Division of Geological & Geophysical Surveys

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MAJOR-OXIDE AND TRACE-ELEMENT GEOCHEMICAL DATA FROM ROCKS COLLECTED IN THE TANACROSS C-1, D-1, and D-2 QUADRANGLES, ALASKA IN 2017

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INTRODUCTION

From June 12–21, 2017, the Alaska Division of Geological & Geophysical Surveys (DGGS) geologists carried out geologic mapping and geochemical sampling in the northeastern Tanacross D-1, and parts of the C-1, and D-2 quadrangles. The project area lies within the Yukon-Tanana Uplands, and encompasses the boundary between Fortymile and Lake George assemblages (Dusel-Bacon and others, 2006). It includes porphyry copper-molybdenum-gold deposits and prospects including: Taurus (Harrington, 2010), Fishhook (also known as SW Pika), and Pika Canyon (U.S. Geological Survey, 2008), and is adjacent to the Fortymile Mining District to the north (Yeend, 1996). Existing reconnaissance-scale geologic maps of the Tanacross Quadrangle (Foster, 1970; Wilson and others, 2015) lack sufficient detail, such as structural features and detailed map units, to understand the geologic context for the known porphyry systems in the region. The structural features have been determined by Sánchez and others (2014) to broadly control the location of some mineral occurrences in this part of Alaska and adjacent Yukon. Detailed geologic mapping in the adjacent Eagle A-1 and A-2 quadrangles to the north (Szumigala and others, 2002; Werdon and others, 2001), as well as geophysical evidence (Burns and others, 2011), led DGGS geologists to conclude the northeastern Tanacross Quadrangle is much more geologically complex than depicted by 1:250,000-scale maps. The combination of a lack of detailed geologic mapping, historical and current industry interest in the area's mineral potential, and interpretation of airborne geophysical datasets prompted the DGGS Mineral Resources section to conduct geologic mapping and geochemical sampling in this area.

Highlights of this geochemical report include sampling and characterization of the Pika Canyon, Fishhook, and Taurus prospects. This dataset contains four samples with gold in excess of 0.1 parts per million (ppm) in several different locations, including two samples from Fishhook with 2.15 ppm and 0.697 ppm gold, respectively (17MBW119, 17MBW130), and a sample with 4,420 ppm silver and greater than 30 percent lead (17MLW002) collected nearby Pika Canyon. The DGGS Tanacross project area includes a section of Paleozoic and Mississippian- to Devonian-age, metasedimentary and metavolcanic rocks, as well as Jurassic(?) to Tertiary intrusive and volcanic rocks. Major- and trace-element geochemical analyses were obtained for metamorphic rocks to distinguish between igneous and

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sedimentary protoliths, and for igneous rocks to characterize and differentiate Mesozoic and Cenozoic rocks in the area.

The analytical data tables associated with this report are available in digital format as comma-separated value (CSV) files. Additional details about the organization of information are noted in the accompanying metadata file. All files can be downloaded from the DGGS website (http://doi.org/10.14509/29778).

All samples collected during this project, as well as laboratory sample rejects and pulps, will be stored at DGGS for the duration of the project and will be available for public viewing upon request. Once the project concludes, the samples and the pulps will be turned over to the Geologic Materials Center in Anchorage.

DOCUMENTATION OF METHODS

Sample Collection

Rock samples were collected for two different purposes. First, samples of visibly mineralized or altered rock were preferentially collected and analyzed for trace-element geochemistry. Second, igneous and metaigneous rocks showing little alteration or weathering were collected for whole-rock major-oxide, minor-oxide, and trace-element analyses to aid in classification and study of petrogenesis and tectonic setting. Most samples are ‘grab’ samples, which were collected for their overall representation of the outcrop. However, a few samples are ‘select’ samples, which were more deliberately collected from a specific feature, as noted in the sample field description.

Location data were collected using Trimble Juno T41/5 WAAS-enabled GPS devices running ArcGIS for Windows Mobile. Data were merged into an ArcGIS geodatabase. WAAS-enabled GPS devices have a reported error of about 1 m. Latitude and longitude are reported in the WGS84 datum.

Magnetic susceptibility measurements were collected using Terraplus KT 5-, 6-, 9-, and 10-model handheld magnetic susceptibility meters. The values reported herein are for average Système International (SI) measurements performed on representative surfaces of the sampled rock outcrop.

Sample Preparation

Rock samples were processed by ALS Geochemistry using their PREP-31 package. The samples were crushed to greater than 70 percent passing through a 2 mm mesh, and a 250-g split was pulverized to greater than 85 percent of the material being less than 75 microns in diameter. Prior to crushing, samples for whole-rock analysis were trimmed by DGGS staff to remove weathering, and cut surfaces were sanded to remove any saw metal.

Analytical Methods

Samples were analyzed for a variety of suites of major and trace elements depending on the sample type. In addition to ALS Geochemistry’ accredited (ISO/IEC 17025–2005) internal quality-control program, DGGS monitored analysis quality with one standard reference material per batch of 20 analyses.

a. Major- and trace-element values for rock samples were determined by ALS Geochemistry method ME-MS61: Four-acid digestion followed by inductively-coupled plasma–atomic emission spectrometry (ICP-AES) and inductively-coupled plasma–mass spectroscopy (ICP-MS); Au values were analyzed using flux digestion and fire assay and ICP-AES (ALS Geochemistry method Au-ICP21).

b. Samples that exceeded detection limits for elements of interest were reanalyzed using specific elemental tests. Over-limit values for Ag, Pb, and S were analyzed using four-acid digestion followed by inductively-coupled plasma–atomic emission spectrometry (ALS Geochemistry method ME-OG62), assay with gravimetric finish (ALS Precious Metals method Ag-GRA21), or atomic absorption (ALS Geochemistry method Pb-AA62).

c. For whole-rock geochemistry samples, major and minor oxides were analyzed by lithium metaborate fusion digestion and ICP-AES (ALS Geochemistry method ME-ICP06). Trace elements, including rare-earth elements, were determined using lithium metaborate fusion digestion and ICP-MS (ALS Geochemistry method ME-MS81). Ag, Cd, Co, Cu, Li, Mo, Ni, Pb, Sc, and Zn were determined by four-acid digestion and ICP-AES (ALS Geochemistry method ME-4ACD81); and As, Bi, Hg, In, Re, Sb, Se, Te, and Tl were determined by aqua regia digestion followed by ICP-MS (ALS Geochemistry method ME-MS42). Total C and S were analyzed by Leco furnace (ALS Geochemistry methods C-IR07 and S-IR08, respectively) and Pt, Pd and Au were determined by fire assay with ICP-MS finish (ALS Precious Metals method PGM-MS23).

For each sample, data tables contain either assay values or coded-value placeholders (null = not analyzed; -1 = the element's assay result is less than the lower detection limit for the method; -2 = the element's assay result is greater than the upper detection limit for the method). Detection limits for each of the reported elemental values obtained by the various methods are documented in the metadata file.

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