Studies by the U.S. Geological Survey in Alaska, 2000

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Introduction

By Frederic H. Wilson *and* John P. Galloway

The collection of eight papers that follow continue the series[1] of U.S. Geological Survey (USGS) investigative reports in Alaska under the broad umbrella of the geologic sciences. The series presents new and sometimes-preliminary findings that are of interest to earth scientists in academia, government, and industry; to land and resource managers; and to the general public. Reports presented in *Studies by the U.S. Geological Survey in Alaska* cover a broad spectrum of topics from various parts of the State (fig. 1), serving to emphasize the diversity of USGS efforts to meet the Nation's needs for earth-science information in Alaska.

The papers in this volume are organized under the topics Geologic Framework, Resources, and Environment and Climate. This organization is intended to reflect the scope and objectives of current USGS geologic programs in Alaska. In particular, Geologic Framework studies provide background information that is the scientific basis for present and future earth-science investigations.

Day and others discuss the geochemistry of and age constraints on metamorphism and deformation in the Fortymile River area, eastern Yukon-Tanana upland. Determining the age of deposition of many of the major rock types within the Fortymile River area is a major challenge for understanding the geologic evolution of the Yukon-Tanana lithotectonic terrane of east-central Alaska. New geochemical data have helped to characterize the bedrock units, along with new U-Pb zircon ages on two critical units within the Fortymile River area. U-Pb-isotopic data on zircons from the early (pre-D_1) Steele Creek Dome Orthogneiss, as well as from a late-tectonic (late-D_2) epidote-bearing leucogranite intrusion, help constrain the youngest possible age for supracrustal rocks and regional D_2 deformation. The Steele Creek Dome Orthogneiss crystallized at 343±4 Ma, indicating that the supracrustal sequence is partly at least Early Mississippian in age. The leucogranite crystallized during the waning states of D_2 deformation at 196±4 Ma. U-Pb data on this Early Jurassic leucogranite also show that the inherited zircons have a complex history, with analyses yielding ages of 359±5 and 232±7 Ma. These data confirm earlier $^{40}Ar/^{39}Ar$ ages that suggest an Early Jurassic timing for the intense regional D_2 metamorphism and tectonism.

Cole and Layer present new field, petrographic, and geochemical data on two Tertiary volcanic-rock units and underlying sedimentary rocks in the southeast corner of the Mount McKinley quadrangle. The volcanic-rock units include late Paleocene and early Eocene rocks of the Foraker Glacier and the late Eocene and early Oligocene Mount Galen Volcanics. New $^{40}Ar/^{39}Ar$ data on two samples from the lower part of volcanic rocks of the Foraker Glacier yield ages of 56.9±0.2 and 5.55±0.1 Ma. Volcanic rocks of the Foraker Glacier unconformably overlie a 550-m-thick sequence of Late Cretaceous(?) sedimentary rocks that dip steeply north and unconformably overlie Paleozoic metamorphic rocks with a schistosity that dips steeply south. The Mount Galen

[1]From 1975 through 1988, *Geologic Studies in Alaska* was published as a series of USGS Circulars, which were titled *The United States Geological Survey in Alaska: Accomplishments During 19xx*. From 1989 to 1994, the series was published as more formal USGS Bulletins. As a result of a reorganization in 1995 of USGS publications, the series is now being published as USGS Professional Papers.

Volcanics consists of basaltic, andesitic, dacitic, and rhyolitic lavas and dacite, and rhyolite tuff and tuff breccia. New $^{40}Ar/^{39}Ar$ data on a basaltic andesite flow 46 m above the base of the Mount Galen Volcanics yield an age of 43.8±0.5 Ma. The Mount Galen Volcanics is enriched in Ba, Th, Sr, and light rare-earth elements, has high Ba/Ta ratios, and exhibits a distinct paired Nb-Ta-depletion trend, all of which are common characteristics of subduction-related volcanic rocks. Cole and Layer interpret that the Late Cretaceous(?) sedimentary rocks record uplift and shortening during the final stages of accretion of the Wrangellia composite terrane to southern Alaska. Volcanic rocks of the Foraker Glacier represent the final phase of Late Cretaceous and early Tertiary Alaska-Talkeetna Mountains magmatism, which ended with suturing of the Wrangellia composite terrane. The Mount Galen Volcanics is part of the northern section of the Eocene to Oligocene Alaska-Aleutian arc that crosscuts older igneous rocks of the region.

Eastham and Ridgway present stratigraphic and provenance data which suggest that thousands of meters of Upper Jurassic to Upper Cretaceous strata which have been grouped together as the Kahiltna assemblage in south-central Alaska may actually represent several different sedimentary basins. The Kahiltna assemblage in the Alaska Range is separated from the Kahlitna assemblage in the Clearwater and Talkeetna Mountains by a large thrust block of Paleozoic and Mesozoic strata known as the Chulitna terrane. Easthman and Ridgway interpret the lithofacies of the Chulitna terrane as representing deposition on a bathymetric high relative to submarine-fan lithofacies of the Kahiltna assemblage in the Talkeetna Mountains and Alaska Range.

McRoberts and Blodgett describe a diverse molluscan fauna of silicified fossils from two localities in the Taylor Mountain D-3 quadrangle. The molluscan fauna consists of a least 8 species of bivalves, including one new species, *Cassianella cordillerana* McRoberts n.sp., and at least 11 species of gastropods, including two new species, *Neritaria nuetzeli* Blodgett n.sp. and *Andangularia wilsoni* Blodgett n.sp. Bivalve and gastropod affinities suggest an early Norian age, with taxonomic similarities to several southern Alaskan lithotectonic terranes (for example, Alexander and Chulitna), as well as to the South American Cordillera of Peru.

Mount Griggs, the highest peak in Katmai National Park, is a fumarolically active andesitic stratovolcano that stands 12 km behind the main volcanic chain of the Alaska Peninsula range crest. (Hildreth and others, report). K-Ar ages indicate that the volcano is as old at 292±11 ka and thus predates inception of the nearby volcanic-front centers. Geochemical analyses of lava flows exposed on Mount Griggs and a few near-vent scoria bombs define a typical Ti-poor, medium-K calc-alkaline arc suite that shows little systematic change over time. Relative to eruptive products of the nearby volcanic-front centers, those of Mount Griggs are slightly depleted in Fe, generally enriched in Rb, Sr, Al, and P, and consistently enriched in K and Zr. The magmatic plumbing system of Mount Griggs is independent of those beneath the main volcanic chain, probably all the way to mantle depths.

Brew and Friedman present recent field studies and published and unpublished data on adjacent areas which show that the Stikine Icefield, part of the Coast Mountains of southeastern Alaska, is underlain by five generalized map: (1) locally foliated and prophyritic granodiorite, (2) foliated tonalite, (3) migmatitic rocks, (4) unfoliated tonalite and granodiorite, and (5) polymetamorphic rocks.

Stottlemyer and others discuss treeline biogeochemistry and dynamics in Noatak National Preserve, Alaska. The objective of their study was to gain an understanding of treeline dynamics, structure, and function and to examine the effects of global climate change—in particular, soil temperature, moisture, and nitrogen availability—on ecosystem processes within an 800-ha watershed in a boreal biome.

Eppinger and others present a detailed environmental-geochemical study of the Slate Creek antimony deposit in the Kantishna Hills, Denali National Park and Preserve, Alaska. The purpose of their study was to focus on identifying and characterizing the environmental and geochemical signatures associated with this historical mining area. Samples collected included water, stream sediment, rock, and soil from upstream and downstream of the mineralized area. Natural springs present within the mineralized area, but outside the disturbed minesite, suggest premining spring waters that naturally ranged from acidic to neutral pH, had relatively high conductivities, had varying high total dissolved solids, were iron rich, and were metalliferous.

Two bibliographies at the end of the volume list reports covering Alaska earth-science topics in USGS publications during 2000 and reports about Alaska by USGS authors in non-USGS publications during the same period.

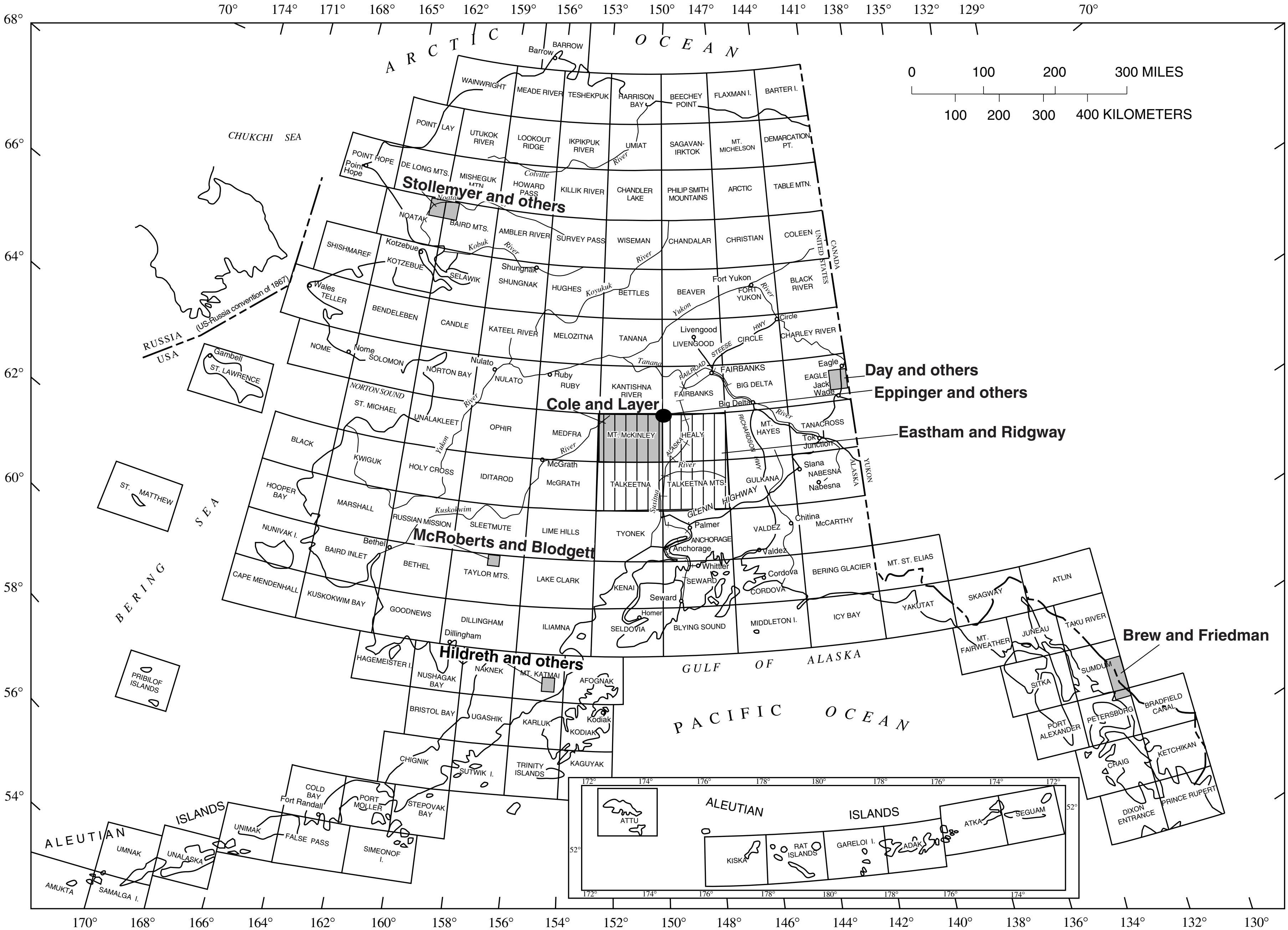

Figure 1. Index map of Alaska showing 1:250,000-scale quadrangles and locations of study areas discussed in this volume.