ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

REPORT OF INVESTIGATIONS 2019-3
Solie and others, 2019
SHEET 2 OF 2
Explanatory text accompanies map
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BEDROCK-GEOLOGIC MAP, ALASKA HIGHWAY CORRIDOR, TETLIN JUNCTION, ALASKA, TO CANADA BORDER; EAST

by

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2019

SCALE 1:63360

1 0 1 2 3 4 5 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 24000 27000 FEET
1 0 1 2 3 4 5 6 7 KILOMETERS

NABESNA C-1 - CONTOUR INTERVAL 100 FEET
NABESNA D-1, D-2, AND D-3 - CONTOUR INTERVAL 50 FEET
NABESNA C-1 - SUPPLEMENTAL CONTOUR INTERVAL 50 FEET
NABESNA C-1, D-1, AND D-3 - DATUM IS MEAN SEA LEVEL
NABESNA D-2 - NATIONAL GEODETIC VERTICAL DATUM OF 1929

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MAP LOCATION

Location of Map Area

APPROXIMATE MEAN DECLINATION, 2017

DESCRIPTION OF GEOLOGIC MAP UNITS

(All map units may not appear on this sheet)

This map shows the distribution of bedrock units exposed at or near the surface in the corridor along the Alaska Highway in parts of the Tanacross A-1, A-2, A-3, and B-3 and Nabesna C-1, D-1, and D-2 quadrangles. Sheets 1 and 2 comprise the eastern two of five maps along the Alaska Highway corridor (Werdon and others, 2019, a, b), and are part of a multi-year project conducted by the Alaska Division of Geological & Geophysical Surveys (DGGS) between 2006 and 2013. The project focused on investigating and reporting the geology and geologic hazards of the corridor. Bedrock units were mapped and structural elements were measured in the field. Where bedrock units are covered by surficial units and/or vegetation, units were interpreted using airborne magnetic and electromagnetic surveys published by DGGS in 2006 (Burns and others, 2006). Rock names were assigned based on field and petrographic observations, modal-mineral percentages, and interpretations of geochemical data (Werdon and others, 2014). Surficial-geologic map units are shown in Reger and others (2012). An evaluation of potentially active faults in the map area is presented in Koehler and Carver (2012). Ages are based on the International Commission on Stratigraphy's chronostratigraphic chart (2018). Where bedrock map units are shown with a pattern and queried label, unit designation is interpreted based on nearby geology and geophysical characteristics. An accompanying text provides detailed map unit descriptions, acknowledgments and references cited.

BEDROCK MAP UNITS

buk — BEDROCK, UNKNOWN (Tertiary and older)

b — UNMAPPED BEDROCK (Tertiary and older)

mb — UNMAPPED MAGNETIC BEDROCK (Tertiary and older)

IGNEOUS DIKES

GRANITE DIKES (Tertiary to Cretaceous)
- Showing strike and dip
- Showing trend
- Unoriented

FELSIC PORPHYRY DIKES (Tertiary to Cretaceous)
- Showing strike and dip
- Showing trend
- Unoriented

APLITE DIKES (Tertiary to Cretaceous)
- Showing strike and dip
- Showing trend
- Unoriented

MAFIC SILLS AND DIKES (Late Cretaceous)
- Showing strike and dip
- Showing trend
- Unoriented

IGNEOUS MAP UNITS

TKf — FELSIC CRYSTAL LITHIC TUFF (Tertiary to Cretaceous)

TKp — FELSIC PORPHYRY (Tertiary to Cretaceous)

Silver Creek Granodiorite

Khgd — PORPHYRYTIC HORNBLENDE GRANODIORITE (Cretaceous)

Airs Hill Quartz Monzonite

Khqm — PORPHYRITIC HORNBLENDE QUARTZ MONZONITE (Cretaceous)

Other Igneous Rocks

Kg — GRANITE (Cretaceous)

Kgd — GRANODIORITE (Cretaceous)

Kgb — GABBRO (Cretaceous)

METAMORPHIC MAP UNITS

Lower Greenschist-Facies Metasedimentary Rocks

Kcg — METACONGLOMERATE (Cretaceous)

Ks — METASANDSTONE, METACONGLOMERATE, AND PHYLLITE (Cretaceous)

Greenschist-Facies Metaigneous Rocks

Tgs — GREENSTONE (Triassic?)

Tg — METAGABBRO (Triassic?)

Lower Greenschist-Facies Metasedimentary Rocks

PTsp — PHYLLITE (Triassic to Permian)

PTss — METASANDSTONE, ARGILLITE, AND PHYLLITE (Triassic to Permian)

Greenschist-Facies Metamorphic Rocks North of Gardiner Creek fault

Ms — FELSIC SCHIST AND QUARTZITE (Mississippian)

Mcs — CHLORITE SCHIST (Mississippian or older)

Mcq — CHLORITIC QUARTZITE (Mississippian or older)

Amphibolite-Facies Metaigneous Rocks — Lake George Assemblage of Parautochthonous North America

MDlo — UNDIFFERENTIATED ORTHOGNEISS (Mississippian to Devonian)

pMlp — PARAGNEISS AND SCHIST (pre-Mississippian)

pMlq — QUARTZITE (pre-Mississippian)

MDla — AMPHIBOLITE (pre-Mississippian)

Greenschist-Facies to Lower Amphibolite-Facies Metamorphic Rocks South of Gardiner Creek fault

Dms — MAFIC SCHIST (Devonian?)

Dfs — FELSIC SCHIST (Devonian?)

DEmq — MICACEOUS QUARZITE (Devonian or older)

DEqms — QUARTZ MICA SCHIST (Devonian or older)

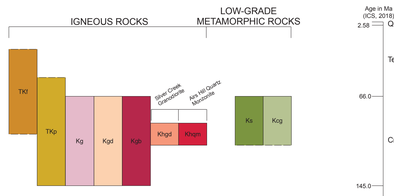
DEcs — CALCAREOUS SCHIST, CALCAREOUS QUARTZITE, AND MARBLE (Devonian or older)

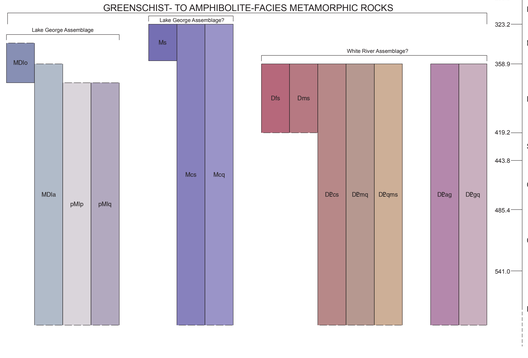
DEgq — GRITTY QUARTZITE (Devonian or older)

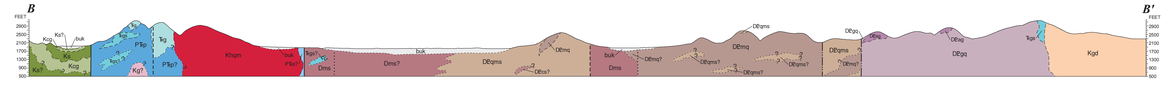
DEag — AMPHIBOLE GNEISS (Devonian or older)

Sample from miarolitic granite outcrop along Alaska Highway (taken 4/5/2018 by M.B. Werdon).

CORRELATION OF MAP UNITS







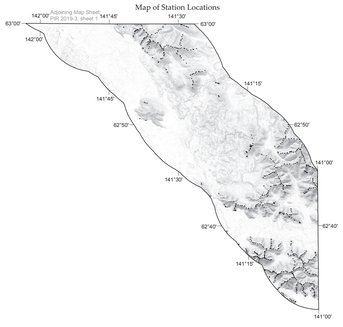


Table 1. $^{40}Ar/^{39}Ar$ and K/Ar age data (data from samples on Sheets 1 and 2).

Map Number	Sample	Mineral Analyzed	Map Unit	Lithology	Integrated Age (Ma)	Plateau Age (Ma)	Plateau Information	Isochron Age (Ma)	Isochron Information
A1	09MBW245.A*	biotite	mafic dike	Biotite feldspar lamprophyre dike	76.6.4 ± 1.2	**84.4 ± 1.5**	4 of 10 fractions 21.1% ^{39}Ar release MSWD = 0.03	-	-
		hornblende			80.8 ± 0.8	**89.7 ± 1.2**	4 of 10 fractions 17.8% ^{39}Ar release MSWD = 0.11	-	-
A2	09MBW269.A*	biotite	felsic porphyry dike	Aphanitic dike with biotite and feldspar phenocrysts	95.8 ± 0.6	**97.0 ± 0.7**	8 of 10 fractions 86.7% ^{39}Ar release MSWD = 0.34	-	-
A3	09LF493.A*	whole rock	Kgb	pyroxene olivine gabbro dike	72.5 ± 0.5	**70.5 ± 0.5**	6 of 8 fractions 93.4% ^{39}Ar release MSWD = 0.32	70.0 ± 0.5	8 of 8 fractions $^{40}Ar/^{36}Ar_i$ = 317.2 ± 2.7 MSWD = 0.39
A4	09LF374.A*	biotite	Kgd	Hornblende biotite granodiorite	72.3 ± 0.4	**73.3 ± 0.4**	8 of 10 fractions 83.6% ^{39}Ar release MSWD = 1.27	73.6.3 ± 0.5	8 of 10 fractions $^{40}Ar/^{36}Ar_i$ = 286.1 ± 17.1 MSWD = 1.37
A5	09MBW215.A*	biotite	Kgb	Biotite clinopyroxene gabbro	95.8 ± 0.7	**100.4 ± 0.8**	7 of 10 fractions 64.4% ^{39}Ar release MSWD = 0.58	98.3 ± 2.5	7 of 10 fractions $^{40}Ar/^{36}Ar_i$ = 300 ± 81.5 MSWD = 0.52
A6	74ASj114	biotite	Kg	Biotite quartz monzonite	**95 ± 3****	-	-	-	-

*Note: $^{40}Ar/^{39}Ar$ samples analyzed by University of Alaska Fairbanks Geochronology Laboratory. Details in Solie and others, 2013 .
** Note: K/Ar age from Foster and others (1976). Approximately located based on degree/minute coordinates in the original report.
Bold: Preferred age for each sample ($^{40}Ar/^{39}Ar$ ages reported at ±1 sigma).

Table 2. U/Pb age data (data from samples on Sheets 1 and 2).*

Map Number	Sample	Mineral Analyzed	Map Unit	Lithology	Weighted Mean $^{206}Pb/^{238}U$ Age
U1	09MBW338A	zircon	Kgd	Hornblende biotite quartz monzonite	106.2 ± 2.8
U2	09LF647A	zircon	Kgb	Hornblende gabbro	103.8 ± 2.7
U3	09LF644A	zircon	Kg	Biotite monzogranite	105.9 ± 2.9
U4	09LF637A	zircon	Kg	Biotite syenogranite	104.9 ± 2.9
U5	09LF254A	zircon	Kg	Hornblende biotite granite	102.9 ± 2.8
U6	09MBW243A	zircon	MDlo	Monzogranite orthogneiss	354.6 ± 9.3
U7	09MBW247A	zircon	Kg	Biotite granite	95.7 ± 2.5
U8	09LF279A	zircon	Kg	Biotite granite	97.3 ± 2.7
U9	09MBW103A	zircon	Kgd	Hornblende biotite granodiorite	100.3 ± 2.7
U10	09MBW400A	zircon	Ms	Metarhyolite	351.7 ± 9.3
U11	09LF419A	zircon	Khgd	Biotite hornblende granodiorite	101.0 ± 2.8
U12	09TDH74A	zircon	Khgd	Hornblende granodiorite	99.7 ± 2.6
U13	09TDH75A	zircon	Khgd	Hornblende granodiorite	97.3 ± 2.6
U14	09LF433A	zircon	Khgd	Biotite hornblende granodiorite	103.1 ± 2.9
U15	09LF454A	zircon	Kg	Monzogranite	96.6 ± 2.7
U16	09LF441A	zircon	Kg	Syenogranite	97.8 ± 2.7
U17	09Z172B	zircon	Kg	Biotite monzogranite	102.5 ± 3.0
U18	09LF206A	zircon	Trg	Diorite/amphibolite?	241.9 ± 13.5?
U19	09Z213A	zircon	Khqm	Biotite hornblende quartz monzonite	97.5 ± 2.6
U20	09RN242A	detrital zircon	DPzg	Gritty quartzite	(see reference)
U21	09LF233A	detrital zircon	Kcg	Metaconglomerate	(see reference)
U22	09LF234A	detrital zircon	Kcg	Metaconglomerate	(see reference)

*Note: U/Pb samples analyzed by Apatite to Zircon, Inc. Details in Solie and others, 2014.

EXPLANATION OF MAP SYMBOLS

SMALL, MINOR JOINTS

- INCLINED BEDDING—Showing strike and dip
- SMALL, MINOR VERTICAL OR NEAR-VERTICAL JOINT—Showing strike
- SMALL, MINOR INCLINED (DIP DIRECTION TO RIGHT) JOINT, FOR MULTIPLE OBSERVATIONS AT ONE LOCALITY—Showing strike and dip
- SMALL, MINOR VERTICAL OR NEAR-VERTICAL JOINT, FOR MULTIPLE OBSERVATIONS AT ONE LOCALITY—Showing strike

FOLIATION

- INCLINED FOLIATION IN IGNEOUS ROCK—Showing strike and dip
- INCLINED METAMORPHIC OR TECTONIC FOLIATION—Showing strike and dip
- VERTICAL METAMORPHIC OR TECTONIC FOLIATION—Showing strike
- INCLINED (DIP DIRECTION TO RIGHT) METAMORPHIC OR TECTONIC FOLIATION, FOR MULTIPLE OBSERVATIONS AT ONE LOCALITY—Showing strike and dip

CONTACTS

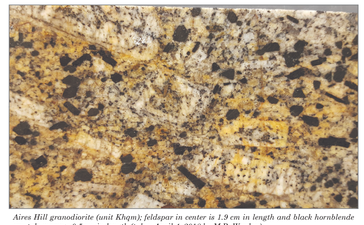
- CONTACT—Identity and existence certain, location accurate
- CONTACT—Identity and existence certain, location inferred
- CONTACT—Identity and existence certain, location concealed

FAULTS

- FAULT—Identity and existence certain, location accurate
- FAULT—Identity and existence certain, location inferred
- FAULT—Identity and existence questionable, location inferred
- FAULT—Identity and existence certain, location concealed
- FAULT—Identity and existence questionable, location concealed
- FAULT LOCATED BY GEOPHYSICAL SURVEY

MISCELLANEOUS MAP SYMBOLS

- A1 — $^{40}Ar/^{39}Ar$ AGE LOCALITY—Showing map number referenced in table1
- A2 — K/Ar AGE LOCALITY—Showing map number referenced in table 1
- U1 — U/Pb AGE LOCALITY—Showing map number referenced in table 2
- B—B' — CROSS SECTION LINE AND LABEL
- HORNFELS ZONE



Aires Hill granodiorite (unit Khqm); feldspar in center is 1.9 cm in length and black hornblende crystals average 0.5 cm in length (taken April 4, 2018 by M.B. Werdon).

Topographic base map from:
U.S. Geological Survey topographic maps
Nabesna C-1 (1955 - minor revisions 1963)
Nabesna D-1 (1952 - minor revisions 1967)
Nabesna D-2 (1955 - minor revisions 1978)
Nabesna D-3 (1955 - minor revisions 1962)
Projection:
Universal Transverse Mercator Zone 7 North
Datum:
North American Datum of 1927

Geologic field investigations by:
L.K. Freeman (2009), R.J. Newberry (2009), D.J. Szumigala (2009), G.G. Speeter (2009), M.B. Werdon (2009), and B.A. Elliott (2010)
Geologic interpretation by:
D.N. Solie (2013), M.B. Werdon (2009), L.K. Freeman (2009), R.J. Newberry (2009), D.J. Szumigala (2009), G.G. Speeter (2009), and B.A. Elliott (2012)
Geologic GIS data layers created by:
B.A. Elliott (2012), D.N. Solie (2013)
Cartography by:
P.E. Gallagher (2014-2017), T.J. Naibert (2016-2017)
Peer review by:
J.V. Jones (2017)