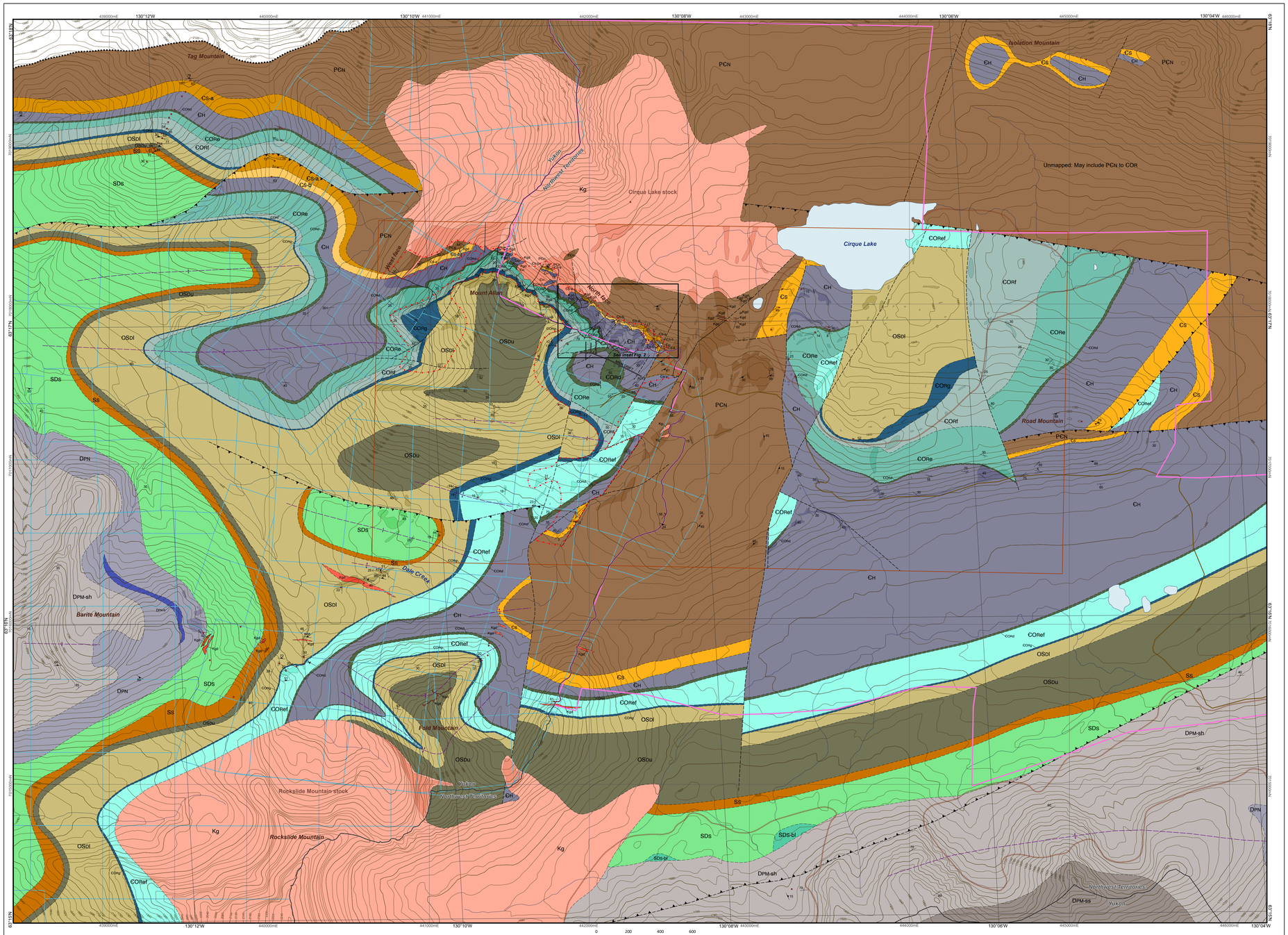
Geology of the Mactung tungsten skarn deposit

Government of
Northwest Territories



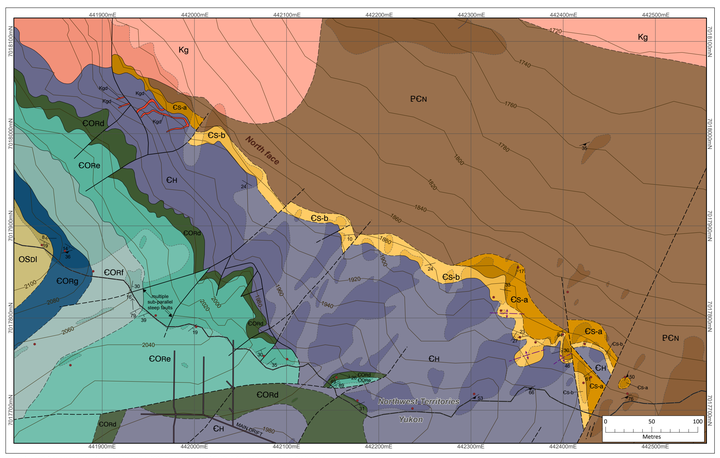


Figure 2. North face area geology (see main legend), 1:2500 (intended scale of display). See main map, above, for location.

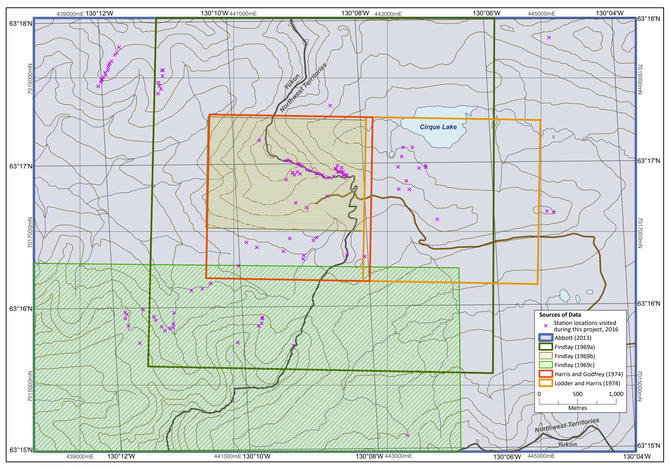


Figure 3. Sources of data used in this map.

BACKGROUND

The Mactung deposit is a W-(Au-Cu-Bi) skarn that straddles the border between Northwest Territories (NWT) and Yukon, 275 km southwest of Norman Wells (Figure 1). The deposit lies 7 km northwest of the Canol Road, a historic route maintained as a trail in NWT and as a seasonally passable road in Yukon. The Mactung deposit was discovered in 1962 during prospecting to follow up regional stream-sediment geochemical anomalies (Allan 1963). The deposit was initially referred to as the Macmillan Pass Tungsten deposit and then as Macmillan Tungsten before it became known as Mactung.

The Mactung deposit is exposed on the steep northern face of Mount Allan, and consists of two scheelite-bearing skarn zones separated by 100 m of hornfelsed mudstone. The deposit is hosted in a Lower Paleozoic succession of mudstone and limestone that has been affected by metamorphism and by hydrothermal alteration associated with Late Cretaceous pluton emplacement.

Early exploration work on the property included geological mapping, soil geochemical surveys, a magnetometer survey, diamond drilling, construction of an access road, some underground development including driving an adit and a raise, and the collection of a 295-tonne bulk sample. After 1980, the property was dormant, until in 2005, North American Tungsten Corporation Limited (NATC) resumed exploration, drilling 25 surface diamond drill holes and rehabilitating the adit. In 2009, the Mactung deposit was reported to contain a probable mineral reserve of 8.5 Mt grading 1.082% WO_3 within an indicated mineral resource of 33.0 Mt grading 0.88% WO_3 (Narsico *et al* 2009). The Government of NWT acquired the Mactung deposit from NATC1 in 2015.

In August of 2016, a small field program was conducted at Mactung with the goals of clarifying the correlation of mine units with formally-defined stratigraphic units, tightening up the registration of map-unit contacts using Global Positioning System locations, and developing research questions to guide future work on the property.

This NWT Open File contains a PDF map at 1:10 000 scale and corresponding digital files in ESRI® geodatabase and shapefile formats. The map and data are based on field observations made by the Northwest Territories Geological Survey in 2016, maps created by private-industry companies (Findlay 1969a, b, c; Lodder and Harris 1974; Harris and Godfrey 1974), and a regional map created by the Yukon government (Abbott 2013) (Figure 3). This publication is an accompaniment to NWT Open File 2018-02, a report on the geology of Mactung (Fischer *et al* 2018).

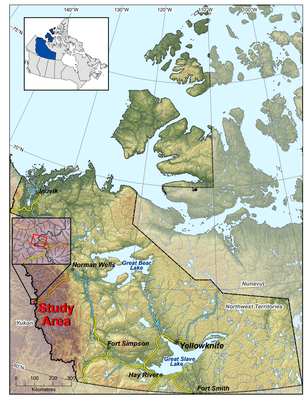


Figure 1. Physiographic relief (GeoGratis 2017) map of the Northwest Territories (NWT), showing the location of the study area (red outline) in the Mackenzie Mountains. Also shown are major communities (grey dots), all season roads (yellow lines), winter roads (light blue lines), Canol Heritage Trail (orange line), and unmaintained trails (brown line, study area inset).
Inset map indicates the location of the NWT (dark blue) within Canada (grey).

LEGEND

Outcrop outline (Harris and Godfrey 1974; Lodder and Harris 1974; this project)

LATE CRETACEOUS

- Kgd — **Felsic dykes and sills:** Granite, quartz monzonite dykes and sills <1 m to >10 m wide, pink to pale tan weathering, cream-coloured, very fine grained to aplitic, porphyritic with feldspar, quartz, or biotite phenocrysts, local muscovite; rare pegmatite. From Harris (1980), Atkinson and Baker (1986), Anderson (1993), and this project.
- Kg — **Granitic stocks:** Granite, quartz monzonite, quartz syenite, minor granodiorite, two-mica; porphyritic, massive equigranular, and aplitic phases; accessory muscovite, garnet, andalusite, and tourmaline in Cirque Lake stock. From Anderson (1982, 1993) and Atkinson and Baker (1986).

MIDDLE TO UPPER DEVONIAN

Portrait Lake Formation

Macmillan Pass member

- DPM-ss — **sandstone facies:** Sandstone and siltstone, brown weathering. Sandstone is coarse to medium grained. Subordinate chert pebble conglomerate and shale. From Abbott (2013).
- DPM-sh — **shale facies:** Shale and siltstone, brown weathering, thinly laminated ("pin-striped"). Subordinate chert, quartz sandstone and "grit" (local grading, flute and groove casts), minor chert conglomerate. From Abbott (1983, 2013).

LOWER TO MIDDLE DEVONIAN

- DPN — **Niddery Lake member:** Chert, cherty argillite, siliceous shale; black to dark blue-grey weathering, platy, thin bedded; discontinuous barite horizons <1 m to 30 m thick, rare intervals a few metres thick of light grey bioclastic limestone near top. Dark reddish brown weathering, dark grey mudstone, thin to very thin bedded, laminated; wavy, non-parallel beds, asymmetrical ripples, intraformational slump breccias. From Abbott (2013).
- DPN-b — **barite:** Abundant barite-rich interbeds. From Abbott (2013).

UPPER SILURIAN TO MIDDLE DEVONIAN

- SDs — **Sapper Formation:** Silty limestone and calcareous black shale, recessive, buff to tan weathering, thin bedded, dark grey to black. Basal non-calcareous mudstone to siltstone, brown weathering, light to dark grey, friable, laminated and thin bedded, rare light grey weathering calcareous siltstone. Graptolitic lime mudstone and lime siltstone at top, dark grey, platy, fissile. From Abbott (2013) and this project.
- SDs-bl — **bioclastic limestone:** Bioclastic limestone, massive, light grey, crinoidal; lenses in upper contact zone of Sapper Formation with Niddery Lake member. From Abbott (1983, 2013) and Findlay (1969c).

UPPER SILURIAN

- SS — **Steel Formation:** Mudstone to siltstone, orangey grey, light grey, or beige weathering, medium and light grey, very fine grained, locally calcareous, locally siliceous, slabby to irregular parting, thin bedded, disseminated pyrite, 1 mm to 2 mm nodules of pyrrhotite; ubiquitous wispy structures of darker grey resemble folded, discontinuous laminations.

LOWER ORDOVICIAN TO LOWER SILURIAN

Duo Lake Formation

- OSdu — **Upper member:** Shale, black to dark grey weathering, black to very dark grey, locally laminated, pyritic, graptolitic; very fissile.
- OSdl — **Lower member:** Fine to medium-grained mudstone, silty mudstone, siltstone, minor limestone. Rusty brown or dark grey weathering, medium grey to black, very thin to medium bedded, blocky to fissile, locally planar laminated, siliceous, or pyritic, rare mud chips. Thin-bedded crystalline limestone and lime mudstone in medium to thick intervals. Hornfels/skarn zone: Cordierite(?) in mudstone, tremolite(?) in limestone, sparse beds of calc-silicate rock.

LOWER TO MIDDLE ORDOVICIAN

Rabbitkettle Formation

- CORe — **G member:** Calc-silicate hornfels and schist, minor marble; resistant, light grey to buff weathering, white or light grey, finely to microcrystalline, commonly has a coarse-grained weathering aspect, thin to very thin bedded, laminated, rarely cross-laminated, locally calcareous, locally siliceous, locally schistose but more commonly unfoliated; sparse, thin, recessive, platy intervals. Calc-silicate rock contains talc, tremolite, quartz, pale pinkish orange garnet (rare pyroxene and scheelite; Harris 1980). Outside the hornfels zone, Member G is a dolostone (Atkinson and Baker 1986; Harris 1980).
- CORef — **Ef member:** Mudstone to siltstone and minor dark, platy limestone. Recessive, brown or dark grey weathering, medium to dark grey, finely planar-parallel laminated, thin bedded. Mudstone is commonly pyritic, silicified, locally calcareous, rarely graded; soft-sediment deformation in limestone. Mudstone locally metamorphosed to lower greenschist grade; rare, semi-resistant, calcareous calc-silicate beds speckled with pyrrhotite (skarn).
- CORf — **F member:** Mudstone to siltstone or hornfels with up to 40% interstratified limestone or calc-silicate hornfels. Lithologies same as for Member E, except limestone and calc-silicate intervals are thinner bedded and better laminated.
- CORe — **E member:** Mudstone to siltstone or hornfels with up to 20% interstratified limestone or calc-silicate hornfels. Mudstone–siltstone is recessive, locally calcareous, brown weathering, medium to dark grey, finely planar-parallel laminated, thin bedded, locally calcareous, commonly silicified, pyritic. Hornfels is semi-resistant, flaggy to blocky, brown weathering, dark steely grey, commonly silicified, pyritic. In the skarn zone, hornfels is bleached or rusty yellow along fractures and bedding planes. Limestone is semi-recessive, dark grey, thin bedded, laminated, silty, finely crystalline. Concretions up to 1 m long, oblong. Calc-silicate intervals are 30 cm to 60 cm thick, resistant, hard, non-siliceous, non-calcareous, thin bedded, planar-parallel laminated, micro- to finely crystalline, pale purplish and greenish grey. Where skarned: bedding is obliterated, calc-silicate rock is pale orange and green cut by multiple veins of quartz, diopside, and garnet.
- CORd — **D member:** Calcareous sandstone to conglomerate with phosphatic clasts, silty limestone; interstratified, very thin to thin bedded, rarely thick, semi-recessive. Sandstone-conglomerate is light or dark grey weathering, mostly clast supported, limestone matrix; clasts are dominantly phosphatic, black or blue-black, fine sand to pebble, rounded, mostly equant, locally dominant lime mudstone clasts to cobble size, locally abundant quartz sand, pyrite grains to granule size, clasts of conglomerate; normal and reverse grading, planar and cross laminations, scours. Limestone is laminated with terrigenous silt. Where skarned: semi-resistant, very finely crystalline calc-silicate rock, pale grey, green or beige weathering, finely laminated; cm-scale bands of green (diopsidic), orange (garnetiferous), and white; veins of calc-silicate minerals, phosphatic clasts weather white.

MIDDLE CAMBRIAN

- CH — **Hess River Formation:** Mudstone, siltstone, hornfels; weathers light or medium grey, dark brown, rusty, rarely blue grey or yellowish grey, fresh surfaces are dark or medium grey, with bluish cast in hornfels; blocky to flaggy, medium to thin beds, well laminated, pyritic laminations, sparse elongate clasts or lenses of soft, creamy grey altered mudstone; local graded phosphatic sandstone and phosphatic(?) siltstone. Minor calc-silicate rock; thin bedded, microcrystalline, white weathering.

LOWER CAMBRIAN

- CS — **Selwi Formation:** Limestone, limestone breccia, grey and green shale, massive to thin bedded (Abbott, 2013); pale yellow mudstone (this project); may include banded and breccia facies. Mostly not visited during this project.
- CS-b — **banded facies:** Thinly banded, dark brown hornfels and pale calc-silicate hornfels, local skarn; brown-weathering hornfels is dark grey to dark purplish grey, pyritic, laminated; cream or light brown weathering hornfels is purplish, reddish or yellowish grey, calc-silicate(?), well laminated. On Tag Mountain: brown-weathering siltstone, cream-weathering calc-silicate rock with 10 cm thick beds.
- CS-a — **breccia facies:** Limestone, silty limestone, and limestone breccia, yellow-grey, light grey and locally sooty dark grey weathering, light to dark grey, nodular beds, intraformational slump breccias, and metres-thick debrites, lime mudstone clasts and nodules in silty lime mudstone matrix, graded beds, planar and cross laminations; planar-bedded silty limestone, minor brown siltstone, calcareous shale, black chert, local interbeds of platy, pale yellow mudstone. Calc-silicate hornfels: microcrystalline, white to pale green, yellow, or purple weathering, planar-parallel laminations, some pyritic, thin to very thin beds of light grey, purple, green, or yellow colour, light grey beds are calcareous. Skarn: weathers rust, ochre, or light grey, is micro- to coarsely crystalline, dark green, apple green, greenish grey, dark grey, or pink; pyroxene, pale orangey pink garnet, pyrrhotite, scheelite, amphiboles; veins of pyroxene-garnet, quartz, or calcite; locally silicified; m-scale pods of friable, coarse, greyish white calcite.

PROTEROZOIC TO CAMBRIAN

- PCN — **Narchilla(?) Formation:** Mica phyllite, mica schist, meta-siltstone, minor fine-grained meta-greywacke, dark brown, rusty, orange-brown, or beige weathering, pale to medium grey, with greenish, yellow-greenish, or purplish cast where foliation is well developed. Within 0 m to 20 m of Selwi Formation, Narchilla(?) Formation is a thin-banded, spotted biotite hornfels. Near Cirque Lake stock, it is tourmalinized. From this project and Harris (1980).

Structural Measurements
(Abbott 2013; Harris and Godfrey 1974; Lodder and Harris 1974; this project)

- Bedding, younging direction unknown
- Cleavage
- Crenulation
- Fold axis
- Axial plane
- Vein

Lithological Contacts

- Certain
- Inferred

Folds

- Anticline
- Syncline

Faults

- Fault, certain
- Fault, inferred
- Thrust fault, inferred

Other Symbols

- Station location
- Extent of slumping
- Extent of hornfels from Harris and Godfrey (1974). Hornfels have been observed outside of this area during this study.
- Limit of mapping
- Underground workings
- Northwest Territories - Yukon border
- Unmaintained road
- Contour line: 20 m; 100 m interval (metres above sea level)
- Stream
- Lake
- Boundary of Harris and Godfrey (1974) and Lodder and Harris (1974) maps
- Active quartz claims and leases (Yukon Mining Recorder 2017)
- Mactung Mineral Property

NOTES

Mountain and lake names are informal. Isolation, Road, Barite, and Tag mountains were named during this project; other features were named previously by Amax Inc. geologists. The Cirque Lake stock has also been referred to, in published literature, as the Mactung pluton.

ACKNOWLEDGEMENTS

This map relies heavily on the knowledge and work of geologists other than the authors; as noted in the legend and Figure 3. Many discussions with, and access to data from, David Tenney, Ayalew Gebru (unpublished map Gebru, 2017), Finley Bakker, Kevin Shelton, David Lentz, and Erin Adlakha were very beneficial for this project. Critical reviews by Scott Cairns, Doug Irwin, and Pilar Lecumberri-Sanchez improved the quality of the final product.

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NORTHWEST TERRITORIES
GEOLOGICAL SURVEY

This map is for illustrative purposes only. Actual feature boundaries depicted may not be exactly as shown. The Northwest Territories Geological Survey and the Government of Northwest Territories accept no responsibility for any errors, inaccuracies, or omissions in these data.

RECOMMENDED CITATION

Martel, E., Fischer, B.J., Pierce, K.L., and Falck, H., 2018. Geology of the Mactung tungsten skarn deposit; Northwest Territories Geological Survey, NWT Open File 2018-01, 1 map at 1:10 000 scale and digital files.