Geological contact
- Defined
- Approximate
- Inferred
- Concealed

Facies change
- Approximate
- Inferred

Thin map unit, displayed in map-unit colour
- Defined
- Approximate
- Inferred
- Concealed

Escarpment
- Defined
- Approximate

Normal fault, solid circle indicates downthrown side
- Approximate
- Inferred
- Concealed

Thrust fault, teeth indicate upthrust side
- Defined
- Approximate
- Inferred
- Concealed

Transverse fault
- Approximate
- Inferred

Steep dip fault
- Approximate

Slump escarpment
- Defined

Landslide, scarp
- Approximate

Anticline, upright, overturned
- Defined
- Approximate
- Inferred
- Concealed

Syncline, upright, overturned
- Defined
- Approximate
- Inferred
- Concealed

Anticline, upright, homeoclinic, shorter arrow on steeper limb
- Approximate

Syncline, upright, homeoclinic, shorter arrow on steeper limb
- Approximate
- Inferred

× Outcrop visited, attitude not determined

Bedding
- Top known, horizontal
- Top known, inclined
- Top known, vertical, ball on younger side
- Top known, overturned
- Top unknown, inclined

Cleavage, inclined

Dyke, inclined

Joint, inclined

Fold hinge
- Map-scale, inclined
- Minor, inclined
- Minor U-shaped, inclined
- Minor Z-shaped, inclined

Minor syncline, overturned, axial plane

Mineral locality (*see* table for type)

Mine

Change in mapping precision, stratigraphic subdivisions are amalgamated at dotted line

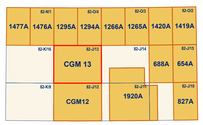
Measured section (number refers to internal cataloguing system)
AC: J.D. Aitken, NE; B.S. Norford

Abstract

Mount Assiniboine map area (NTS 82-J/13, 1:50 000 scale) straddles portions of the Front Ranges, Main Ranges, and Western Ranges subdivisions of the southern Canadian Rocky Mountains, from northeast to extreme southwest. Thrusts carrying folded Ordovician, Devonian, and Mississippian carbonate and clastic strata characterize the Front Ranges, where Upper Devonian Fairholme Group strata change facies from reef to basinal deposits. At the Middle and Upper Cambrian Kicking Horse Rim, an abrupt westward facies change from competent platform and ramp carbonate units to thick basinal strata, divides the Main Ranges into eastern broadly folded and western penetratively deformed parts. Tight and overturned northeast-facing folds occur immediately west of the Kicking Horse Rim. Boulders and blocks shed from the rim are spectacularly exposed near Indian Peak. Hydrothermal alteration localized at the rim produced magnesite ore near Mount Brussilof. Folded Lower to Upper Ordovician strata cut by steep to overturned thrusts characterize the Western Ranges.

Résumé

La région de la carte Mount Assiniboine (82-J/13 du SNRC, à l'échelle de 1:50 000) couvre des parties des subdivisions des chaînons frontaux, des chaînons principaux et des chaînons de l'ouest des Rocheuses canadiennes du sud, du nord-est à l'extrême sud-ouest. Des chevauchements comportant des couches carbonatées et clastiques plissées de l'Ordovicien, du Dévonien et du Mississippien caractérisent les chaînons frontaux, tandis que les couches du Groupe de Fairholme du Dévonien supérieur passent d'un milieu dépositaire récifal à celui de bassin. À la bordure de Kicking Horse du Cambrien moyen et supérieur, un changement de faciès abrupt vers l'ouest entre des unités carbonatées compétentes de plateforme et de rampe et d'épaisses couches de bassin, divise les chaînons principaux en deux parties : une partie est à grands plis et une partie ouest à déformation pénétrative. Des plis serrés à déversement vers le nord-est sont observés immédiatement à l'ouest de la bordure de Kicking Horse. Des roches et des blocs provenant de la bordure sont à découvert et présentent un affleurement spectaculaire près de Indian Peak. La présence de minéral de magnésite près du mont Brussilof est attribuable à une altération hydrothermale localisée immédiatement à l'intérieur de la bordure. Des couches plissées de l'Ordovicien inférieur à supérieur, recoupées par des chevauchements diverses abrupts, caractérisent les chaînons de l'ouest.



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

Cover illustration:
Thick Middle and Upper Cambrian carbonate units developed at the Kicking Horse Rim form high castellated peaks including Mount Assiniboine (back centre). Mount Brussilof magnesite mine, Mitchell River, British Columbia.
Photograph by M.E. McMechan. 2010-271

© Her Majesty the Queen in Right of Canada 2011

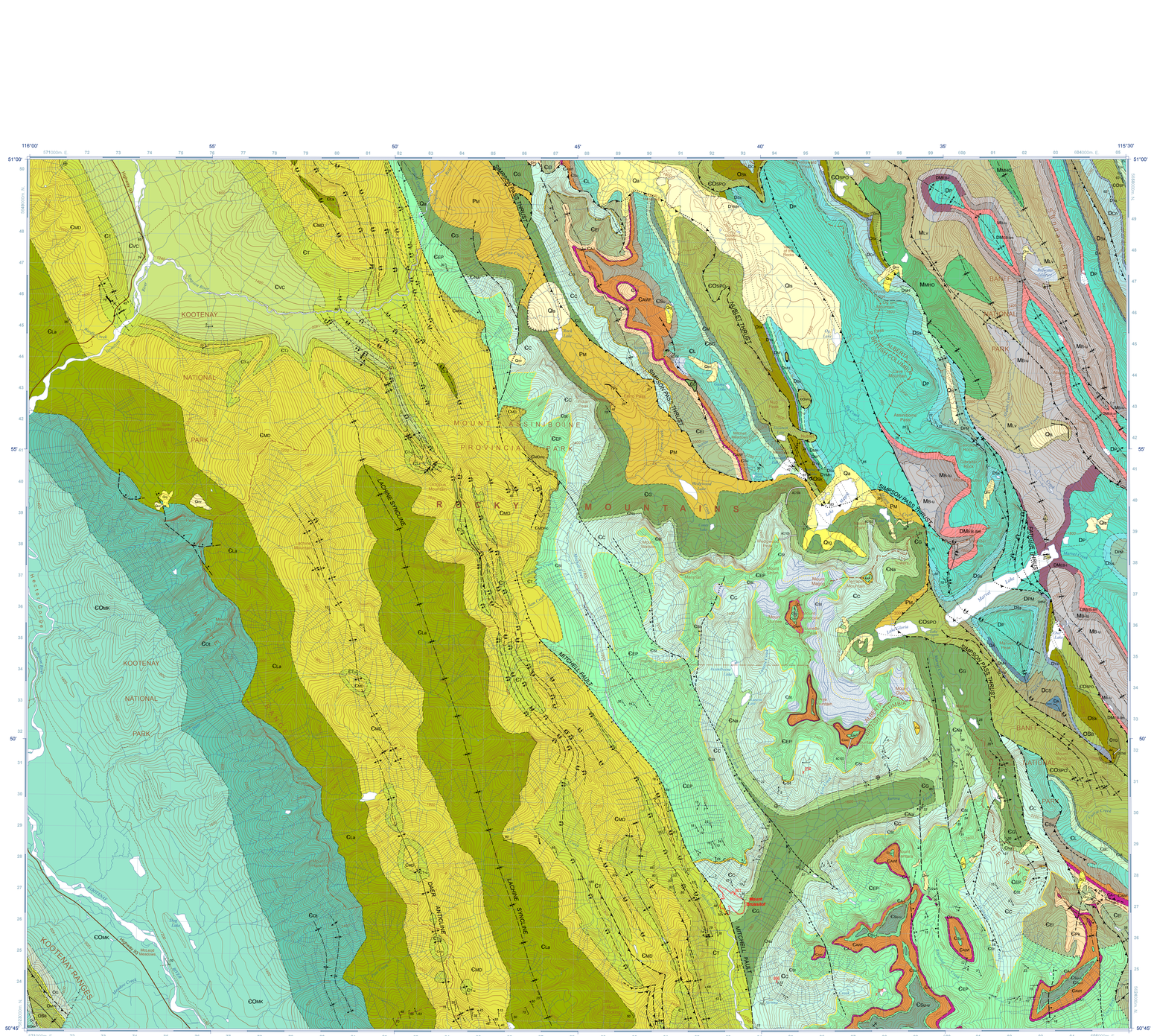
Printed map:
Catalogue No. M183-1/13-2010E
ISBN 978-0-660-20016-3

Digital map:
Catalogue No. M183-1/13-2010E-PDF
ISBN 978-1-100-17455-8

doi:10.4095/287204

Natural Resources Canada | Ressources naturelles Canada

CANADIAN GEOSCIENCE MAP 13
GEOLOGY
MOUNT ASSINIBOINE
British Columbia • Alberta
1:50 000



MINFILE No.	NAME	STATUS	COMMODITY
082JNW001	Mount Brussilof	Producer	Magnesite
082JNW008	Leech 2	Showing	Magnesite
082JNW011	Yelo	Showing	Magnesite
082JNW014	Mount Assiniboine	Prospect	Magnesite

Table 1. British Columbia MINFILE occurrences

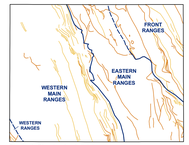


Figure 1. Structural subdivisions

QUATERNARY
- Qa — **Alluvium, colluvium, and till** - deposits of gravel, sand, and silt; this unit is shown only where these deposits cover the bedrock extensively.
- Qs — **Landslide** - blocks of nearby bedrock.
- Qmr — **Neoglacial moraine** - diamicton.
- Qrg — **Rock glacier** - rock debris, ice.

MISSISSIPPIAN
Rundle Group (MLv–MMHO)
- MMHO — **Mount Head Formation, Opal Member** - lime wackestone, packstone, and grainstone: medium to dark grey; limestone and dolostone: argillaceous, commonly cherty, minor shale: grey, forms a distinctive dark, relatively recessive-weathering unit.
- MLv — **Livingstone Formation** - grainstone and packstone: light grey, resistant, skeletal, lime, and dolomitized equivalents, locally cherty; resistant-weathering unit.

Banff Formation
- MB-u — **Upper unit; Bourgeau facies** - lime wackestone and packstone: dark grey, cherty; dolostone: cherty; chert: dark, bedded with carbonate lenses; lime grainstone bands in upper part.

UPPER DEVONIAN–MISSISSIPPIAN
- MB-u — **Lower unit, upper part; Bourgeau facies** - shale: black, siliceous; carbonate: dark grey, argillaceous; chert: black; local minor siltstone; relatively recessive unit.
- DMEB-l — **Exshaw and Banff (lower unit; Bourgeau facies) formations** - shale: black, rusty-weathering, recessive with subordinate black chert interbeds and laminae (Exshaw Formation, lower part); lime mudstone: black, ribbon-bedded, pyritic; rare sandstone: fine-grained, quartz; minor siltstone: brown-weathering, dolomitic and calcareous, commonly bioturbated (Exshaw Formation, upper part); shale: black, recessive; interbedded with wackestone: argillaceous to cherty; spiculitic lime wackestone, with spiculite in the upper part (Banff Formation, lower unit, lower part); interbedded chert, spiculite, and spiculitic carbonate, resistant (Banff Formation, lower unit, middle part); shale: black, rusty-weathering, recessive; carbonate: argillaceous, chert; local minor siltstone (Banff Formation, lower unit, upper part).
- DMEB-lm — **Exshaw and Banff (lower unit, lower and middle parts; Bourgeau facies) formations** - shale: black, rusty-weathering, recessive with subordinate black chert interbeds and laminae (Exshaw Formation); shale: black, recessive, interbedded with wackestone, argillaceous to cherty, calcareous,commonly bioturbated (Exshaw Formation, upper part); shale: black, recessive, interbedded with wackestone, argillaceous to cherty; spiculitic lime wackestone, with spiculite in the upper part (lower unit, lower part); interbedded chert, spiculite, and spiculitic carbonate, resistant (lower unit, middle part).

UPPER DEVONIAN
- DP — **Palliser Formation** - limestone: massive-weathering, burrow-mottled, dolomitic-peloidal; minor dolostone near top, local chert nodules; resistant cliff-forming unit.
- DA — **Alexo Formation** - sandstone and siltstone: quartz, dolomitic, calcareous, siliceous; minor carbonate; silty shale.
- DSs — **Sassenach Formation** - siltstone and sandstone: quartzose, interbedded with dark shale; argillaceous limestone and silty limestone near top and base.

Fairholme Group, Off-reef facies (DN–DMH)
- DYMH — **Yahatinda, Maligne, and Mount Hawk formations** - undivided.
- DMH — **Mount Hawk Formation** - limestone: grey, argillaceous; mudstone and shale: calcareous.
- DPM — **Perdrix and Mount Hawk formations** - shale: dark grey and black, calcareous; limestone: argillaceous and highly bituminous; minor shale: black; minor siltstone: quartzose, calcareous, laminated, interbeds near top, relatively recessive unit.
- DM — **Maligne Formation** - limestone: dark grey, grey- and buff-weathering, commonly micritic, more argillaceous in upper part; brachiopods common locally.

Fairholme Group (DCs–DSs)
- DCS — **Cairn and Southesk formations** - dolostone: light to dark grey-weathering.
- DSs — **Southesk Formation** - dolostone: light and medium grey-weathering, massive, fine to coarse crystalline.
- DCn — **Cairn Formation** - dolostone: dark grey and brown-grey, medium to coarse crystalline, with Amphipora- and stromatoporoid-rich beds.

MIDDLE DEVONIAN
- DYa — **Yahatinda Formation** - sandstone: buff- to brown-weathering, dolomitic; quartzite: vari-coloured; dolostone: buff, yellow- and orange-weathering, sandy and silty, more abundant in upper part.

UPPER ORDOVICIAN–LOWER SILURIAN
- OSB — **Beaverfoot Formation** - dolostone: light and medium grey, light brown-grey-weathering, resistant, medium-bedded to massive, siliceous, slightly silty or sandy (quartz grains), chert nodules and silicified fossils including corals locally; minor sandstone: dolomitic, locally near base; resistant unit.

MIDDLE ORDOVICIAN
- OSk — **Skoki Formation** - dolostone: light brown-grey and light grey-weathering, resistant, very silty or sandy (quartz grains), chert nodules and siliceous partings; minor quartz sandstone or siltstone: commonly dolomitic; resistant unit.

LOWER ORDOVICIAN
- OTG — **Tipperary Quartzite** - quartzite: light grey, resistant, siliceous, less commonly dolomitic, thick-bedded; rare crossbeds, laminations; minor dolostone: generally sandy; shale: dark grey, more common near base.

UPPER CAMBRIAN–LOWER ORDOVICIAN
- COSPO — **Survey Peak and Outram formations** - shale: grey, calcareous interbedded with limestone, partly bioclastic and limestone: argillaceous; shale: grey to green-grey, forms a thicker unit at base; minor limestone: intraformational, flat-pebble conglomerate in very thin to thick beds; rare sandstone: quartz, calcareous (more resistant upper part).
- COSP — **Survey Peak Formation** - shale: grey, calcareous interbedded with limestone, partly bioclastic and limestone, argillaceous; shale: grey to green-grey, forms a thicker unit at base; minor limestone: intraformational; flat-pebble conglomerate.

UPPER CAMBRIAN
- CM — **Mistaya Formation** - limestone: micritic or fragmental, common algal stromatolites, dolomitized equivalents; dolostone: very silty, calcareous with limestone ribbons and nodules; minor siltstone with sandy laminae; prominent stromatolite limestone band near top; relatively resistant unit.
- CBC — **Bison Creek Formation** - argillite: green-grey, grey, brown-weathering, dolomitic with interbeds of limestone, micritic or fragmental and intraformational, limestone, flat-pebble conglomerate; recessive unit.
- CL — **Lyell Formation** - dolostone: crystalline, commonly silty or sandy (quartz grains), thick-bedded to massive, local argillaceous laminae, limestone: argillaceous or dolomitic, burrow-mottled, wavy- to irregular-bedded; minor limestone: crossbedded to crosslaminated; resistant cliff-former.
- CSu — **Sullivan Formation** - argillite, ribbon argillite, limestone, and ribbon limestone. (Ribbon limestone refers to grey-weathering limestone with brown- to orange-brown-weathering, argillaceous and/or dolomitic interbeds and laminae.)
  - CSu-u — **Upper part** - argillite: grey, grey-green, locally calcareous or dolomitic; ribbon argillite: calcareous, limestone: micritic, very thin- to thin-bedded, common orange-brown-weathering, silty argillaceous bands, local soft-sediment deformation; minor limestone: dolomitic, argillaceous, locally intraformational conglomeratic; dolostone: dolomitic, lower part forms thick recessive interval; limestone-dominated and resistant at top.
  - CSu-l — **Lower part** - limestone: bioclastic, oolitic in part, forms relatively resistant unit (Shaq carbonate) above a basal green-grey shale with limestone and dolostone interbeds and ribbon limestone intervals; rare limestone-pebble conglomerate.

MIDDLE CAMBRIAN–UPPER CAMBRIAN
- CAWT — **Arctomys (upper part) and Waterfowl formations** - dolostone: light grey, massive, resistant, commonly silty or sandy (quartz grains), dark grey, dolomitic; commonly rubbly or pastelic; dolostone: buff-weathering, silty or sandy (quartz grains), common stromatolitic laminations, local bioturbation, intraclasts; minor dolostone: grey, laminated with black and grey shale partings; siltstone to sandstone: tan-weathering, laminated, ripple marks, dolomitic. Aitken and Greggs (1966) proposed the Waterfowl Formation and advised mapping an undifferentiated Arctomys–Waterfowl Formation in the Mount Assiniboine–Mount Brussilof area.

MIDDLE CAMBRIAN
- CA-l — **Arctomys Formation, lower part** - siltstone: maroon, green, commonly mud-cracked, dolomitic; dolostone: yellow-orange- and maroon-weathering, silty or sandy (quartz grains), commonly stromatolitic; argillite: maroon, red, and green, as thin beds and partings; argillaceous dolostone; minor sandstone: quartz arenite, crosslaminated, dolomitic. Base marked by sharp topographic break; a cliff-forming interval of interbedded dolostone, siltstone and argillite partings forms the prominent 'red band' in the peaks of the Mount Assiniboine–Mount Brussilof region and forms the main part of the map unit.
- CEP — **Eldon and Pika formations (Kicking Horse Rim facies)** - dolostone: light to dark grey, thin to very thick bedded, locally thick-bedded stromatolitic boundstone; minor limestone: dark grey, dolomitic; dolostone: white, very coarse crystalline, hydrothermal; limestone: dolomitic, burrow-mottled, limestone: argillaceous, wavy-bedded; shale: tan-weathering, calcareous, only in some westernmost exposures (ET Field Member); limestone: dark grey, with dolomitic partings, local oolites, intraclast conglomerate near top, forms a nearly black cliff 'the basal black band'; resistant unit. Kicking Horse Rim: The Eldon Formation is dominantly limestone, is locally completely dolomitized, and its character is little different from the Eldon Formation (Aitken, 1997); in at least part of the area, at section AC102 a relatively recessive dolomitic parted interval, 10 m thick, preserved near the top of the unit was used to define the base of the Pika Formation (Aitken, 1997).
- CPk — **Pika Formation** - dolostone: medium grey to white, crystalline, occasional silty laminations, thin- to thick-bedded, cryptalgal laminations, stromatolitic; minor limestone: argillaceous, dolomitic partings and mottles, locally oolitic; minor argillite: green, dolomitic near base in eastern exposures. The base of the Pika Formation is only mappable east of Kicking Horse Rim.
- CEI — **Eldon Formation** - dolostone: light to medium grey, bedded, local relict burrow-mottled fabric; minor limestone: grey, dolomitic, burrow-mottled or wavy-bedded; limestone: dark grey to black, dark weathering, thin-bedded, with very thin argillaceous-dolomitic interbeds, forms dark band at base; resistant unit.
- CSt — **Stephen Formation** - shale: green and grey, brown- or green-weathering, dolomitic; limestone: skeletal, dolomitic; shale: dolomitic, very silty, grading to siltstone: argillaceous, dolomitic at base.
- CC — **Cathedral Formation** - dolostone and limestone: buff, white, and grey, bedded, penecontemporaneous, local disseminated pyrite or veins; intense red-brown-weathering common in lower part; local, very coarse hydrothermal dolomitization.
- CNa — **Naiset Formation** - argillite and silty argillite: blue-green, blue-grey, grey-green, and grey, commonly calcareous or dolomitic; minor siltstone: calcareous as lenses, laminae and thin interbeds; lime mudstone: black, ribbon-bedded, pyritic; rare sandstone: calcareous, gritty and pebbly in basal part; local conglomerate: quartz-pebble at base.

LOWER CAMBRIAN
- CG — **Gog Group** - quartzite, sandstone: quartzose, white, pink, and brown, bedded, resistant; interbedded siltstone, sandstone, fine-grained and shale (more common near top); minor argillite: grey, red, and green, and conglomerate: pebble to cobble, with well rounded quartzite clasts.

NEOPROTEROZOIC
- PM — **Miette Group** - argillite: rusty-brown-weathering, grey to black (recessive); minor conglomerate: muddy, pebbly, sandy; in resistant bands.
- ?Ps — **Diabase sill** - probable Paleozoic or Neoproterozoic.

WHITE RIVER TROUGH

MIDDLE ORDOVICIAN–UPPER ORDOVICIAN
- OMW — **Mount Wilson Formation** - quartzite: white- to buff-weathering, medium- to coarse-grained, well rounded grains, resistant unit.
- OG — **Glenogle Formation** - shale: dark grey, calcareous; limestone, argillaceous and shaly; minor limestone beds (Lower Member); recessive; siltstone: pale orange-brown-weathering, quartz, laminated; with minor platy limestone and calcareous shale in lower part (*Upper Member*).
- COMK — **McKay Group** - argillite: grey to green, commonly phyllitic, calcareous or dolomitic; limestone: argillaceous, commonly bioclastic, dolomitic, and/or cherty; minor siltstone: calcareous and/or dolomitic, increase upsection; minor siltstone: green, argillaceous near base (lower part); limestone: grey- to brown-weathering, bedded, silty, argillaceous, irregular-bedded, wavy-bedded, nodular-bedded, or ribbon- or irregular-bedded and dolomitic; limestone: argillaceous, dark grey, brown-weathering, with argillite ribbons, bioclastic debris; argillite: calcareous, cleaved; minor coarse bioclastic limestone and intraformational limestone, flat-pebble conglomerate in very thin to thick beds; rare sandstone: quartz, calcareous (more resistant upper part).
- COI — **Ottertail Formation** - limestone: micritic, dolomitic, silty, sandy, wavy- to planar-bedded, local crossbeds, common banded grey- and orange-brown-weathering; minor argillaceous limestone; calcareous shale: laminated, planar- to wavy-bedded; limestone or dolostone: light grey-weathering, sandy, calcarenite: intraclast conglomerate; pebble,sandstone: fine-grained, quartz; resistant unit.

MIDDLE CAMBRIAN–UPPER CAMBRIAN
- CLa — **Lauseadet Formation** - argillite: grey-brown, grey-green, calcareous, silty, cleaved; forms resistant homogeneous unit at base, locally laminated; in middle part: argillite: grey, green-grey and brown-grey, commonly phyllitic, silver-weathering, laminated, limestone nodules locally; rare siltstone laminae; calcareous or dolomitic argillite: phyllitic, commonly micaceous; minor argillite: cleaved; minor limestone: orange-brown-weathering, dolomitic, ribbon, locally nodular or massive, and limestone: orange-brown-weathering in units up to several metres thick; argillaceous limestone: cleaved, locally phyllitic; relatively recessive unit with a few thick (5–20 m), more resistant-weathering carbonate bands in middle and upper parts.

MIDDLE CAMBRIAN
- CMD — **Mount Dockring Formation** - argillite: dark grey, brown-weathering, dolomitic, cleaved; limestone conglomerate: pebble to boulder, in carbonate or argillite matrix; local carbonate slide blocks (olistostromes), mega-pull-aparts and megaboulder conglomerate near bases change thicker deposits mapped as Mount Dockring Formation; megaconglomerate): ribbon limestone and dolostone: dark grey, thin- to thick-bedded, calcareous, commonly laminated, dark grey to black, cleaved, locally phyllitic, laminated, dolomitic, pyritic; dolostone: dark grey, orange-brown-weathering; thin- to thick-bedded, calcareous, commonly laminated, pyritic; argillite: dark grey to black, rusty-weathering, laminated, siliceous, with stratiform pyrite common locally; in western exposures carbonate beds form distinctive, colour-banded units (upper part).
- CMDmc — **Mount Dockring Formation, megaconglomerate** - limestone conglomerate: pebble to boulder, in carbonate or argillite matrix; local carbonate slide blocks (olistostromes), mega-pull-aparts and megaboulder conglomerate near facies change.

- CT, CT-u, CT-l — **Takuma Formation** - limestone: dark grey, planar to irregular ribbons with argillaceous and/or dolomitic ribbons, thin- to medium-bedded; local slump folds; limestone: medium to dark grey, massive, local syndepositional deformation; limestone: nodular, minor interbeds and intervals of argillite: dark grey, calcareous, dolomitic to noncalcareous. CT-l is lower tongue; CT-u is upper tongue.
- CVC — **Verdant Creek Formation** - argillite: light grey-weathering, laminated, slump folds, debris flows; rare ribbon argillite as exotic boulder-sized blocks; pervasive cleavage.

REFERENCES

Aitken, J.D., 1997, Stratigraphy of the Middle Cambrian platformal succession, southern Rocky Mountains; Geological Survey of Canada, Bulletin 398, 322 p.

Aitken, J.D. and Greggs, R.G., 1966. Upper Cambrian Formations, southern Rocky Mountains of Alberta, an interim report; Geological Survey of Canada, Paper 66-49, 91 p.

Simandl, G.J., Hancock, K.D., Fournier, M., Koyanagi, V.M., Vikos, V., Lett, R., and Colbourne, C., 1992. Geology and major element geochemistry of the Mount Brussilof magnesite area, southeastern British Columbia; British Columbia Geological Survey Branch, Open File 1992-14, 14 p.

Recommended citation:
McMechan, M.E. and Leech, G.B., 2011. Geology, Mount Assiniboine, British Columbia–Alberta; Geological Survey of Canada, Canadian Geoscience Map 13, scale 1:50 000. doi:10.4095/287204

CANADIAN GEOSCIENCE MAP 13
GEOLOGY
MOUNT ASSINIBOINE
British Columbia • Alberta

1:50 000

1 0 1 2 3 4 km

Authors: M.E. McMechan and G.B. Leech

Geology by M.E. McMechan and G.B. Leech, based on ground and air observations by G.B. Leech, 1964–1965, and M.E. McMechan, 2007–2010; ground observations by J.D. Aitken, 1963; R.G. Greggs, 1964; B.S. Norford, 1964; and L.D. Cecile, 1982; 1983; 1984; and the unpublished geological map by Simandl et al., 1992, for the Cathedral Formation in the Mount Brussilof Mine area. GSC Bulletin 398 by J.D. Aitken, 1997; and studies of vertical air photographs and high-resolution orthorectified satellite images by M.E. McMechan, 2008–2010

Geological compilation by M.E. McMechan, 2009–2010

Cartography by E. Macey

Scientific editing by E. Inglis

Conducted under the auspices of the Targeted Geoscience Initiative (TGI3)

Map projection Universal Transverse Mercator, zone 11. 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 2011, 15°52'E, decreasing 12.0' annually

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

This publication, including digital data, can be downloaded free of charge from GeoPub (http://geopub.nrcan.gc.ca/). It is also available from the Geological Survey of Canada Bookstore (http://gsc.nrcan.gc.ca/bookstore)

ess.nrcan.gc.ca

Canadian **Geoscience** Maps
Cartes **géoscientifiques** du Canada

Canada

Four trim marks around perimeter of map sheet. Trim map sheet first, then fold at folding marks.

Cover is 17cm wide when folded.

Second panel when folded is also 17cm wide.

Subsequent panels when folded are 17cm wide or less.

CANADIAN GEOSCIENCE MAP 13
GEOLOGY
MOUNT ASSINIBOINE
British Columbia • Alberta