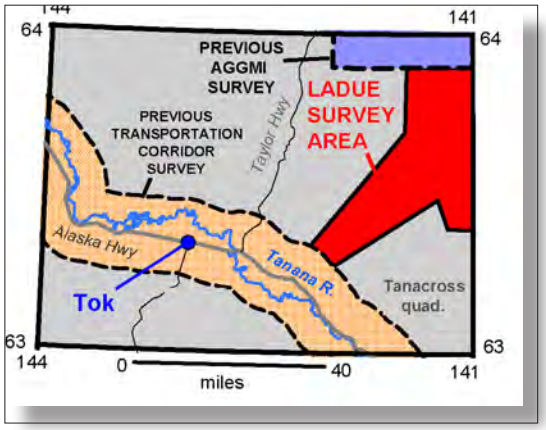
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: AIRBORNE GEOPHYSICAL SURVEY OF THE LADUE AREA, FORTYMILE MINING DISTRICT, EASTERN ALASKA

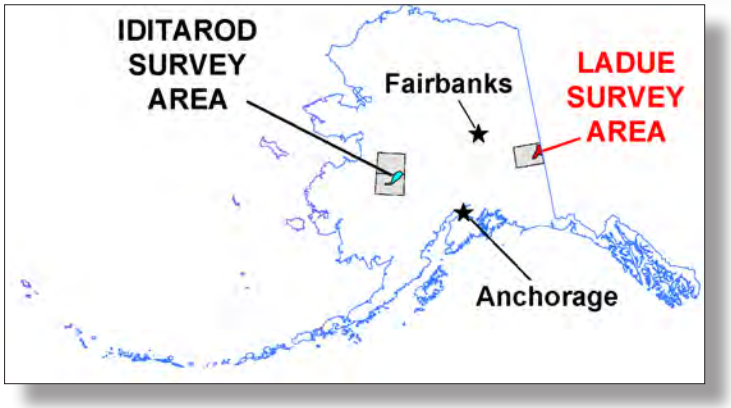
The Airborne Geophysical/Geological Mineral Inventory (AGGMI) program is a multi-year investment to expand the knowledge base of Alaska's mineral resources and catalyze private-sector mineral development. The project seeks to delineate mineral zones on Alaska state lands that: (1) have major economic value; (2) can be developed in the short term to provide high-quality jobs for Alaska; and (3) will provide economic diversification to help offset the loss of Prudhoe Bay oil revenue. Candidate lands for this project are identified based on existing geologic knowledge, land ownership, and responses to solicitations for nominations from Alaska's geologic community. Products resulting from these surveys generally include: (1) 1:63,360-scale aeromagnetic and airborne-electromagnetic maps; (2) 1:63,360-scale geologic maps; and (3) various other geological, geochemical, and geophysical data compilations. As a result of this program, millions of dollars of venture capital have been spent in the local economies of the surveyed mining districts and adjacent areas in direct response to the new geologic knowledge provided by the surveys.

Through the AGGMI program, DGGS is acquiring airborne-geophysical data for the Ladue and Iditarod areas (see p. 43) in FY11. The 730-square-mile Ladue survey tract, about 25 miles east of Tok, is all State land and is part of the Fortymile mining district, the oldest placer gold camp in Alaska. More than 500,000 ounces of placer gold have been produced from the district. Like much of the Yukon–Tanana Uplands, the Ladue survey area is underlain by Paleozoic and older (?) deformed and regionally metamorphosed rocks, and consists of quartzite, schist, gneiss, marble, greenstone, amphibolite, and orthogneiss. Cretaceous- to Tertiary-age igneous rocks of mafic, intermediate, and granitic composition intruded the metamorphosed rocks. The survey area contains large, low-grade copper–molybdenum ± gold(?) porphyry deposits, plutonic-related lode gold prospects, and prospects with anomalous lead and zinc concentrations. The survey area has the potential for hosting emerald deposits similar to the Tsa Da Glisza property in Yukon, Canada, and for metamorphic/orogenic lode gold deposits similar to those of the historic Klondike Gold District in Yukon, Canada, and the Napoleon deposit just northeast of Chicken, Alaska.

Airborne-geophysical surveys enable users to delineate regional structures, and identify metamorphic–stratigraphic lithologies and plutonic rock types based on their geophysical characteristics. Follow-up geologic mapping tests geophysical anomalies and interpretations, and provides detailed documentation of the types, locations, and spatial distribution of metamorphic and plutonic rocks and structural features. By completing an integrated geophysical–geological mineral inventory study, new zones of mineralization may be identified, and extrapolation of some of the information into surrounding areas may be appropriate.



Geophysical information being acquired for the Ladue area includes aeromagnetic and electromagnetic data. Maps and digital data will be released as DGGS Geophysical Reports in mid-winter 2011. A second publication, containing a project report, interpretation, and electromagnetic anomalies, will be released in summer 2011. DGGS believes these data will lead to a better understanding of the geologic framework of the area and will stimulate increased mineral exploration investment within the survey boundary and the surrounding area.



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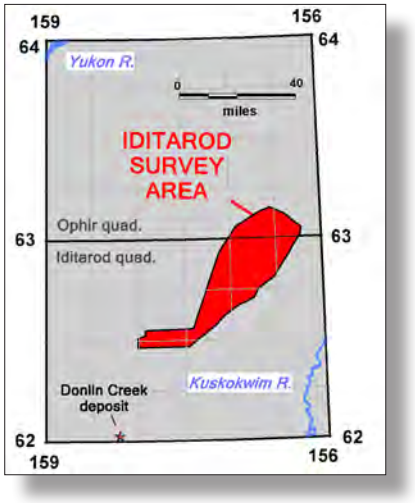
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: AIRBORNE GEOPHYSICAL SURVEY OF THE IDITAROD AREA, IDITAROD, INNOKO, AND MCGRATH MINING DISTRICTS, WESTERN ALASKA

The Airborne Geophysical/Geological Mineral Inventory (AGGMI) program is a multi-year investment to expand the knowledge base of Alaska's mineral resources and catalyze private-sector mineral development. The project seeks to delineate mineral zones on Alaska state lands that: (1) have major economic value; (2) can be developed in the short term to provide high-quality jobs for Alaska; and (3) will provide economic diversification to help offset the loss of Prudhoe Bay oil revenue. Candidate lands for this project are identified based on existing geologic knowledge, land ownership, and responses to solicitations for nominations from Alaska's geologic community. Products resulting from these surveys generally include: (1) 1:63,360-scale aeromagnetic and airborne-electromagnetic maps; (2) 1:63,360-scale geologic maps; and (3) various other geological, geochemical, and geophysical data compilations. As a result of this program, millions of dollars of venture capital have been spent in the local economies of the surveyed mining districts and adjacent areas in direct response to the new geologic knowledge provided by the surveys.

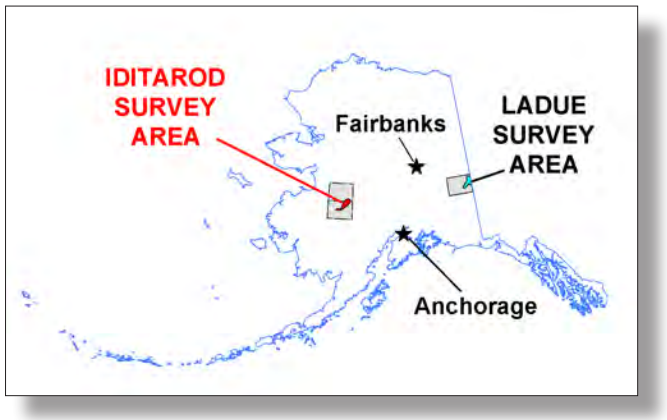
Through the AGGMI program, DGGS is acquiring airborne-geophysical data in for the Iditarod and Ladue areas (see p. 42) in FY11. The 850-square-mile Iditarod survey tract is about 20 miles west of McGrath and 240 miles northwest of Anchorage. The survey area consists primarily of State land, with a small amount of Federal and Native land. Most of the survey area is part of the Iditarod–Innoko mining districts, which have produced more than 2.3 million ounces of gold; only 3,000 ounces of this production has been from lode sources. The discovery of more than 30 million ounces of gold associated with a Late Cretaceous dike swarm at the Donlin Creek deposit, about 30 miles southwest of the survey area, has kept mining activity high in the region.

Like the Donlin Creek area, most of the survey area is composed of the Upper Cretaceous Kuskokwim Group, a flysch sequence consisting of interbedded sandstone and shale. Most plutons have quartz monzonitic to monzonitic compositions and are calc-alkaline. Mineralization is thought to be contemporaneous with plutonism at several localities in the region. Besides plutonic-related gold deposits, other lode potential in the survey area includes mesothermal and epithermal deposits that contain mercury, tungsten, silver, antimony, and tin.



Airborne-geophysical surveys enable users to delineate regional structures, and identify metamorphic–stratigraphic lithologies and plutonic rock types based on their geophysical characteristics. Follow-up geologic mapping tests geophysical anomalies and interpretations, and provides detailed documentation of the types, locations, and spatial distribution of metamorphic and plutonic rocks and structural features. By completing an integrated geophysical–geological mineral inventory study, new zones of mineralization may be identified, and extrapolation of some of the information into surrounding areas may be appropriate.

Geophysical information being acquired for the Iditarod area includes aeromagnetic and electromagnetic data. Maps and digital data will be released as DGGS Geophysical Reports in mid-winter 2011. A second publication, containing a project report, interpretation, and electromagnetic anomalies, will be released in summer 2011. DGGS believes these data will lead to a better understanding of the geologic framework of the area and will stimulate increased mineral exploration investment within the survey boundary and the surrounding area.



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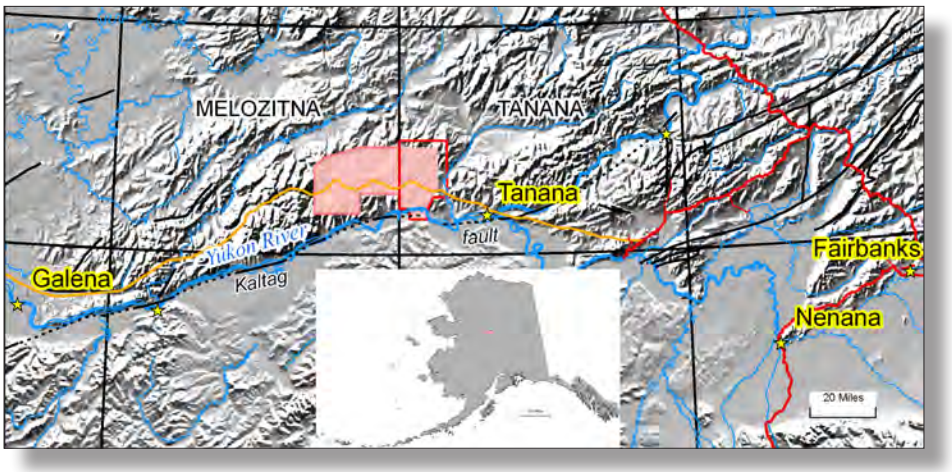
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
FY11 Project Description

AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PRGRAM: GEOLOGIC MAPPING IN THE EASTERN MORAN AREA, TANANA AND MELOZITNA QUADRANGLES, ALASKA

Historic and active placer mines in the Melozitna mining district, which encompasses the Moran area, have produced more than 12,000 ounces of gold and an undetermined amount of tin, yet little is understood about the source of the placer metals or the few gold and polymetallic lode occurrences in the area. To encourage renewed industry exploration for mineral deposits in this region, and to provide geologic data for State and local land-use management, the Alaska Division of Geological & Geophysical Surveys (DGGS) in 2010 released the 653-square-mile Moran airborne-geophysical survey (pink area, fig. 1) as part of the State-funded Airborne Geophysical/Geological Mineral Inventory program. The Moran survey area is 150 miles west of Fairbanks in the eastern Kokrines Hills, on the north side of the Yukon River. In summer 2011, DGGS will conduct fieldwork to geologically map approximately 300 square miles in the eastern Moran area (outlined in red, fig. 1). The remainder of the geophysical survey will be mapped in 2012. Interim data reports and a preliminary interpretive map will be published in 2011 and 2012. A final set of 1:63,360-scale bedrock-, surficial- and comprehensive-geologic maps of the combined map areas will be published in 2013. This mapping project will be funded primarily by State General Funds, with supplemental funding through the Federal STATEMAP program.

Currently, only reconnaissance-level, 1:250,000-scale geologic maps are available for the Moran area; DGGS's new geophysical data indicate this area is much more complex than shown on these maps. DGGS's detailed, 1:63,360-scale geologic mapping and geologic investigations in this region will: (1) field check geophysical anomalies and patterns, (2) identify the location, type, and character of bedrock and surficial geologic units, and (3) determine the location and kinematics of structural features. This detailed geologic framework will allow us to develop models for the area's gold and polymetallic lode prospects, and explain the distribution and metal content of local placer deposits. In addition, the preferred route of the Western Alaska Access Planning Study for the proposed road to Nome along the Yukon River corridor transects the eastern Moran map area (yellow-orange line, fig. 1). Current geologic mapping is insufficient to evaluate geologic-engineering challenges of infrastructure development in the area. Geologic hazards are also of concern, and include the Kaltag fault, which crosses the southern edge of the map area. Although the fault is potentially active, the recent displacement history of the fault and its associated seismic hazards have not been evaluated. As DGGS's work progresses, preliminary results will be presented in public venues, allowing timely access to the new information on the Moran area's geology, mineral resources, and geologic hazards.

The primary objective of the eastern Moran project is to map the geology in sufficient detail to inform State and local land-use decisions and to guide mineral industry exploration efforts. The timing of this project coincides with renewed mineral-industry interest in underexplored gold districts and in high-tech and strategic metals. Because economic or infrastructure development could potentially conflict with other land uses, the availability of DGGS's detailed geologic, mineral-resource, and hazard assessments is important for long-range planning. Providing this baseline geologic framework will help State and local planners balance the need for resource and infrastructure development with other land-management strategies.



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AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: BEDROCK GEOLOGIC MAPPING IN THE TOLOVANA MINING DISTRICT, LIVENGOOD QUADRANGLE, ALASKA

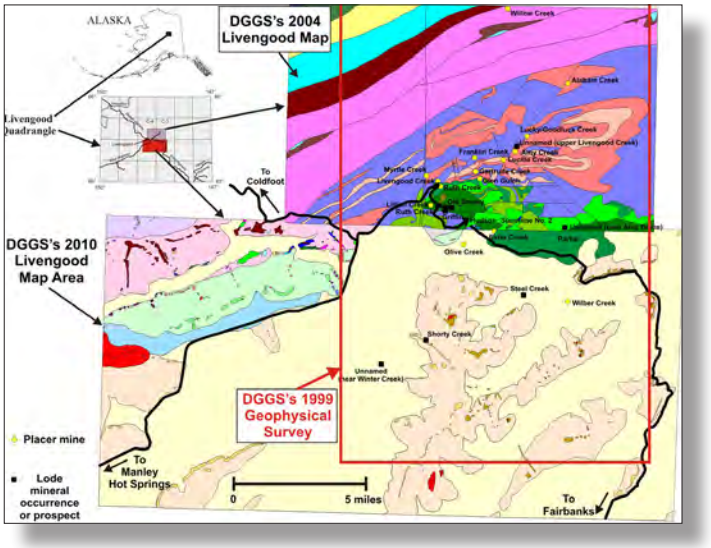
Historic and active placer mines have produced more than 500,000 ounces of placer gold in the Livengood area. To encourage renewed industry exploration for additional mineral deposits in this region, and to provide geologic data for State and local land-use management, the Alaska Division of Geological & Geophysical Surveys (DGGS) has conducted a series of geophysical and geological investigations in the area. This work is part of the Airborne Geophysical/Geological Mineral Inventory (AGGMI) program, supported by State of Alaska General Funds. DGGS released a 123-square-mile airborne-geophysical survey of the Livengood area in 1999. In 2004, DGGS published a geologic map and associated geologic report for an area that includes the northern portion of the 1999 geophysical survey (fig. 1). Subsequent mineral industry exploration in this map area resulted in the discovery of an estimated 19-million-ounce gold deposit at Money Knob. DGGS returned to the area in June 2010 to conduct geologic mapping and sampling of the southern portion of the 1999 geophysical survey and surrounding area (fig. 1). A geochemical report was published in November 2010, and a 1:50,000-scale bedrock-geologic map will be published in 2011.

The purpose of DGGS's mapping is to provide geologic context for known lode and placer deposits and occurrences, and to evaluate the area's mineral-resource potential. Wilber Creek is the only creek in the 2010 map area with known placer gold production. Its gold compositions are similar to placer gold of the Livengood area, but the area's present morphology suggests the gold is derived from the 2010 map area. The only known significant lode mineralization occurs west–northwest of Wilber Creek at the Shorty Creek prospect.

Rocks in the northern and northwestern portions of the 2010 map area belong to the Livengood Terrane and include: the Ordovician Livengood Dome Chert, overlying Amy Creek unit, Cambrian ophiolite suite, and Devonian Cascaden unit. DGGS work has refined both the location and the nature of the contacts between these units. The Lower Cretaceous Wilber Creek unit of the Manley Terrane dominates the bulk of the southern map area, and it is in fault contact with the Livengood Terrane.

Felsic igneous rocks, with variable textures and compositions, range in size from thin dikes to small plutons and are typically quite altered. DGGS studies distinguished Devonian volcanic rocks, and four groups of presumed Cretaceous intrusive rocks. Group I is compositionally variable, scattered across the map area, and not associated with mineralization. Group II comprises the Cascaden Ridge pluton, is compositionally similar compared to gold-related Money Knob dikes, and is spatially associated with Devonian volcanic rocks that act as the host rock in the Money Knob system. Group III is compositionally similar to gold-related Money Knob dikes, and mostly located in the Wilber Creek drainage. Placer gold found in Wilber Creek may be derived from these dikes. Group IV is similar in composition and age to the Tolovana Hot Springs pluton (65 Ma), and is associated with the high Ag–Bi–Sn and locally anomalous Au mineralization of the Shorty Creek lode prospect.

To fulfill the goals of this project, age information will be obtained for group II and III felsic intrusive rocks to determine if their similarity to the Money Knob dikes is temporal as well as compositional. The relative age of high-angle structures to hydrothermal alteration in the Cambrian ophiolite and Wilber Creek unit are still unknown. Faulting emplaced the Wilber Creek unit from an unknown source area, but from how far and when in relation to the Money Knob gold system? These issues will be addressed in the next year, along with conducting petrography, further geochemical analyses, and completion of the geologic map.



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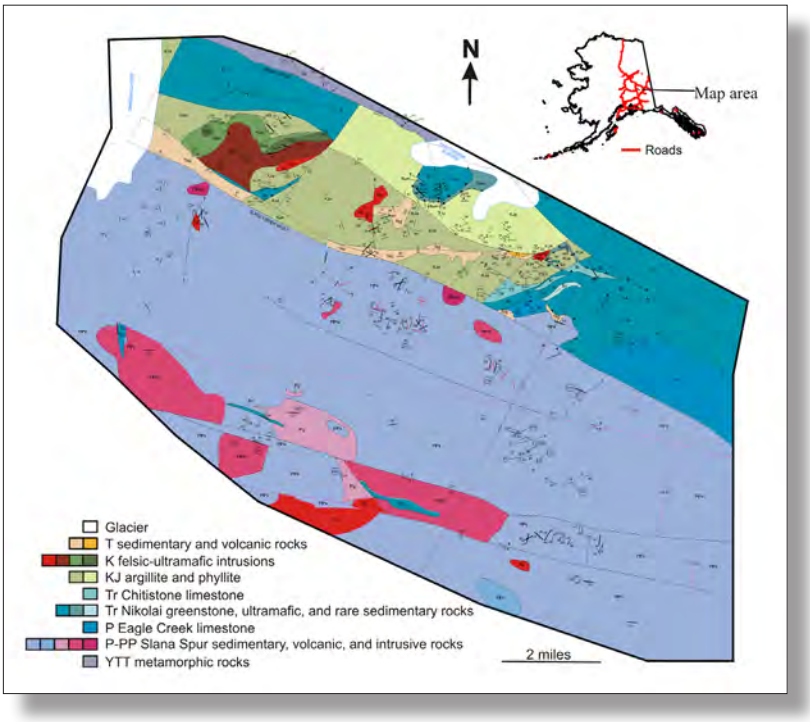
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: BEDROCK GEOLOGIC MAPPING OF THE SLATE CREEK AREA, MT. HAYES QUADRANGLE, SOUTH-CENTRAL ALASKA

The Alaska Division of Geological & Geophysical Surveys (DGGS) released a 442-square-mile airborne geophysical survey, including magnetic and electromagnetic data, for the Slate Creek–Slana River area in the northern Chistochina mining district in early 2009. DGGS conducted geologic mapping of about 113 square miles in the western Slate Creek portion of the geophysical survey tract during July 2009 (fig. 1). This mapping project is funded primarily by State CIP funds, with supplementary Federal STATEMAP funding. The geophysical survey and Slate Creek mapping project are part of DGGS's Airborne Geophysical/Geological Mineral Inventory program, a special multi-year investment by the State of Alaska to expand Alaska's geologic and mineral resources knowledge base, catalyze future private-sector mineral exploration and development, and guide state planning.



The Slate Creek study area is in the southern foothills of the Alaska Range, about 140 miles southeast of Fairbanks and 20 miles east of Paxson. Approximately 183,000 ounces of placer gold have been mined from the region since 1898, with most production from the historic Slate Creek subdistrict. The map area comprises one active placer gold mine, 64 inactive placer gold occurrences and mines (with minor platinum-group metals [PGM]), and 29 metallic lode occurrences. There are no significant known lode gold occurrences to explain the extensive placers. Gold chemical data suggest the placers are sourced from transported and reworked auriferous Tertiary gravels instead of from the local gold-bearing bedrock. The Mentasta–Slana area also hosts many plutonic-related skarn, replacement, and vein–gossan occurrences as well as potential porphyry(?) copper–gold lode prospects and 'Alaska-type' PGM lode occurrences associated with Cretaceous mafic–ultramafic rocks.

A portion of the main strand of the Denali Fault System (DFS), which ruptured in 2002 (with an associated magnitude 7.9 earthquake), is included in and bounds the northern edge of the study area. DGGS is identifying, determining orientations, and characterizing the kinematics of active and inactive faults along the DFS and subsidiary faults to provide a better understanding of the regional stress regime. The results of a paleoseismic trench study across the 2002 rupture trace of the Denali fault are contained in a Preliminary Interpretive Report presently under review at DGGS. These data are necessary for subsequent assessment of earthquake hazards to critical infrastructure and population centers.

New geologic mapping and neotectonic studies, incorporating interpretations of DGGS's airborne geophysical data, will lead to a better understanding of the region's geologic framework, provide data on recent fault movement essential to geologic hazard assessments, provide geologic-resource data critical to land-use decisions, and help to stimulate increased mineral exploration investment within this belt of rocks. Products will be a series of geologic maps at 1:50,000 scale, and reports containing geological, geochemical, and geophysical data. Geologic maps of the Slate Creek–Slana River area will be completed in 2011. Surficial-geologic mapping performed in conjunction with this project is described separately (p. 62).

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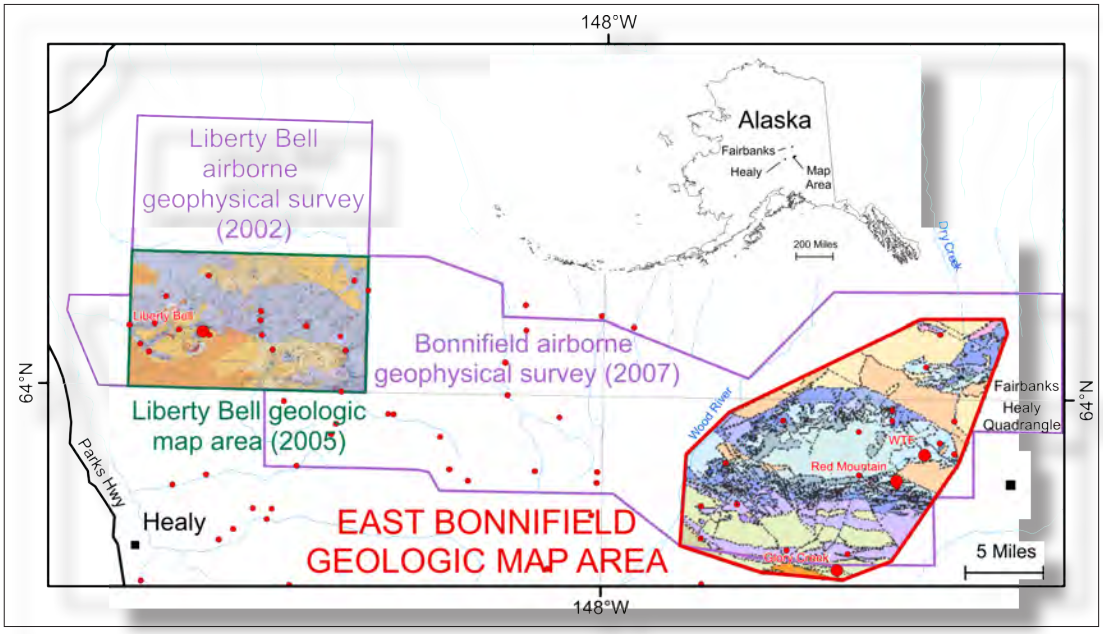
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: GEOLOGIC MAPPING IN THE EASTERN BONNIFIELD MINING DISTRICT, HEALY AND FAIRBANKS QUADRANGLES, ALASKA

Historic and active placer mines in the Bonnifield mining district have produced more than 86,000 ounces of gold; the region also contains numerous significant polymetallic volcanogenic massive sulfide (VMS) and gold–polymetallic pluton-related lode occurrences. To encourage renewed industry exploration for mineral deposits in this region, and to provide geologic data for State and local land-use management, in 2007 the Alaska Division of Geological & Geophysical Surveys (DGGS) released a 613-square-mile airborne-geophysical survey for the eastern two-thirds of the area outlined in magenta (fig. 1) as part of the State-funded Airborne Geophysical/Geological Mineral Inventory program. In summer 2008, DGGS conducted fieldwork to geologically map an approximately 200-square-mile area in the eastern Bonnifield mining district (area outlined in red; fig. 1). A geochemical data report was published in 2009, and 1:50,000-scale bedrock- and comprehensive-geologic maps will be published in 2011. This project is funded primarily by State Capital Improvement Project (CIP) funds, with supplemental funding from the U.S. Geological Survey through the Federal STATEMAP program.

The eastern Bonnifield map area is 60 miles south of Fairbanks in the northern foothills of the Alaska Range. The map area contains significant mineral occurrences, most notably the WTF and Dry Creek VMS prospects, which contain drill-inferred resources of copper, lead, zinc, silver, and gold. Lithologic and structural relationships and interpretations depicted on 50-year-old published geologic maps are not supported by our summer 2008 investigations. DGGS's new geologic map incorporates interpretations of our Bonnifield airborne geophysical survey data, aerial photographs, donated industry data, and our 2008 field observations and new scientific analytical data. Our work documents many sets of newly discovered inactive faults and one potentially active fault, and presents a revised stratigraphic section based on actual lithologic units instead of grouped rock packages.

The primary objective of the eastern Bonnifield project is to map the geology of the area in sufficient detail to facilitate wise State and local land-use decisions and to guide mineral industry exploration efforts. The timing of this project coincides with renewed mineral-industry interest in exploration for volcanogenic massive sulfide deposits including those in the eastern Bonnifield mining district; exploration activity in Alaska in general is near an all-time high. Because economic development could potentially conflict with other land uses, the availability of DGGS's detailed geologic, resource, and reconnaissance hazard assessments is important for long-range planning. Providing a basic geologic framework and an inventory of potentially mineralized areas will help State and local planners balance the need for resource development with other land-management strategies. Geologic maps and data produced by this project will also serve as a framework for further scientific studies and increased regional understanding of this tectonically active area, which is 21 miles north of the Denali fault.



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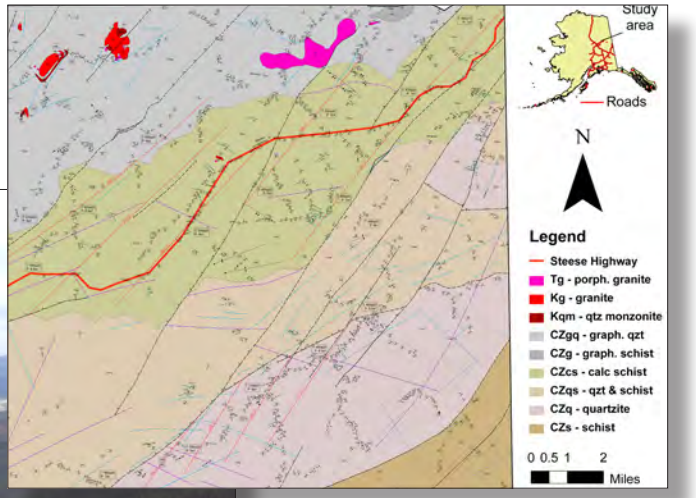
ALASKA GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: BEDROCK GEOLOGIC MAPPING OF THE NORTHERN FAIRBANKS MINING DISTRICT, CIRCLE QUADRANGLE, ALASKA

In summer 2007, the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted 189 square miles of geologic mapping northeast of Fairbanks, covering the central portion of DGGS's 404-square-mile northeast Fairbanks airborne magnetic and electromagnetic geophysical surveys released in January 2006. The mapping project is funded primarily by DGGS's Airborne Geophysical/Geological Mineral Inventory program, an annual investment by the State of Alaska to expand Alaska's geologic- and mineral-resources knowledge base, catalyze future private-sector mineral exploration and development, and guide state planning. Additional support is from the federal STATEMAP program.

The Steese Highway bisects the study area from highway mileposts 66 to 85. Good access from the highway, placer mining roads, and a few trails, in addition to nearby power from the high-voltage power lines of the Fort Knox gold mine 25 miles to the southwest, would facilitate possible mineral development. The map area lies in a northeast-oriented trend of plutonic-related gold mineralization between the central and southwestern Fairbanks and Circle mining districts. The Fairbanks mining district has the largest historic gold production in Alaska, with nearly 12.9 million troy ounces of gold produced as of 2007. Three placer mines (two active) and one lode gold prospect are present in the northeast Fairbanks map area. Placer gold is spatially associated with monzogranite and quartz monzonite plugs, dikes, and sills. The distribution of paystreaks within the placers and paucity of mineralization within the intrusions suggest some of the gold may be structurally controlled. In 2007, DGGS identified arsenopyrite–pyrite–quartz veins and boxworks and semi-massive stibnite–quartz veins proximal to the intrusive suite.

In addition to geologic mapping, DGGS conducted a rock and stream-sediment geochemical study instrumental in the Alaska Division of Mining, Land & Water's decision to relocate a portion of the proposed Mount Ryan Remote Recreational Cabin Sites Staking Area to an area with lower perceived mineral potential. Because land open to settlement is usually closed to mineral exploration and development, knowledge of an area's mineral potential is crucial to decisions about whether to retain that land for subsurface users. These geochemical data were published in January 2008.

DGGS's geologic mapping incorporates interpretations of our airborne geophysical data, and will provide: (1) a better understanding of the lithologic, metamorphic, and tectonic framework of Interior Alaska; (2) baseline geologic-materials and hazards data for future infrastructure and residential construction, and current maintenance of the Steese Highway; (3) geologic-resource data critical to land-use decisions; and (4) geologic knowledge that will help encourage mineral exploration investment in the northern section of the Fairbanks mining district. A series of 1:50,000-scale geologic maps and associated scientific studies for this project will be completed in 2011. Surficial-geologic mapping performed in conjunction with this project is described separately (p. 65).



Draft bedrock geologic map.

View, looking north, of the Faith Creek gold placer.

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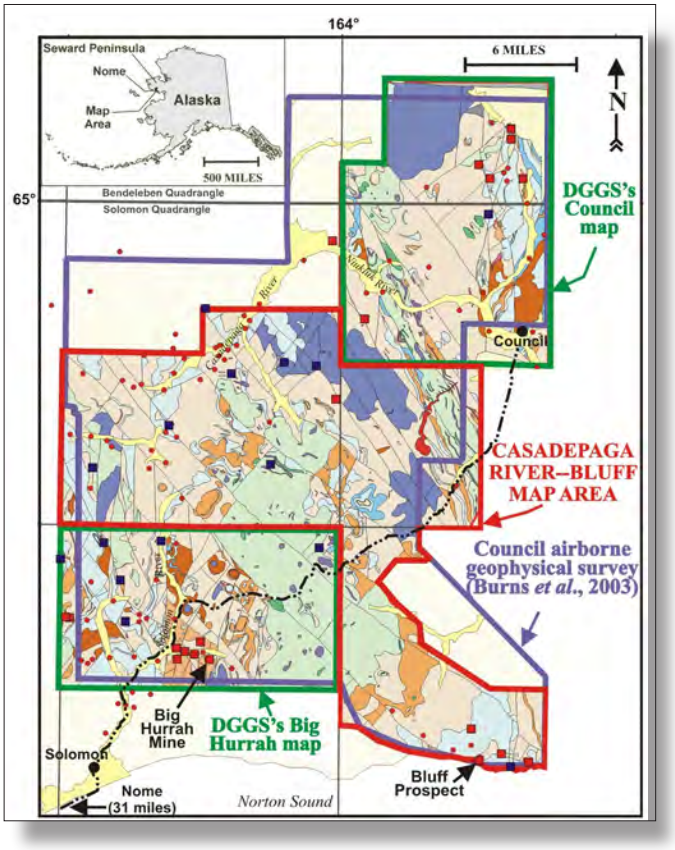
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: BEDROCK GEOLOGIC MAPPING IN THE COUNCIL–BIG HURRAH–BLUFF AREA, SEWARD PENINSULA, ALASKA

More than 1 million ounces of placer gold have been extracted from the Solomon–Council area of Alaska's Seward Peninsula during the past century, but gold production has declined in recent decades. To encourage renewed industry exploration for lode gold and base-metal deposits in this region, and to provide geologic data for land-use management, in 2003 the Alaska Division of Geological & Geophysical Surveys (DGGS) released airborne-geophysical surveys for the area outlined in purple (fig. 1). These surveys are part of the Airborne Geophysical/Geological Mineral Inventory (AGGMI) program, supported by State Capital Improvement Project (CIP) funds. In 2004, DGGS conducted 1:50,000-scale geologic mapping and geochemical sampling in the Big Hurrah and Council areas (green outline, fig. 1).



In 2006, DGGS extended this mapping into the Casadepaga River–Bluff area (red outline, fig. 1), and will produce a combined map and a geologic report of the entire project area in 2011. A geochemical report for the 2006 map area was released in October 2007. This part of the project is primarily supported by the State CIP-funded AGGMI program, and was partially supported in 2007 by the Federal STATEMAP program. The purpose of DGGS's mapping is to provide geologic context for known lode gold and base-metal deposits and occurrences, and evaluate the area's mineral-resource potential. The Casadepaga River–Bluff map area contains the Bluff lode gold prospect, and covers the headwaters of the Casadepaga River, known for its rich placer gold deposits. The lode sources of this placer gold have not yet been identified.

The Casadepaga River–Bluff area is underlain by Proterozoic to Lower Paleozoic metasedimentary and metaigneous rocks of the Nome Group, including the Solomon Schist, Mixed Unit, Casadepaga Schist, and undifferentiated marble. DGGS's recent detailed geologic mapping defines the internal metamorphic stratigraphy of these rock units, and is revealing new relationships between units as well. Efforts to determine their depositional ages are in progress. Stratigraphic relationships and depositional-age data are essential for evaluating the economic potential of the Nome Group for hosting base-metal sulfide deposits.

In the Casadepaga River–Bluff area, DGGS's geologic mapping and associated studies have documented the location, geochemistry, age, distribution, orientation, and regional structural controls on the area's gold-bearing quartz vein systems. To help predict where additional veins may be located, it is important to determine the timing of gold-vein formation relative to structural features, metamorphic events, and igneous intrusions. Our preliminary work indicates that Nome Group rocks underwent high-pressure blueschist-facies metamorphism ~200 million years ago, and were later partially overprinted by a greenschist-facies mineral assemblage. Rare, extension-related alkalic intrusions of Cretaceous to Quaternary age are scattered throughout the map areas, but are not spatially associated with gold-bearing quartz veins. These veins yield 40Ar/39Ar adularia and white mica ages of ~105 to 115 Ma. Hydrothermal kaolinite, cinnabar, and adularia indicate epithermal-style mineralization on the southern Seward Peninsula, as well as the more widely distributed, gold-bearing veins of possible orogenic or extensional origin.

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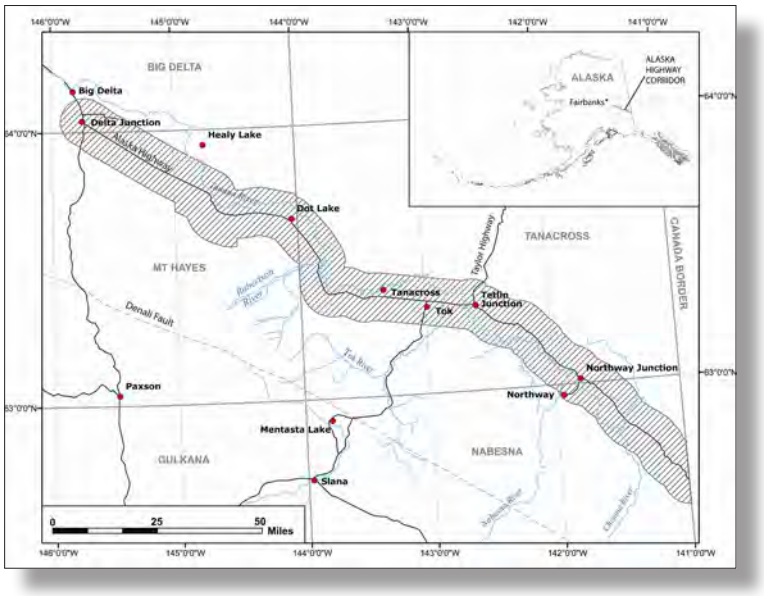
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
FY11 Project Description

BEDROCK GEOLOGY & MINERAL-RESOURCE ASSESSMENT ALONG THE PROPOSED GAS PIPELINE CORRIDOR FROM DELTA JUNCTION TO THE CANADA BORDER

The Alaska Highway is the primary land transportation route to interior Alaska from the contiguous United States, and is likely to become the locus of increasing development, especially if the proposed natural gas pipeline or Alaska Railroad extension are constructed along this route. Despite the corridor's strategic location, relatively little geologic and geotechnical work has been published along its length. This multi-year project, primarily supported by State Capital Improvement Project (CIP) funds, will provide a framework of geologic data upon which engineering, design, and resource decisions may be evaluated for future development between Delta Junction and the Canada border. In 2006, as the first phase of this project, DGGS collected, interpreted, and published airborne geophysical data for a 16-mile-wide corridor centered on the Alaska Highway. The second phase of the project consists of mapping bedrock and surficial geology and evaluating geologic hazards and resources. The surficial-geology and geologic hazards parts of the project are described separately.

The bedrock portion of the project includes 1:63,360-scale bedrock geologic mapping and mineral-resource assessment work. In 2006 and 2007, DGGS conducted geologic fieldwork between Delta Junction and Dot Lake, in 2008 between Dot Lake and Tetlin Junction, in 2009 between Tetlin Junction and the Canada border, and in 2010 final field checking from Delta Junction to the border. The 2008 portion of the corridor is particularly significant because of its close proximity to the active Denali fault, approximately 25 miles to the southwest in the Alaska Range. DGGS determined the location and kinematics of many smaller-scale, potentially active faults related to the Denali fault system within the corridor, and this data will provide a better understanding of the history and potential impacts of these faults.



The bedrock maps incorporate interpretations of DGGS's airborne magnetic and resistivity data, field data, and various scientific analytical data. The geophysical data are particularly valuable for interpreting the geology in areas covered by surficial deposits or vegetation. Preliminary results from 2009 fieldwork show a continuation of geologic relationships determined by 2006–2008 fieldwork, along with new features and interpretations. Numerous plutonic rock suites were defined; these plutons intruded amphibolite-facies metasedimentary and metaigneous rocks similar to those elsewhere in the Yukon–Tanana Upland, as well as a suite of greenschist-facies metasedimentary rocks and metamorphosed mafic intrusions, which likely correlate with similar units directly across the border in Canada.

These rocks have undergone several ductile to brittle deformation and faulting events. High-grade contractional ductile deformation affects rock units as young as Mississippian. Normal faulting, accommodating east–west extension, affects rock units as young as Late Cretaceous. Overprinting all of this is a complex system of younger strike-slip, reverse, and oblique faults that have affected all of the rock units. These structures accommodate overall north–south contraction with a component of right-lateral slip, similar to deformation on the Denali fault. The latest structures may have been active during the Late Cenozoic, shown by their alignment with major topographic changes, and there are similar-azimuth lineations in young sedimentary units on aerial photographs and in DGGS's airborne-geophysical data. In addition, there is evidence of Quaternary-age faulting along the northern front of the Alaska Range.

DGGS is also evaluating the mineral-resource potential of bedrock units by sampling and analyzing altered rocks to provide baseline geochemical data for use by State land managers and mineral exploration companies. Geochemical analyses for 2006–2010 fieldwork will be published in 2011. Bedrock geologic maps for the 2006–2009 corridor segments will be published in 2011; funding for this planned work consists of FY2010 CIP funding and State General Funds.

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ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
FY11 Project Description

ANNUAL ALASKA MINERAL INDUSTRY REPORT

Alaska Statute 41.08 charges the Division of Geological & Geophysical Surveys (DGGS) to *"determine the potential of Alaska land for production of metals, minerals, fuels, and geothermal resources"; "conduct such other surveys and investigations as will advance knowledge of the geology of Alaska"; and "print and publish an annual report and such other special and topical reports and maps as may be desirable for the benefit of the state."* To meet part of this goal, we gather, verify, collate, and supply statistics and summary observations about Alaska's mineral industry and release this information in a timely manner to the public in the format of an annual mineral industry report, an interim summary, and public presentations. This project supplies information to the mineral industry, provides the State and the public with valuable data pertaining to the health of Alaska's mineral industry, and fosters a better understanding of the significance of the mineral industry to Alaska's private sector and government.

The annual Alaska mineral industry report is a key source of information about exploration, development, and production of Alaska's mineral resources. Statewide and international circulation of the report and its findings at professional mineral industry conventions and trade shows, at chambers of commerce and other organizations' meetings, and in professional journals informs the general public, local and international mineral industry, and local, state, federal, and international government agencies about current activities within Alaska's mineral industry. The report serves as a barometer for the mineral industry's status in any given year and provides unbiased, authoritative information compiled in a consistent format from year to year. Government personnel rely on the report as an essential tool for formulating public policy affecting resource and land management.

The 2009 Alaska mineral industry report, released in December 2010, summarizes information provided through replies to questionnaires mailed by DGGS, phone interviews, press releases, and other information sources. The 2009 cumulative value of Alaska's mineral industry, the sum of exploration, development, and production values, was $2.966 billion, $204.2 million lower than 2008's value of $3.171 billion. This was the fourth consecutive year that the cumulative value topped $2 billion and the 14th straight year that Alaska's mineral industry topped $1 billion. Exploration expenditures for 2009 were $180 million, approximately one-third of the United States total, but a 48 percent drop from the record $347.3 million expended on exploration in 2008. Development expenditures amounted to $330.8 million, down 17 percent from the $396.2 million spent in 2008; and the value of mineral production was $2,455.6 million, with production volumes of most metals increasing from 2008 amounts. Alaska's mineral industry value will likely increase in 2010 due to improving metal prices and new mines starting production in 2010.

The annual mineral industry report has been published for 28 consecutive years as a cooperative venture between the Department of Natural Resources' (DNR) Division of Geological & Geophysical Surveys, and the Office of Economic Development (OED) in the Department of Commerce, Community & Economic Development (DCED). A summary of the 2010 Alaska mineral industry activities will be released by February 2011. The 2010 Alaska mineral industry report will be released by early November 2011.

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ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
FY11 Project Description

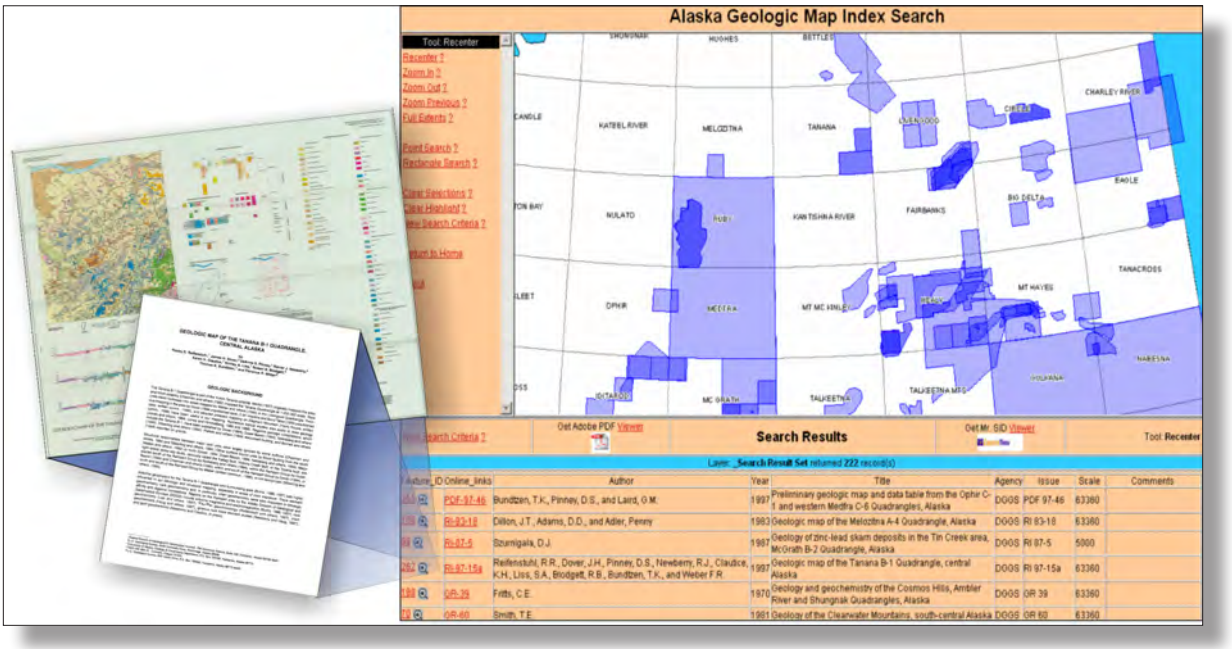
ALASKA GEOLOGICAL AND GEOPHYSICAL MAP INDEX

In 2003 the Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS) and Land Records Information Section (LRIS; now Information Resource Management) released the first version of a Web application that will ultimately provide the locations and outlines of Alaska geologic maps from all government agencies in a single, interactive, Internet-accessible location. The "Alaska Geology Map Index" site (http:maps.akgeology.info/) currently contains about 300 citations and outlines for DGGS-authored geologic maps. About 900 additional U.S. Geological Survey (USGS) and DGGS geologic map outlines and associated bibliographic references have been compiled and are being categorized and checked for errors. The 1,200 outlines will be uploaded into DGGS's central Oracle database during 2010 and 2011. DGGS intends to add outlines for remaining geologic maps by DGGS, U.S. Geological Survey (USGS), U.S. Bureau of Mines (BOM), and U.S. Bureau of Land Management (BLM), and geophysical maps by DGGS and other agencies in future years.

Currently, no up-to-date geographic index of Alaska geologic maps exists. Internet access to the current status of geological and geophysical maps of Alaska will make it easier for the public and government agencies to more quickly find the maps they need to make informed resource- and land-management decisions. The categorized database provides an effective means of searching for maps of particular interest. For example, geologic hazard-related maps will be harvested from the Map Index database to help create the comprehensive map-based interface, "Online Guide to Geologic Hazards in Alaska." This project is described separately under the Alaska Coastal Management Program.

DGGS anticipates upgrading the Map Index interface to a fully integrated map- and text-based search application based on real-time data served from DGGS's central Oracle database. The user will be able to: (1) retrieve subsets of map outlines based on map categories (bedrock geology, surficial geology, resources–metals–lode, hazards–permafrost, etc.) or metadata (scale, publishing organization, publication date, etc.); (2) view the results in an interactive map interface and listing; and (3) re-query the results by either a text search or map selection. The interface will also provide links to downloadable digital reports and maps for each citation, where available. Some of these functions are available at this time, but the capability of the interface, number of maps available, and currency of the data will be greatly improved.

The project was initiated with funding from the Federal Minerals Data and Information Rescue in Alaska (MDIRA) program and is now supported by State General Funds. The primary objective of the MDIRA program was to ensure that all available Alaska minerals-related data are preserved in a safe and readily accessible format for all potential users. DGGS is applying for additional support from the National Geological & Geophysical Data Preservation Program of USGS.



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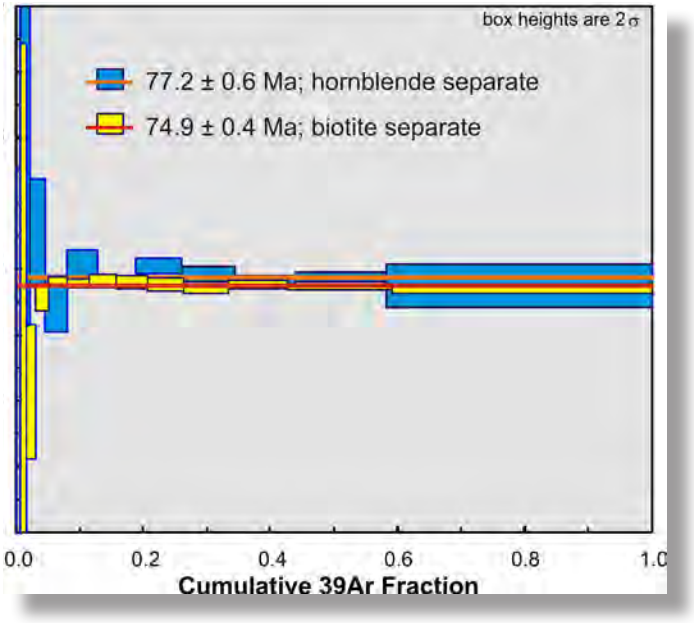
GEOCHRONOLOGIC DATABASE FOR ALASKA

In 2005, the Alaska Division of Geological & Geophysical Surveys (DGGS) initiated development of a comprehensive geochronologic database for Alaska. The geochronologic database contains summary interpretive and detailed analytical data and associated information for all available radiometric ages of rocks and minerals in Alaska. The objective of this project is to expand the most-current existing compilations of radiometric data and to make this age information widely accessible to private industry, academia, and government. This project was initially funded through the Federal Minerals Data and Information Rescue in Alaska (MDIRA) program and in 2010 was supported by State General Funds and the National Geological and Geophysical Data Preservation Program (NGGDPP). The primary objective of the MDIRA program is to ensure that all available Alaska minerals data are securely archived in perpetuity and in a format readily accessible by all potential users. Information on mineral resources is important for management policy decisions in both the public and private sectors. Increased use of high-quality data should lead to better economic, legislative, and environmental decisions.

The compilation includes information for all available U-Pb, K-Ar, $^{40}Ar/^{39}Ar$, and Rb-Sr ages of Alaska samples. Radiometric ages are compiled from both published and unpublished sources. Essential basic supporting information that is currently not easily accessible was harvested from original publications, student theses, industry records, and laboratory archives. This detailed information includes raw analytical data, standards, constants used in calculations, analytical laboratory, analyst, sample preparation and processing steps, sampling agency and geologist, and sample context and descriptions. To date, more than 4,925 age records have been compiled.

In 2009, DGGS loaded the compiled geochronologic data into its central Oracle database. In 2010, DGGS created a beta-version Web Feature Service (WFS) containing age sample locations, basic metadata, and references to the appropriate original publications that were harvested by the National Digital Catalog (http:datapreservation.usgs.gov/catalog.shtml). WFS data are served online in real time directly from DGGS's Digital Geologic Database described on p. 73 and are importable into Geographic Information Systems (GIS) software. Current efforts include documentation of data fields, creation of record-level metadata, and development of a WFS-type data release with instructions for GIS users. In 2011, DGGS anticipates upgrading the WFS with summary age data and publishing a report of all summary geochronologic data in the central database. The final stage of the geochronology project will be to make these data fully accessible via an interactive, map- and text-based search application on DGGS's website and through a link on the MDIRA website (http:akgeology.info). DGGS's central database will serve as a repository for future Alaska radiometric data and provide an authoritative, up-to-date, digital source of this important geologic information.



Age spectra plot generated from detailed $^{40}Ar/^{39}Ar$ age data stored in the geochronologic database.

Table 1. Example summary table information for an $^{40}Ar/^{39}Ar$ sample.

Analytical Method	Sample Number	Latitude	Longitude	Estimated Location Error	Age	Lithology	Dated Material	Age Interpretation	Age Type	Citation	Link
40Ar/39Ar	1999JS59A	62.3	-149.13	100	77.2 ± .6 Ma	quartz diorite	mineral separate: hornblende	igneous crystallization	plateau	PIR 2002-4	http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=7144
40Ar/39Ar	1999JS59A	62.3	-149.13	100	74.9 ± .4 Ma	quartz diorite	mineral separate: biotite	igneous crystallization	plateau	PIR 2002-4	http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=7144

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