



# Major- and Trace-Element Concentrations in Rock Samples Collected in 2005 from the Taylor Mountains 1:250,000-scale Quadrangle, Alaska

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Open-File Report 2006–1306

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## Introduction

The Kuskokwim mineral belt of Bundtzen and Miller (1997) forms an important metallogenic region in southwestern Alaska that has yielded more than 3.22 million ounces of gold and 400,000 ounces of silver. Precious-metal and related deposits in this region associated with Late Cretaceous to early Tertiary igneous complexes extend into the Taylor Mountains 1:250,000-scale quadrangle. The U.S. Geological Survey is in the process of conducting a mineral resource assessment of this region. This report presents analytical data from 412 rock geochemistry samples collected by the U.S. Geological Survey during the 2005 field season. All samples were analyzed using the ICP-AES/MS42, ICP-AES10, fire assay, and cold vapor atomic absorption methods described in more detail below. Analytical values are provided in percent (% or pct: 1 gram per 100 grams), parts per million (ppm: 1 gram per 1,000,000 grams), or parts per billion (ppb: 1 gram per 1,000,000,000 grams) as indicated in the column heading of the data table. Data are provided for download in Excel (\*.xls), comma delimited (\*.csv), dBase 4 (\*.dbf) and as a point coverage in ArcInfo interchange (\*.e00) formats available at <http://pubs.usgs.gov/of/2006/1306/>.

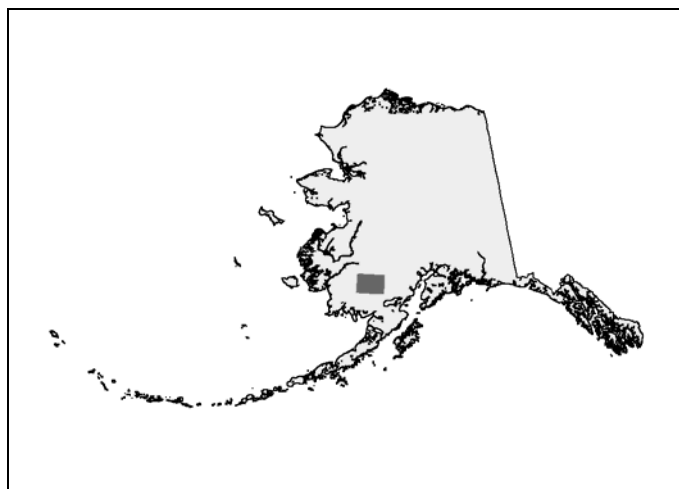


Figure 1. Location (dark shaded box) of Taylor Mountains 1:250,000-scale quadrangle, Alaska

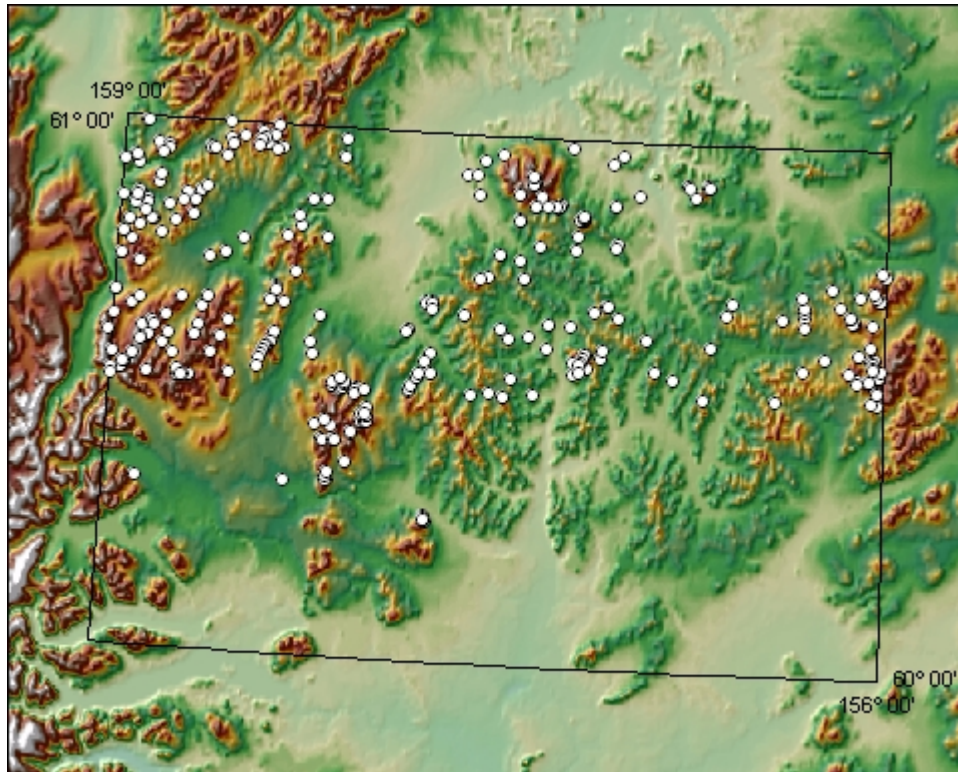


Figure 2. Location of samples (white circles) collected in the Taylor Mountains 1:250,000-scale quadrangle (Alaska) by the USGS in 2005.

## Sample Preparation and Analysis

Samples were prepared for analysis at the U.S. Geological Survey laboratories in Denver, Colorado. Rock samples were crushed in a jaw crusher, then ground in a vertical pulverizer to less than 100 mesh (<150 microns), followed by thorough mixing to ensure homogeneity (Taylor and Theodorakos, 2002). Analyses were made by XRAL Laboratories in Don Mills, Ontario, Canada, under contract to the USGS. Rock reference materials and a series of multi-element solution standards were used for calibration and quality assurance and quality control (QA/QC) purposes (Taggart, 2002).

## Analytical Methods

### ICP-AES/MS 42-Element

A 0.25 gram portion of each sample was decomposed using a mixture of hydrochloric, nitric, perchloric, and hydrofluoric acids at low temperature. Digested samples were analyzed for 42 major, minor, and trace elements simultaneously by a combination of inductively coupled plasma atomic emission spectrometry (ICP-AES) and mass spectrometry (ICP-MS) (modified from Briggs and Meier, 2002).

**Table 1.** Elements determined by 42-element ICP-AES/MS showing lower and upper reporting limits.

<b>Element</b>	<b>Lower reporting limit</b>	<b>Upper reporting limit</b>
Aluminum, Al	0.01%	15%
Calcium, Ca	0.01%	15%
Iron, Fe	0.01%	15%
Potassium, K	0.01%	15%
Magnesium, Mg	0.01%	15%
Sodium, Na	0.01%	15%
Phosphorous, P	50 ppm	10,000 ppm
Titanium, Ti	0.01%	15%
Silver, Ag	1 ppm	10 ppm
Arsenic, As	1 ppm	10,000 ppm
Barium, Ba	5 ppm	10,000 ppm
Beryllium, Be	0.1 ppm	100 ppm
Bismuth, Bi	0.04 ppm	10,000 ppm
Cadmium, Cd	0.1 ppm	10,000 ppm
Cerium, Ce	0.05 ppm	1,000 ppm
Cobalt, Co	0.1 ppm	10,000 ppm
Chromium, Cr	1 ppm	10,000 ppm
Cesium, Cs	0.05 ppm	1,000 ppm
Copper, Cu	0.5 ppm	10,000 ppm
Gallium, Ga	0.05 ppm	500 ppm
Indium, In	0.02 ppm	500 ppm
Lanthanum, La	0.5 ppm	1000 ppm
Lithium, Li	1 ppm	50,000 ppm
Manganese, Mn	5 ppm	10,000 ppm
Molybdenum, Mo	0.05 ppm	10,000 ppm
Niobium, Nb	0.1 ppm	1,000 ppm
Nickel, Ni	0.5 ppm	10,000 ppm
Lead, Pb	0.5 ppm	10,000 ppm
Rubidium, Rb	0.2 ppm	10,000 ppm
Sulfur, S	0.01%	5%
Antimony, Sb	0.05 ppm	10,000 ppm
Scandium, Sc	0.1 ppm	1,000 ppm
Tin, Sn	0.1 ppm	1,000 ppm
Strontium, Sr	0.5 ppm	10,000 ppm
Tellurium, Te	0.1 ppm	500 ppm
Thallium, Tl	0.1 ppm	10,000 ppm
Thorium, Th	0.2 ppm	10,000 ppm
Uranium, U	0.1 ppm	10,000 ppm
Vanadium, V	1 ppm	10,000 ppm
Tungsten, W	0.1 ppm	10,000 ppm
Yttrium, Y	0.1 ppm	10,000 ppm
Zinc, Zn	1 ppm	10,000 ppm

## ICP-AES 10-Element

Ten loosely bound metals (Ag, As, Au, Bi, Cd, Cu, Mo, Pb, Sb, and Zn) were solubilized by treatment of 1.0 gram of sample with a hydrochloric acid-hydrogen peroxide solution then extracted as organic halides using a 10% aliquot 336-diisobutylketone (DIBK) solution. Organic halide solutions were then quantified using ICP-AES (modified from Matooka, 1996).

**Table 2.** Elements determined by 10-element ICP-AES showing lower and upper reporting limits.

Element	Lower reporting limit (ppm)	Upper reporting limit (ppm)
Silver, Ag	0.08	400
Arsenic, As	1	6,000
Gold, Au	0.1	1,500
Bismuth, Bi	1	6,000
Cadmium, Cd	0.05	500
Copper, Cu	0.05	500
Molybdenum, Mo	0.1	900
Lead, Pb	1	6,000
Antimony, Sb	1	6,000
Zinc, Zn	0.05	500

## Gold, Palladium, and Platinum by Fire Assay

A 30 gram portion of each sample was mixed in a crucible with 150 grams of flux, followed by addition of 1 mg of silver nitrate and covered with borax. Crucibles were placed in a furnace for 45 minutes at 1080° C. The resulting dore bead was heated to remove all lead then digested in a mixture of nitric acid and hydrochloric acid. The final solution was adjusted to 10 ml and analyzed by ICP-MS. The lower reporting limits were 1 ppb for gold and palladium and 0.5 ppb for platinum. The upper reporting limits for all three were 10,000 ppb (Detra, 2006).

## Mercury by Cold Vapor Atomic Absorption Spectrometry

Analysis of mercury (Hg) was obtained by digestion of 0.1 g of sample in a mixture of nitric and hydrochloric acids. Addition of potassium permanganate, sulphuric acid, and potassium persulphate, was followed by addition of a NaCl-hydroxylamine solution. Dilution completed the sample preparation. Mercury concentrations were determined using a Perkin-Elmer Flow Injection Mercury System, FIMS-100; the lower reporting limit of 0.02 ppm (modified from Brown and others, 1997).

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