Geochemical reanalysis of archival igneous rock pulp samples, Yukon-Tanana Upland, Alaska

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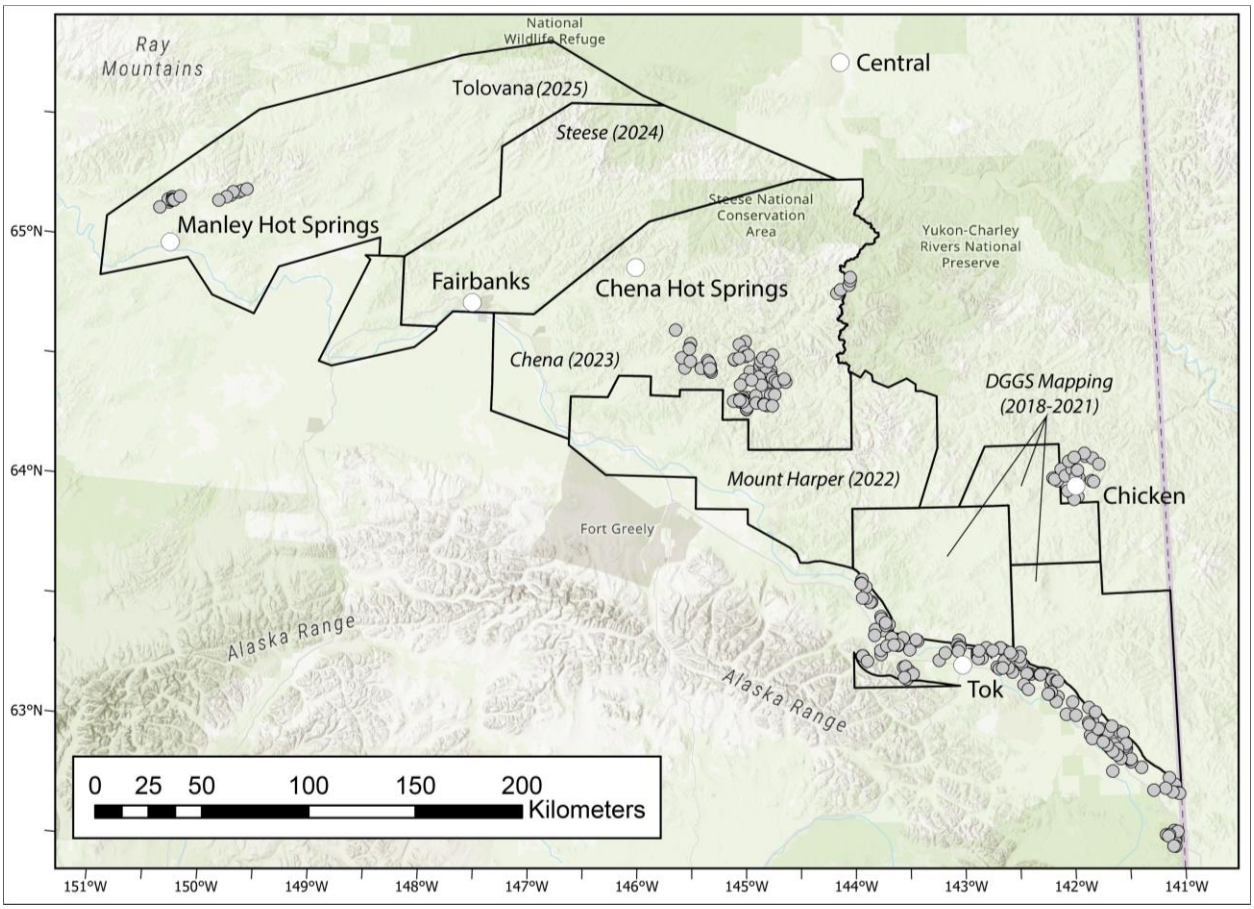

Location map of samples (gray circles) selected for geochemical reanalysis. The black polygons represent Earth MRI project areas and are labeled with the project name and the year of award funding. White circles are population centers.

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Geochemical reanalysis of archival igneous rock pulp samples, Yukon-Tanana Upland, Alaska

J. Wesley Buchanan[1]

INTRODUCTION

Since 2019, the Division of Geological and Geophysical Surveys (DGGS) Mineral Resources Section has focused on the Yukon Tanana Upland (YTU) in conjunction with the United States Geological Survey's Earth Mapping Resources Initiative (USGS Earth MRI). Earth MRI has a stated goal of modernizing the geologic mapping of the nation's surface and subsurface with a focus on collecting data in areas of potential critical mineral resources. As part of the Earth MRI program, DGGS submitted previously collected rock samples to the USGS Geology, Geophysics, and Geochemistry Science Center (GGGSC) in Lakewood, CO for reanalysis. The reanalysis provides DGGS geologists with modern analytical data from previous field seasons to compare with recently collected geochemical data. This report presents the results of that effort.

This dataset contains geochemical data from igneous rock samples collected by DGGS geologists during fieldwork conducted between 1997 and 2009. The samples were geochemically analyzed soon after collection, and the returned sample pulps were stored at the DGGS Geologic Materials Center (GMC) in Anchorage, AK. Two hundred seventy-eight pulp samples were selected for reanalysis from previous DGGS projects, including the Salcha River-Pogo, Fortymile, Alaska Highway Corridor, Caribou Creek, and Rampart Mining District projects. Bedrock mapping references for these projects are listed at the end of the report (Lessard and others, 2022; Solie and others, 2019; Szumigala and others, 2002; Werdon and others, 2004; Werdon, Solie, Andrew, and others, 2019; Werdon, Solie, Newberry, and others, 2019). The major-, minor-, and trace-element geochemical data provided by the GGGSC help elucidate magmatic mineral systems, including potential critical mineral systems. The data also support and inform geologic mapping and broad tectonic interpretation across the Yukon–Tanana Upland (YTU). These data are provided as a Raw Data File under an open end-user license and are available on the DGGS website http://doi.org/10.14509/32120.

DATA PRODUCTS

Analytical results, sample locations, sample descriptions, and analytical metadata accompanying this report can be downloaded directly from the Alaska Geochemistry database at https://maps.dggs.alaska.gov/geochem/#search=citation:"RDF+2026-16"

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METHODS

Sample Collection

During field campaigns from 1997 to 2009, DGGS geologists collected 2–5 kg igneous whole-rock samples from targeted stations for geochemical analysis. The samples were selected from fresh surfaces that generally represent the exposed outcrop.

The location coordinates of each sample station were recorded with handheld recreational-grade GPS units, or location data were marked on paper topographic maps in the field and later digitized in GIS. GPS devices in use at that time had reported errors of approximately 30 m. GPS Selective Availability was in effect prior to 2000, and pre-2000 sites and digitized sites may have errors of up to 100 m. Sample locations were collected using the NAD27 datum and are reported here using the NAD83 datum.

Sample Preparation

Geochemical samples were historically processed by several companies using different methods. All samples were crushed so that at least 70 percent of the material passed through a -10 mesh screen. Either a representative 200- or 250-gram split was crushed in a chrome-steel ring mill until 85 percent passed through either a -150 or -200 mesh screen.

For this reanalysis, samples were retrieved from the GMC and sent to the USGS, where staff used a chrome-steel ring mill to reprocess pulp samples that had passed a -150 mesh screen, reducing the sample to 85 percent passing through a -200 mesh screen, ensuring all samples met lab standards.

Analysis

The USGS laboratories and contract laboratories used different method packages and analytes to fully characterize the samples. Each package will be described in detail below. Geochemical standards were included roughly every ten samples, and unknown duplicates were included about every 20 samples.

For each sample, the accompanying digital data provide either assay values or coded placeholders (null = not analyzed; −1 = the element's assay result is below the method's lower detection limit; −2 = the element's assay result exceeds the method's upper detection limit). The dataset also provides detection limits for each reported elemental value generated by the various analytical techniques.

Major-oxide Analytical Methods

All samples were analyzed using the GGGSC packages with the analytes and methods described below.

- WDXRF-MAJORS: analytes - Al_2O_3, CaO, Cr_2O_3, Fe_2O_3, MgO, MnO, P_2O_5, K_2O, SiO_2, Na_2O, TiO_2, V_2O_5, Loss on Ignition (LOI) -in %; typical sample size of 0.2 to 0.5 g; sample preparation entails the formation of a homogenous glass disk by the fusion of the sample and a lithium tetraborate/lithium metaborate mixture; LOI

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is determined separately and gravimetrically at 1000°C; the prepared disks are analyzed by wavelength dispersion X-ray fluorescence (WD-XRF). The LOI is included in the matrix correction calculations performed by the XRF software.

- FA_AU-PD-PT: Au, Pt, and Pd – in parts per billion (ppb); weighed representative samples are mixed with flux and fused using lead oxide at 1100°C, followed by cupellation of the resulting lead button; the bead is dissolved using HCl and HNO_3, and the resulting solution is submitted for analysis; the digested sample solution is analyzed by Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES).
- AQUA-REGIA: Ag, As, Ba, Be, Bi, Cd, Ce, Cr, Co, Cs, Cu, Ga, Ge, Hf, In, La, Li, Lu, Mn, Hg, Mo, Nb, Ni, Pb, Rb, Re, Sb, Sc, Se, Sn, Sr, Ta, Te, Tb, Tl, Th, U, V, W, Y, Yb, Zn, Zr - in parts per million (ppm); Al, Ca, Fe, K, Mg, Na, P, S, Ti - in %; weighed representative samples are digested with HCl and HNO_3, with the acids in a 3:1 ratio; this digestion is recommended for samples which contain no organic material and are low in sulfide mineral content; the digested sample solution is analyzed by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES).
- ICPOES_MS-61: Ag, As, Ba, Be, Bi, B, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Ge, Hf, Ho, In, La, Li, Lu, Mn, Mo, Nb, Nd, Ni, Pb, Pr, Rb, Sb, Sc, Sm, Sn, Sr, Ta, Tb, Th, Tl, Tm, U, V, W, Y, Yb, Zn, Zr - in ppm; Al, Ca, Fe, K, Mg, P, Si, S, Ti - in %; weighed representative samples are digested fused in glassy carbon crucibles using sodium peroxide (Na_2O_2); the resultant cake is dissolved in HNO_3; the digested sample solution is analyzed by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES).

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REFERENCES

Lessard, R.R., Wildland, A.D., and Montayne, Simone, 2022, Bedrock geologic map database of the Caribou Creek area, Big Delta C-4 and D-4 quadrangles, east-central Alaska: Alaska

Division of Geological & Geophysical Surveys Miscellaneous Publication 172, 2 p. https://doi.org/10.14509/30866

Solie, D.N., Werdon, M.B., Freeman, L.K., Newberry, R.J., Szumigala, D.J., Speeter, G.G., and Elliott, B.A., 2019, Bedrock-geologic map, Alaska Highway corridor, Tetlin Junction, Alaska to Canada border: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2019-3, 16 p., 2 sheets, scale 1:63,360. https://doi.org/10.14509/30038

Szumigala, D.J., Newberry, R.J., Werdon, M.B., Athey, J.E., Flynn, R.L., and Clautice, K.H., 2002, Bedrock geologic map of the Eagle A-1 Quadrangle, Fortymile mining district: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2002-1B, 1 sheet, scale 1:63,360. https://doi.org/10.14509/2864

Werdon, M.B., Newberry, R.J., Athey, J.E., and Szumigala, D.J., 2004, Bedrock geologic map of the Salcha River-Pogo area, Big Delta Quadrangle, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2004-1B, 19 p., 1 sheet, scale 1:63,360. https://doi.org/10.14509/3209

Werdon, M.B., Solie, D.N., Andrew, J.E., Freeman, L.K., Newberry, R.J., Szumigala, D.J., and Elliott, B.A., 2019, Bedrock-geologic map, Alaska Highway corridor, Dot Lake to Tetlin Junction, Alaska: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2019-2, 14 p., 2 sheets, scale 1:63,360. https://doi.org/10.14509/30037

Werdon, M.B., Solie, D.N., Newberry, R.J., Freeman, L.K., Elliott, B.A., and Lessard, R.R., 2019, Bedrock-geologic map, Alaska Highway corridor, Little Gerstle River to Dot Lake, Alaska: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2019-1, 12 p., 1 sheet, scale 1:63,360. https://doi.org/10.14509/30036