey of Canada, Paper 72-19, 161 p.

Bamber, E.W. and Waterhouse, J.B., 1971. Carboniferous and Permian stratigraphy and paleontology, northern Yukon Territory, Canada; Bulletin of Canadian Petroleum Geology; v. 19, p. 29–250.

Bell, K.M., 2018. Biostratigraphy of Cretaceous and Paleogene strata from Northern Yukon Territory and District of Mackenzie, Northwest Territories; Ph.D. thesis, Department of Geoscience, University of Calgary, Calgary, AB, 339 p.

Dixon, J., 1992. Stratigraphy of the Mesozoic strata, Eagle Plain area, northern Yukon; Geological Survey of Canada, Bulletin 408, 58 p. https://doi.org/10.4095/133237

Hall, K.W. and Cook, F.A., 1998. Geophysical transect of the Eagle Plains fold belt and Richardson Mountains anticlinorium, northwestern Canada; Geological Society of America Bulletin, v. 110; p. 311–325.

Lane, L.S., 1996. Geometry and tectonics of early Tertiary triangle zones, northeastern Eagle Plain, Yukon Territory; Bulletin of Canadian Petroleum Geology, v. 44, p. 337–348.

Lane, L.S., 1998. Late Cretaceous-Tertiary tectonic evolution of northern Yukon and adjacent Arctic Alaska; American Association of Petroleum Geologists Bulletin, v. 82, p. 1353–1371. https://doi.org/10.1306/1D9BCA75-172D-11D7-8645000102C1865D

Norris, D.K., 1982. Geology, Ogilvie River, Yukon Territory; Geological Survey of Canada, Map 1526A, scale 1:250 000, 1 sheet. https://doi.org/10.4095/119037

Norris, D.K., 1985. Geology of the northern Yukon and northwestern District of Mackenzie; Geological Survey of Canada, Map 1581A, scale 1:500 000, 1 sheet. https://doi.org/10.4095/120537

Zhao, S., 2015. Analysis of remote sensing and geographic information system technologies to enhance geological mapping in Eagle Plain, northern Yukon; M.Sc. thesis, Department of Geology and Geophysics, University of Calgary, Calgary AB, 267 p.

Table 1. Outcrop fossil localities.

Label	Curation	Sample name	Sample type	Easting	Northing	Unit name	Report	Age	
F1	C-053348	649NC-1mf	palynology	609057	7296813	Parkin Fm, basal sandstone	N.S. Ioannides, unpub. GSC Paleontological Report 8-NSI-1979, 1979	mid-Albian to Santonian	
F2	C-080213	651NC-1F	micropaleontology	605367	7314518	Ettrain Fm	B.L. Mamet, unpub. GSC Paleontological Report BM-1-80, 1980	mid-Carboniferous or slightly younger	
F3	C-149319	DFA86-9-1	micropaleontology	607988	7312360	Whitestone River Fm	S.P. Fowler, unpub. GSC Paleontological Report 1-SPF-1986, 1986; D.H. McNeil, pers. comm., 2021	early to middle Albain	
	C-149319	DFA86-9-1	palynology	607988	7312360	Whitestone River Fm	D.J. McIntyre, unpub. GSC Paleontological Report 4-DJM-1987, 1987	Cretaceous	
F4	C-149320	DFA86-9-2	micropaleontology	607912	7311370	Whitestone River Fm	S.P. Fowler, unpub. GSC Paleontological Report 1-SPF-1986, 1986; D.H. McNeil, pers. comm., 2020	probably Albian	
	C-149320	DFA86-9-2	palynology	607912	7311370	Whitestone River Fm	D.J. McIntyre, unpub. GSC Paleontological Report 4-DJM-1987, 1987	Cretaceous	
F5	C-149342	DFA86-18-1	palynology	612711	7305527	Parkin Fm	D.J. McIntyre, unpub. GSC Paleontological Report 4-DJM-1987, 1987	Cenomanian	
F6	C-149343	DFA86-18-2	palynology	612711	7305527	Parkin Fm	D.J. McIntyre, unpub. GSC Paleontological Report 4-DJM-1987, 1987	Cenomanian	
F7	C-149344	DFA86-19-1	micropaleontology	601990	7297250	Whitestone River Fm	S.P. Fowler, unpub. GSC Paleontological Report 1-SPF-1986, 1986; D.H. McNeil, pers. comm., 2020	Albian	late middle, to late Albian based on combined data
	C-149344	DFA86-19-1	palynology	601990	7297250	Whitestone River Fm	D.J. McIntyre, unpub. GSC Paleontological Report 4-DJM-1987, 1987	late middle Albian to Cenomanian	
F8	C-149345	DFA86-19-2	micropaleontology	601990	7297250	Whitestone River Fm	S.P. Fowler, unpub. GSC Paleontological Report 1-SPF-1986, 1986; D.H. McNeil, pers. comm., 2020	Albian	late middle, to late Albian based on combined data
	C-149345	DFA86-19-2	palynology	601990	7297250	Whitestone River Fm	D.J. McIntyre, unpub. GSC Paleontological Report 4-DJM-1987, 1987	late middle Albian to Cenomanian	
F9	C-636357	222NB-1	palynology	599760	7309840	Jungle Creek Fm	K.M. Bell, unpub. GSC Petrostat Applied Stratigraphy Report PS21-089, 2021	Late Carboniferous to Permian	

Table 2. Wells.

Label	UWID	Full name	Spud date	TD (m)	Surface location Easting, Northing (NAD83)
N-58	300N586600138150	Murphy Mesa PB Whitestone YT N-58	10 Feb. 1973	2131.5	617009E; 7318287N

Table 3. Stratigraphic sections.

Section name	Measured by	Year	Formations	References
116G-9A	E.W. Bamber	1962	Canol, Ford Lake, Hart River, Ettrain	Bamber and Waterhouse, 1971; Bamber, 1972
116G-9B	E.W. Bamber	1962	Hart River, Ettrain, Jungle Creek	Bamber and Waterhouse, 1971; Bamber, 1972

Recommended citation
Lane, L.S. and Zhao, S., 2023. Bedrock geology, Mount Huley and Mount Harbottle, Yukon, NTS 116-G/15 and 16; Geological Survey of Canada, Canadian Geoscience Map 448, scale 1:50 000. https://doi.org/10.4095/329451

CANADIAN GEOSCIENCE MAP 448

Geological Survey of Canada
Canadian Geoscience Maps

Authors: L.S. Lane and S. Zhao

Geology by D.K. Norris, 1962 and 1970; E.W. Bamber, 1962; A.W. Norris, 1970; G.C. Taylor, 1970; F.G. Young, 1970; J. Dixon, 1984 to 1986; L.S. Lane, 2010 and 2019 to 2022; S. Zhao, 2012; D.H. Huntley, 2012; K.M. Bell, 2012

Geological compilation by L.S. Lane, 2012, 2016 to 2022; S. Shao, 2012 to 2015

Geological data conforms to Bedrock Data Model v. 4.0.

Geological data conversion by K. Rentmeister, 2019 to 2021; S. Zhao, 2012 to 2014; L.S. Lane, 2018 to 2022; M. Le, 2021 and 2022

Geomatics and cartography by K. Rentmeister, L.S. Lane, S. Zhao, and M. Le

Scientific editing by L. Ewert

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

Map projection Universal Transverse Mercator, zone 7
North American Datum 1983

BEDROCK GEOLOGY

MOUNT HULEY AND MOUNT HARBOTTLE

Yukon

NTS 116-G/15 and 16

1:50 000

1 0 1 2 3 4 km

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

Magnetic declination 2023, 18°49'E, decreasing 19.2' annually

This map is not to be used for navigational purposes.

Title photograph: Aerial view toward the northeast, down Whitestone River from 2012WS019 sample site on the west limb of North Cluett anticline, Yukon. Gently west-dipping limestone beds of the Carboniferous Ettrain Formation form the bluff in the foreground. Photograph by S. Zhao. NRCan photo 2021-261

The Geological Survey of Canada welcomes corrections or additional information from users (gscpublications-cgcpublications@nrcan-rncan.gc.ca).

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

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

CANADIAN GEOSCIENCE MAP 448
BEDROCK GEOLOGY
MOUNT HULEY AND MOUNT HARBOTTLE
Yukon
NTS 116-G/15 and 16