Update on geological and geophysical investigations in the Slate Creek mining area, Alaska

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Presented by Jennifer Athey at the Alaska Miners Association meeting in Anchorage, Alaska on November 5, 2009.

In July 2009, the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted geologic mapping in the Slate Creek area 20 miles northeast of Paxson and immediately south of the Denali fault (parts of Mount Hayes A-2 and A-3 quadrangles). As part of the Airborne Geophysical/Geological Mineral Inventory (AGGMI) Program, we are utilizing new detailed airborne electromagnetic and magnetic geophysical data for the Slate Creek–Slana River area (Burns et al., 2009), whole rock data, $^{40}$Ar/$^{39}$Ar and detrital zircon ages, thin-section and grain-mount petrography, palynology and macrofossils, historical, and industry data in conjunction with field observations to produce a 1:50,000-scale geologic map. The area has high mineral interest and is a key location for understanding the active Denali fault system. DGGS plans to publish the map on our website (http://www.dggs.alaska.gov/) in winter 2010.

The Slate Creek fault, a high-angle fault system parallel and possibly related to the Denali fault system, separates two dissimilar sections of bedrock described by Nokleberg et al. (1992). South of the Slate Creek fault, volcaniclastic rocks, thin limestones, volcanic sedimentary rocks, and basaltic to rhyolitic (Athey, 1999) “coherent” volcanic rocks compose the Permian–Pennsylvanian Slana Spur Formation. Red, oxidized quartz–pyrite gossans spatially associated with quartz-phenocryst-bearing volcanic rocks contain up to 0.72 ounces of gold/ton (Athey, 1999). Farther south, near the edge of the study area, five or six 0.5- to 2-mile-wide, granite to basalt bodies of unknown age and chemistry intrude volcanic rocks of the Slana Spur Formation.

North of the Slate Creek fault, Early Permian Eagle Creek limestone and sedimentary rocks, Late Triassic Nikolai greenstone and minor sediments, Late Triassic Chitistone limestone, and Cretaceous to Jurassic argillite and phyllite compose the upper plate of an apparent north-dipping thrust fault. The lower plate of the thrust fault includes the felsic Slana Spur(?) and Eagle Creek formations, and Tertiary sedimentary rocks. The involvement of Tertiary sedimentary rocks in the thrust fault and the Slate Creek fault system infers a Tertiary, possibly Neogene, age of latest movement on the faults. Two hand-dug trenches on the Denali fault revealed evidence of possible Holocene offsets at this location in addition to the 2002 event. No Quaternary fault movement, other than on the Denali fault, was observed in air photos or outcrop in the study area.

Most of the 183,356 troy ounces of gold (Szumigala et al., 2009) and minor platinum group elements (PGE) recorded within the Chistochina mining district were extracted from placers in the Slate Creek area. Placer miners and previous researchers assert that placer gold in Quaternary valley and bench deposits was derived and reconcentrated from
semi-consolidated “round wash” gravels found on higher slopes and ridgetops between Slate Creek and the Chistochina Glacier. The “round wash” gravels, containing up to 113 ppm gold (Bittenbender et al., 2007), eroded from fault-bounded and perched, poorly indurated Tertiary conglomerate. In addition to detailed mapping, we are conducting petrologic and palynological studies of the conglomerate to better understand the tectonic history of the area. PGEs in the placer deposits are likely sourced from one or more of the Triassic and (or) Cretaceous (?) mafic and ultramafic bodies in the study area. Planned chemical analyses and age data will help us test their PGE potential, and determine the structural (and intrusive?) relationships of these bodies relative to surrounding units.


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Slate Creek area, Chistochina mining district

183,356 Troy ounces Au, Minor amounts of PGE’s
ARDF Placer and Lode Occurrences

Wilson et al., 1998
5 miles

Foley and Summers, 1990

Rose, 1967

Matteson, 1973

Foley and Summers, 1990

Athey, 1999

STATEMAP
Area

113 sq mi

Wilson et al., 1998
Wrangellia terrane:
- KJ turbidites, Gravina-Nuzotin belt
- Trn Nikolai greenstone
- P-PP Skolai volc & volcaniclastics

Wilson et al., 1998
DGGS’s draft geologic map

5 miles
Rich Koehler describing the events in the trench (view to the south)
• Thrust and high angle faulting

• Long section of geologic history represented
923 field stations from 2009 season and thesis work

5 miles
Faults interpreted in the aeromagnetic and EM geophysical data (Burns and others, 2019)
Permian-Pennsylvanian Slana Spur Fm (Mankomen Group, originally called Chisna Fm by Mendenhall [1905]):

Volcaniclastics, tuffs, andesite flows, conglomerate, thin limestones, volcanic sedimentary rocks (basaltic to rhyolitic composition volcanics)

Welded tuff

Andesite “mini-bombs” with spindle ends

Algal mats?
Pennsylvanian Tetelna Volcanics (Mendenhall, 1905):
Massive andesite flows with minor volcaniclastics

Massive, brecciated andesite blocks
Total field magnetics

Purple-red – highs
Blue-black – lows

Faults interpreted in the aeromagnetic and EM geophysical data
(Burns and others, 2019)
• Shallow north-dipping thrusts
• Thrust plate thickens and deepens to NW

5 miles
- Slana Spur north of Slate Creek
- Eagle Ck Fm
Early Permian Eagle Creek Fm (Mankomen Group):
Limestone, argillite, graywacke

Eagle Ck limestone
Late Triassic Nikolai Greenstone and Chitistone Limestone:
Weakly metamorphosed basalt, Chitistone limestone, minor siltstone and conglomerate

Pillows?

Pahoehoe-texture capped column
Cretaceous-Jurassic argillite/phyllite

Overturned folding

Massive section of KJa

Pencil cleavage

Small thrusts
Faults interpreted in the aeromagnetic and EM geophysical data (Burns and others, 2019)
Slate Creek, looking northeast

KJa

Ts

Ts

Ts

Ts

Ts

PPs

Slate Creek, looking northeast
Tertiary (Miocene-Eocene) Gakona Fm?

Tc on north side of Miller Gulch

Metasequoia

T med-coarse sandstone

Alder family?
Sources of Gold

Roundwash concentrate (non-magnetic fraction): 3.31 oz/T gold (Bittenbender et al., 2007)

Quartz-pyrite gossan in Slana Spur Fm.: Up to 0.72 oz/T gold (Athey, 1999); associated with felsic volcanics

Hydrothermally altered argillite: concentrate 0.008 oz/T gold, tabled tailings 0.005 oz/T gold (Foley and Summers, 1990)
Total field magnetics

Purple-red – highs
Blue-black – lows

5 miles
5 miles

Total field magnetics
Purple-red – highs
Blue-black – lows

Ar-Ar ages:
119 – 123 Ma
(Bittenbender et al., 2007)
Cretaceous mafic and ultramafic rocks

dunite

gabbro

hornblendite

monzonite

KJa?

pd, px, hb

mz

PPs

Ts
Triassic(?) mafic and ultramafic rocks

Serpentinized thrust sheet

basalt
cpxite
diorite?
Pending analyses

- Au, geochem ± PGE (57)
- Major oxide/TE (120)
- Thin sections (251)
- Slab XRF (260)
- Modal analysis of igneous rocks
- Macrofossils (27)
- Ar-Ar ages (~6)
- Palynology (3)
- Detrital zircon ages (2)
- Pebble/sand grain counts

Chistochina Glacier
Project schedule

- Data release spring 2010
- Surficial map publication summer 2010
- Bedrock map publication winter 2010

Pyrite-quartz gossan in PPs
I’m outta here...