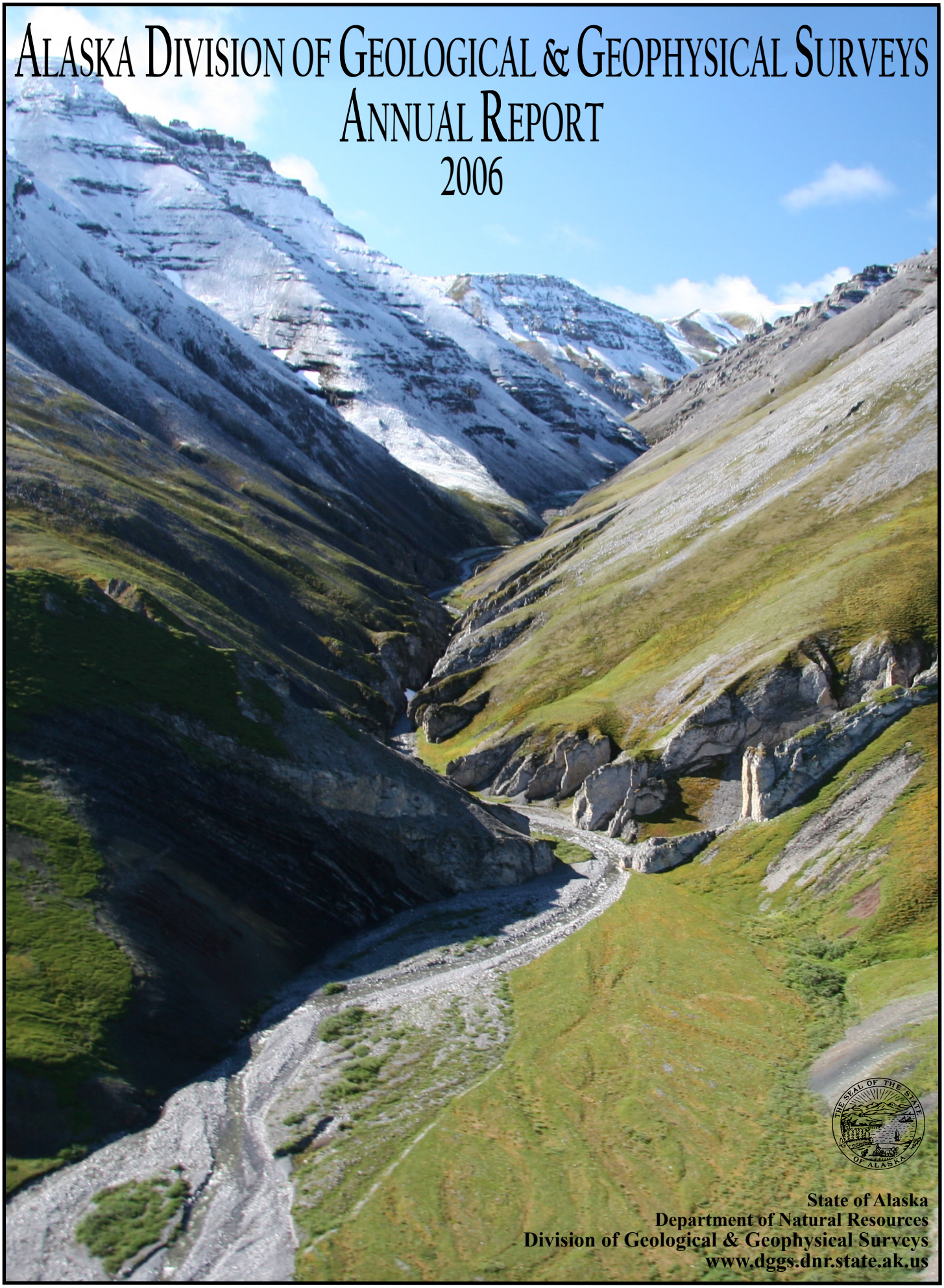
Alaska Division of Geological & Geophysical Surveys
Annual Report
2006



State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
www.dggs.dnr.state.ak.us

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Annual Report
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Cover Photo: View looking to the southeast along Skimo Creek in central Brooks Range foothills. Here, gently south-dipping Lisburne group carbonates at the skyline roll over into a vertical forelimb of this large asymmetric mountain-front fold. The dark bedded strata in the foreground are Permian age Siksikupk Formation which unconformably overlies the Mississippian to lower Pennsylvanian age carbonates. This sequence of exposures provides critical data and insight into the depositional environments, deformation history, and exploration potential of the region. *Photo by Rocky R. Reifenstuhl.*

State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
February 2007

STATE OF ALASKA
Sarah Palin, *Governor*

DEPARTMENT OF NATURAL RESOURCES
Marty Rutherford, *Acting Commissioner*

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
Robert F. Swenson, *State Geologist and Acting Director*

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Address mail orders to the Fairbanks office.

Alaska Division of Geological
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Fairbanks, Alaska 99709-3707

University of Alaska Anchorage Library
3211 Providence Drive
Anchorage, Alaska 99508

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University of Alaska Fairbanks
Fairbanks, Alaska 99775-1005

Alaska Resource Library
3150 C Street, Suite 100
Anchorage, Alaska 99503

Alaska State Library
State Office Building, 8th Floor
333 Willoughby Avenue
Juneau, Alaska 99811-0571

Publication of this report is required by Alaska Statute 41.08.

CONTENTS

FIGURE

Commissioner's Foreword

In order to manage and develop our natural resources for the maximum benefit of Alaskans, we must know what we have. That means knowing what resources have been discovered and proven, as well as what potential exists for new resources that may be awaiting discovery. Similarly, to provide for the public safety of our citizens and the infrastructure on which they depend, we must understand the geologic processes that put **people** at risk from natural hazards.

Collecting and providing information about the state's geologic resources and hazards is the mission of DNR's Division of Geological & Geophysical Surveys (DGGS). DGGS fulfils this mission in a number of ways, including field work in coordination with the Division of Oil and Gas, the Division of Mining, Land & Water and other agencies, and an ambitious program of resource evaluation, geological hazards identification, research, publication, and outreach.

The phenomenal growth in the number of requests to the DGGS website for geological and geophysical information—a more than 20-fold increase during the past two years—attests to not only the success of the division's geoscience information collection and distribution programs, but also the growing demand for basic information about the state's geology in all sectors, public and private. The fruits of this success, along with continued high commodity prices, help fuel the continuing strong interest from around the world in Alaska as a treasure house of oil and gas, coal and other geologic resources.

As you will read in the following report, 2006 held many challenges and successes for the Division of Geological & Geophysical Surveys. I am especially proud that our primary success lies in maintaining our commitment to manage Alaska's resources according to sound scientific principles. By building on this foundation, the Division is providing the geologic information and analysis necessary for Alaska to support a strong resource industry, a safe and secure public, and a healthy environment.

MartyK. Rutherford, Acting Commissioner, Department of Natural Resources

Director's Foreword

I hope you enjoy reviewing the 2006 program accomplishments of the Alaska Division of Geological & Geophysical Surveys (DGGS). This past year has been challenging on many fronts, but also very exciting and rewarding. The programs and new initiatives outlined in this report are producing results that are critical for the economic well-being of the state. Continued safety of Alaskan citizenry and visitors is being accomplished through continual monitoring and scientific analysis of the many potential geologic hazards. Identification of new resource-rich areas is helping spur a resurgence in exploration activity, and the tremendous amount of data being generated by these programs is being distributed in a timely and efficient manner to a growing user base through our world-class website and data distribution system. I am very proud of the dedicated staff at DGGS and of the continued diligence in providing the information necessary to keep DDGS one of the premier geological surveys of the nation.

As is the case for most organizations, customer statistics tell an important story and provide insight into the goals being pursued and product being generated. We are very pleased to report that a 20-fold increase in the number of user sessions at DGGS-managed websites has been recorded over the past 2 years. There were more than 5 million user sessions on the DGGS and Alaska Volcano Observatory websites alone; in addition, we have seen a dramatic increase in the number of geologic information accesses with more than 300,000 downloads from our expanded datasets. Obviously, the staff at DGGS has been very busy producing critical information that remains in high demand.

Geologic field studies and detailed geologic mapping are the cornerstones of sound geologic knowledge. This information in turn provides a backbone for policies that encourage responsible resource management. DGGS worked diligently this year to meet the increased demand for scientific information and safely managed six geologic field programs in remote locations across the state, a significant undertaking. Data associated with this work are already showing tangible results in resource development, infrastructure design, and public safety.

The Energy Resources section performed studies in the Kavik River area of the Brooks Range foothills and held a successful industry sponsor tour, taking numerous industry geologists and representatives to critical areas exposing the newly discovered geologic relationships that increase our understanding of the geology and natural gas accumulations of the area. The frontier basins team began work on a multi-year study of the Cook Inlet basin, and made immediate advances in its knowledge of basin-edge geometry and depositional systems. The Minerals Resource section finalized a three-season mapping effort in the Council area of the Seward Peninsula. These detailed geologic maps made use of the DGGS high-resolution geophysical data and have greatly enhanced our understanding of the geology in this historic mining district. New geophysical data were acquired in the Alaska Range and more than 5,400 square miles of new airborne geophysical data were interpreted and published. The Engineering Geology Section had a very busy year dealing with myriad geohazard-related issues and programs including the Augustine eruption response, tsunami-inundation mapping, coastal zone management reviews, and geologic mapping along the pipeline corridor. Our educational outreach program, MapTEACH, performed its first successful pilot test, which resulted in student project presentations being invited to a national meeting in Oregon.

Our Geologic Communications section published 140 new geological and geophysical maps and reports and kept the industry and public informed through data distribution and information response. The DGGS Web site has received a significant amount of positive press because of the great job our staff is doing in both design and ease of data access. The Geologic Materials Center continued to accept samples from across the state and industry, and to protect this valuable asset for current and future geologists and resource developers.

The year 2006 was clearly a busy and exciting one at the Division of Geological & Geophysical Surveys and we look forward to providing you with the latest up-to-date information on the geology of the state of Alaska.

Robert Swenson, State Geologist and Acting Director, Division of Geological & Geophysical Surveys

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
ANNUAL REPORT 2006

INTRODUCTION

MISSION STATEMENTS

DEPARTMENT OF NATURAL RESOURCES
Mission: *Develop, conserve, and enhance natural resources for present and future Alaskans*

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
Mission: *Determine the potential of Alaskan land for production of metals, minerals, fuels, and geothermal resources, the locations and supplies of groundwater and construction material; and the potential geologic hazards to buildings, roads, bridges, and other installations and structures (AS 41.08.020)*

HISTORY

The present Division of Geological & Geophysical Surveys (DGGS) evolved from Alaska's Territorial Department of Mines. That heritage is reflected in the Division's ongoing commitment to the application of geology to improve the welfare of Alaska citizens. The current name and mission of the Division were established in 1972 with the passage of Alaska Statute AS 41.08.

Territorial Department of Mines, 1959
Division of Mines and Minerals, 1959–1966
Division of Mines and Geology, 1966–1970
Division of Geological Survey, 1970–1972
Division of Geological & Geophysical Surveys, 1972–Present

LEADERSHIP

Ten qualified professional geoscientists have served as State Geologist:
Jim Williams, 1959–1971
William Fackler, 1971–1973
Donald Hartman, 1973–1975
Ross G. Schaff, 1975–1986
Robert B. Forbes, 1987–1990
Thomas E. Smith, 1991–1995
Milton A. Wiltse, 1995–2002
Rodney A. Combellick, 2003–January 2005
Mark D. Myers, February–October 2005
Robert F. Swenson, November 2005–present

By statute the State Geologist serves as the Director of the Division of Geological & Geophysical Surveys in the Department of Natural Resources (DNR) and is appointed by the DNR Commissioner. Since the early 1970s, the State Geologists have been selected from lists of candidates prepared by the geologic community and professional societies within Alaska. A department order in 2002 formalized a process whereby the Geologic Mapping Advisory Board oversees evaluation of candidates and provides a list to the Commissioner. The qualifications and responsibilities of the State Geologist and the mission of DGGS are defined by statute.

STATUTORY AUTHORITY

Alaska Statutes Sec. 41.08.010. Division of geological and geophysical surveys. There is established in the Department of Natural Resources a Division of geological and geophysical surveys under the direction of the state geologist. (1 ch 93 SLA 1972)

Sec. 41.08.015. State geologist. The commissioner of natural resources shall appoint the state geologist, who must be qualified by education and experience to direct the activities of the Division. (1 ch 93 SLA 1972)

Sec. 41.08.020. Powers and duties. (a) The state geologist shall conduct geological and geophysical surveys to determine the potential of Alaskan land for production of metals, minerals, fuels, and geothermal resources; the locations and supplies of groundwater and construction materials; the potential geologic hazards to buildings, roads, bridges and other installations and structures; and shall conduct such other surveys and investigations as will advance knowledge of the geology of Alaska. With the approval of the commissioner, the state geologist may acquire, by gift or purchase, geological and geophysical reports, surveys and similar information.

Sec. 41.08.030. Printing and distribution of reports. The state geologist shall 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, including the printing or reprinting of reports and maps made

by other persons or agencies, where authorization to do so is obtained. Reports and maps may be sold and all money received from these sales shall be paid into the general fund. (§ I ch 93 SLA 1972)

LOCATION

The Division's administrative headquarters and personnel were moved to Fairbanks in 1987. The close proximity of the Division to the earth science research laboratories of the University of Alaska Fairbanks campus has a strategic benefit to the DGGS program. University staff and students are important adjunct members of many DGGS project teams.

Current DGGS staff totals 34 permanent full-time professional and support personnel, four non-permanent professional geologists, a Director, Deputy Director, and five student interns hired through the State of Alaska internship program.

DGGS operates the Alaska Geologic Materials Center in Eagle River, Alaska, staffed by two professional geologists.

ORGANIZATION

DGGS is one of seven divisions and six offices in the Alaska Department of Natural Resources. Under the overall administration of the Director's Office, the Division of Geological & Geophysical Surveys is organized into four sections and the Geologic Materials Center (fig. 1). The Division also administers the Alaska Seismic Hazards Safety Commission.

Division of Geological & Geophysical Surveys offices in Fairbanks

Geologic Materials Center in Eagle River

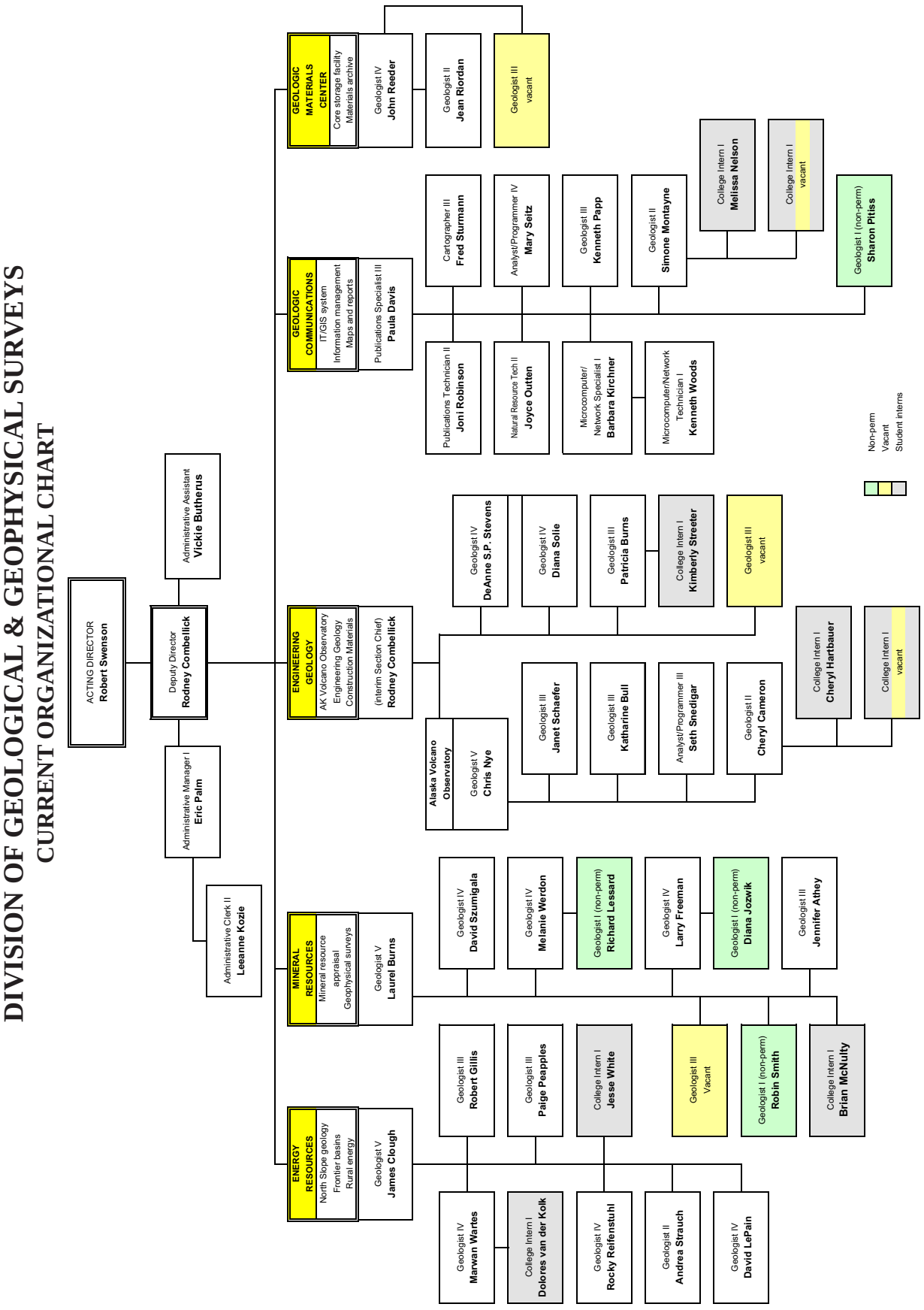


Figure 1. *Organizational chart for the Alaska Division of Geological & Geophysical Surveys.*

The **Director's Office** provides strategic planning for the Division's programs to ensure that DGGS is meeting the needs of the public within the guidelines of AS 41.08.020, manages the Division's fiscal affairs, and provides personnel and clerical services. The Director acts as a liaison between the Division and local, state, federal, and private agencies; seeks out and encourages cooperative geologic programs of value to the state; and advises the Commissioner of the Department of Natural Resources about geologic issues.

L TO R: Eric Palm, LeeAnne Kozie, Rod Combellick, Bob Swenson, Vickie Butherus

The **Energy Resources Section** generates new information about the geologic framework of frontier areas that may host undiscovered oil, gas, or coal, or geothermal resources. Summary maps and reports illustrate the geology of the state's prospective energy basins and provide data relating to the location, type, and potential of the state's energy resources. The Energy Resources Section seeks to improve the success of state-revenue-generating commercial oil and gas exploration and development and to identify local sources of energy for rural Alaska villages and enterprises.

BACK L TO R: Andrea Strauch, Jim Clough, Jesse White, Marwan Wartes, Rocky Reifenstuhl, Dave LePain
FRONT L TO R: Paige Peapples, Dolores van der Kolk, Bob Gillis

The **Mineral Resources Section** collects, analyzes, and makes available information on the geologic and geophysical framework of Alaska as it pertains to the mineral resources of the state. Summary maps and reports illustrate the geology of the state's prospective mineral terranes and provide data on the location, type, and potential of the state's mineral resources. The Mineral Resources Section seeks to improve the success of mineral discovery in Alaska so that new employment opportunities are created for Alaska's citizens.

BACK L TO R: Richard Lessard, Melanie Werdon, Dave Szumigala, Larry Freeman
FRONT L TO R: Laurel Burns, Robin Smith, Diana Jozwik, Jen Athey

BACK L TO R: DeAnne Stevens, Janet Schaefer, Cheryl Cameron, Kim Streeter, Chris Nye
FRONT L TO R: Kate Bull, Patty Burns, Seth Snedigar
INSET: Diana Solie

The **Engineering Geology Section** collects, analyzes, and compiles geologic data useful for engineering and hazard-mitigation purposes. Surficial-geologic maps portray the distribution of unconsolidated surficial geologic materials and provide information on their engineering properties and potential as construction-materials sources. Studies of major geologic hazards such as earthquakes and volcanoes result in reports outlining potential hazards in susceptible areas and estimated frequencies of occurrence.

BACK L TO R: Sharon Pitiss, Ken Papp, Susan Seitz, Joni Robinson, Joyce Outten, Fred Sturmann, Bobby Kirchner
FRONT L TO R: Paula Davis, Ken Woods, Simone Montayne

The **Geologic Communications Section** has the primary responsibility for transferring Division-generated geologic information to the public and for maintaining and improving public access to Alaska-related geologic information. Increased utilization of computer technology is resulting in faster preparation of maps and reports and a wider awareness of Alaska geologic information available at DGGS. This section manages the design and implementation of a computer-hosted database for the Division's digital and map-based geologic and geophysical data, as well as the Division's website <www.dggs.dnr.state.ak.us> and the Alaska Seismic Hazards Safety Commission website <www.dggs.dnr.state.ak.us/seismic_hazards_safety_commission.htm>.

John Reeder, Jean Riordan

The **Geologic Materials Center** is the state's single central repository for representative geologic samples of oil- and gas-related well cores and cuttings, mineral deposit core samples, and regional geologic voucher samples. These materials are routinely used by industry to enhance the effectiveness and success of private-sector energy and mineral exploration ventures. New materials are continuously acquired. Access to the materials at the GMC is free. To ensure that the value of the GMC holdings is maintained over time, any new data or processed samples generated from privately funded analyses of the geologic materials stored there must be donated to the GMC database.

The **Alaska Seismic Hazards Safety Commission** is charged by statute (AS 44.37.067) to recommend goals and priorities for seismic risk mitigation to the public and private sectors and to advise the Governor and Legislature on policies to reduce the state's vulnerability to earthquakes and tsunamis. The Commission is administered by DGGS and consists of 11 members appointed by the Governor from the public and private sectors for three-year terms. The Commission produces a separate annual report to the Governor and Legislature.

RELATIONSHIPS WITH OTHER STATE AGENCIES

DGGS provides other DNR agencies with routine analyses and reviews of various geologic issues such as geologic-hazards evaluations of pending oil lease tracts; competitive coal leases; geologic assessments of land trades, selections, or relinquishments; mineral potential; and construction materials availability. DGGS's interaction with the Land Records Information Section in the DNR Support Services Division continues to increase as more geologic data are compiled and organized in digital format amenable to merging with other land information. The DGGS Energy Resources Section works closely with geologic personnel in the Division of Oil and Gas (DOG) on issues related to energy resources and in providing geologic control for the subsurface oil-related geologic analyses conducted by DOG. Each year DGGS prepares an annual report on the status of Alaska's mineral industry in cooperation with the Office of Economic Development in the Department of Commerce, Community & Economic Development. The Engineering Geology section works closely with Division of Homeland Security & Emergency Management in the Department of Military and Veterans Affairs to evaluate hazards, develop scenarios for hazards events, and prepare the State Hazard Mitigation Plan. Additionally, the Engineering Geology section participates in the Alaska Coastal Management Program to advise on geologic hazards issues and review coastal district plans and project applications.

Funding to support work requested by other DNR agencies mostly has been drawn from DGGS's yearly general fund appropriation. For larger inter-division efforts, however, the work is supported by interagency fund transfers, Capital Improvement Project (CIP) funding, federal cooperative agreements, or private industry grants that supplement DGGS's general funds.

RELATIONSHIPS WITH LOCAL GOVERNMENTS

Most of the cooperative efforts implemented by DGGS with borough and municipal governments are conducted on a mutually beneficial but informal basis. For example, DGGS participates in a federally funded cooperative program to develop tsunami-inundation maps for coastal communities. In Kodiak, Homer, and Seldovia, the first communities for which maps were prepared, the City and Borough governments worked closely with DGGS and other project cooperators to help design the project outputs to best benefit their needs for planning evacuation areas and routes. Similar cooperative efforts are currently underway with Seward and Sitka for the next tsunami-inundation maps to be generated by this program. The Engineering Geology section has also worked closely with rural communities such as Minto, Nome, and Nenana to develop a field-geoscience outreach program for middle- and high-school students in rural Alaska. Similarly, the Energy Resources section has worked closely with rural communities to help assess local potential for shallow gas as a potential energy source.

RELATIONSHIP WITH THE UNIVERSITY OF ALASKA

DGGS has had a long and productive professional association with geoscientists and students in various departments of the University of Alaska. University of Alaska faculty work as project team members on DGGS projects and provide special analytical skills for generating stratigraphic, structural, geochemical, and radiometric-age data. University students employed as DNR/DGGS interns also are an important part of the DGGS work force. While working on current DGGS projects, the students learn a wide variety of geology-related skills ranging from conventional geologic mapping and sample preparation techniques to modern digital database creation and geographic information systems. Some students are able to apply their DGGS intern work to their graduate thesis projects. DGGS and the University make frequent use of each other's libraries and equipment.

RELATIONSHIPS WITH FEDERAL AGENCIES

DGGS has ongoing cooperative programs with the U.S. Geological Survey (USGS), the U.S. Bureau of Land Management (BLM), and the U.S. Department of Energy. Periodically, in the past, DGGS has also engaged in cooperative programs with the U.S. Minerals Management Service (MMS) and National Aeronautics and Space Administration (NASA). Recently DGGS was successful in receiving its first-ever funding from the National Science Foundation through a highly competitive proposal process. DGGS receives some federal funds from matching grants for which we must compete nationally with other organizations on a yearly basis. In the past we have been successful in securing funds to support mineral inventory mapping, surficial and earthquake hazards-related mapping, volcanic-hazards evaluations, and studies related to oil and gas potential. Although DGGS has historically been very successful in receiving federal grants and appropriations, the process is highly competitive and these funds are therefore project specific or complementary to state-funded programs and do not replace state General Fund money. Federal funding is pursued only for projects that are needed to advance the division's statutory mission.

Three ongoing cooperative programs with federal agencies have provided support for key elements of the DGGS mission in recent years. One is the Alaska Volcano Observatory (AVO), a partnership of USGS, DGGS, and the University of Alaska Fairbanks Geophysical Institute that was established in 1988. The USGS funds and administers the program for the purpose of providing a coordinated approach to mitigating volcano hazard risks to the public, the state infrastructure, and air commerce. A second longstanding cooperative federal program is the STATEMAP component of the National Cooperative Geologic Mapping Program, established by Congress in 1992 and also administered by USGS. STATEMAP provides matching funds for geologic-mapping projects according to priorities set by the Geologic Mapping Advisory Board (see below). A third major federal program is the Minerals Data & Information Rescue in Alaska (MDIRA) program, established by Congress in 1997. DGGS conducts numerous MDIRA projects, administered by USGS, for the purpose of recovering, indexing, archiving, and making publicly available minerals information at risk of becoming lost due to downsizing of public and private minerals-related programs.

ALASKA GEOLOGIC MAPPING ADVISORY BOARD

The Alaska Geologic Mapping Advisory Board guides DGGS in pursuing its goal of providing earth science information to the Alaska public. A number of prominent geologists and community leaders, with a variety of backgrounds and a broad spectrum of experience in Alaska, have agreed to serve on the advisory board. The purpose of the board is multifold:

- To identify strategic geologic issues that should be addressed by the state.
- To inquire into matters of community interest relating to Alaska geology.
- To provide a forum for collection and expression of opinions and recommendations relating to geologic investigation and mapping programs for Alaska.
- To make recommendations toward identifying Alaska's diverse resources and promoting an orderly and prudent inventory of those resources.

- To increase public awareness of the importance of geology to the state's economy and to the public's health and safety.
- To promote communication among the general public, other government agencies, private corporations, and other groups that have an interest in the geology and subsurface resources of Alaska.
- To facilitate cooperative agreements between DGGS and other agencies, professional organizations, and private enterprise to develop data repositories and enhance the state's resource inventory and engineering geology programs.
- To communicate with public officials as representatives of groups interested in the acquisition of Alaska geologic information.
- To enlist public and legislative support for statewide geologic resource inventories and engineering geology programs.

The board held its first meeting in Fairbanks on October 22, 1995, and meets at least three times a year to discuss state needs, review DGGS programs, and provide recommendations to the State Geologist. The members solicit and welcome comments and suggestions from the public concerning state needs and DGGS programs throughout the year.

Members of the board are:

Jim Rooney
R & M Consultants, representing the engineering geology and geotechnical community
James W. Rooney, P.E., is President of R & M Consultants, Inc., and an original partner of this Alaskan engineering firm that celebrated its 35th year in business in 2004.

Curt Freeman
Avalon Development Corporation, representing the minerals industry
Curt Freeman is President of Avalon Development Corporation, a consulting mineral exploration firm based in Fairbanks, Alaska.

David Hite
Hite Consultants, representing the energy industry
Dr. David Hite is based in Anchorage, Alaska, and has extensive knowledge of the geologic issues associated with Alaska's oil industry.

Paul Layer
University of Alaska Fairbanks Department of Geology and Geophysics, representing the academic community
Dr. Paul Layer is an Associate Professor of Geophysics at the University of Alaska Fairbanks and former Head of the Department of Geology and Geophysics.

Irene Anderson
Bering Straits Native Corporation, representing rural Alaskans in western Alaska
Irene Anderson is the Assistant Land Manager for Bering Straits Native Corporation. Mrs. Anderson has first-hand knowledge of the mineral, energy, and engineering geology needs throughout a wide region of rural Alaska.

Greg Beischer
Bristol Environmental & Engineering Services Corporation, a wholly owned subsidiary of Bristol Bay Native Corporation
Greg Beischer is a geologist and mining engineering technologist with 17 years of experience in the industry, specializing in exploration, development, and management of mineral resources.

FY2006 ACCOMPLISHMENTS

The Division of Geological & Geophysical Surveys (DGGS) is charged by state statute to generate new, objective, peer-reviewed information about the geology of Alaska, the potential of Alaska's land for production of minerals, fuels, and construction materials, and the potential geologic hazards to its people and infrastructure. As in past years, in FY2006 the Division successfully pursued multiple funding avenues to finance geological and geophysical mineral inventory mapping, generate new geologic data to support energy exploration, conduct hazard investigations, expand volcano monitoring in the Alaska Peninsula and Aleutian Islands, and streamline geologic data archival and dissemination.

MAJOR ACCOMPLISHMENTS IN FY2006

Energy Resources

- Conducted structural and stratigraphic studies on the North Slope in collaboration with the Division of Oil & Gas and U.S. Geological Survey, collecting geologic data relevant to assessing the **hydrocarbon potential of the Brooks Range foothills**. This work is funded in part through contributions from oil and gas companies.
- Initiated new **bedrock geologic mapping** for a one-year project in the **Kavik River and Canning River areas** in the Brooks Range foothills region of the eastern North Slope. The new bed-

rock mapping is conducted in conjunction with ongoing petroleum resource evaluations and the federal STATEMAP program for use by industry and government in lease sales on state and federal lands.

- Conducted **detailed outcrop studies** at remote locations along the **Colville River** to investigate the sequence stratigraphy and depositional variation of the Nanushuk Formation, an objective for natural gas exploration on state and federal lands in the North Slope foothills.
- Prepared a **field tour for industry geologists** at Kavik camp to present new technical results bearing on the petroleum geology of northern Alaska, including conducting a two-day geologic tour of field localities illustrating structural and stratigraphic relationships that are key to oil and gas exploration.
- Initiated a multi-year program of geologic investigations of coal-bearing strata in **Cook Inlet basin** designed to catalyze hydrocarbon exploration activity by providing relevant geologic data in the public domain. Work in FY2006 included a three-day field trip illustrating the tectonic and stratigraphic setting of oil and gas accumulations in the basin.
- Completed the second year of a three-year field program as part of a federally funded (USDOE) geologic evaluation of **petroleum potential in the Bristol Bay and Alaska Peninsula region** relevant to the newly established, annually scheduled areawide lease sales initiated in October 2005.
- Completed summary reports on 2005 field studies and on the sedimentology, stratigraphy, and hydrocarbon reservoir-source rock potential using surface and subsurface data from Bristol Bay Basin and Alaska Peninsula.
- Completed a summary report of investigations addressing **reservoir characterization of the Yukon Flats Basin**.
- Completed a summary report on the geology of the 2004 **Fort Yukon slim-hole drill core** as part of a U.S. Department of Energy-funded project to assess shallow gas potential in rural Alaska.
- Evaluated **coal deposits near Eek River** in the Bethel region during the final year of a three-year study of remote coal occurrences in Southwest and Southeast Alaska as part of DGGS participation in the USGS National Coal Resource Database System program. This program is designed to record all known coal occurrences in Alaska and archive the information into a single, readily accessible database. The final report for this study will be released in FY2007.
- Co-organized four **technical sessions related to Alaska's oil and gas basins** at the joint meeting of the American of Association of Petroleum Geologists–Geological Society of America, *North to Alaska: Geoscience, Technology and Natural Resources*, held in Anchorage, May 2006. Also at this conference, co-organized a Society of Petroleum Engineers round table discussion focusing on Alaskan issues facing oil and gas independent companies and consultants.

Mineral Resources

- In collaboration with the Alaska Department of Commerce, Community and Economic Development, completed ***Alaska's Mineral Industry*** (Special Report 60), an authoritative annual report of statewide mining activity.
- Completed analysis and draft publication of the bedrock- and surficial-geologic mapping of 130 square miles of the **Liberty Bell airborne-geophysical survey tract**. The publication will be released during the first half of FY2007.
- Initiated the ground-truth bedrock- and surficial-geologic mapping project of 300 square miles of the **Council mining district** airborne-geophysical survey tract.
- Released **airborne-geophysical surveys** of 918 square miles of mineral districts near Fairbanks, Richardson, and Black Mountain (near the Pogo gold deposit) in Interior Alaska.
- Released airborne-geophysical surveys of 1,447 square miles of the **southern National Petroleum Reserve–Alaska (NPRA)**. This project is funded by the U.S. Bureau of Land Management; data will be used to aid land management recommendations and decisions.
- Released airborne geophysical surveys of 3,116 square miles along part of the **Alaska Highway Corridor** between Delta Junction and the Canadian border. The survey parameters were designed to help delineate potential geologic hazards and surficial geologic resources in this important transportation corridor.
- Initiated airborne geophysical surveys of 602 square miles of the **Bonnifield mining district** east of Healy in Interior Alaska.

Engineering Geology & Construction Materials

- Initiated geologic mapping and **geologic-hazards study of the proposed natural gas pipeline corridor** along the Alaska Highway within the area covered by the airborne-geophysical survey. The multi-year study includes bedrock- and surficial-geologic mapping; evaluation of geologic hazards

such as potentially active faults, landslides, permafrost, and liquefaction; and identification of construction materials and mineral resource potential.

- Published surficial-geologic mapping of **268 square miles of the Council mining district** airborne-geophysical survey tract.
- Initiated surficial-geologic mapping project of an **additional 300 square miles of the Council mining district** airborne-geophysical survey tract.
- Supported the Alaska Coastal Management Plan (ACMP) by providing **natural hazards review** for the List of Expedited Consistency Reviews and State Authorizations Subject to the ACMP (the "ABC List") and a presentation on the **use of geologic maps for natural-hazard identification** at the annual ACMP Regional District Workshop.
- Completed year 2 of **MapTEACH** (*Mapping Technology Experiences with Alaska's Cultural Heritage*), a pilot project funded by the National Science Foundation (NSF) to develop an educational program for middle- and high-school students in Alaska emphasizing hands-on experience with geospatial technology (GPS, GIS, and remote sensing imagery) in conjunction with traditional activities and geoscience. The project is a collaborative effort with the University of Alaska Fairbanks and University of Wisconsin Madison.
- Led Alaska Volcano Observatory field studies at **Chiginagak Volcano**, Alaska Peninsula, focusing on natural acid crater lake drainage and its severe impact on Mother Goose Lake and King Salmon River.
- Conducted geologic field mapping at **Emmons Lake volcanic center** (including Pavlof, Pavlof Sister, Emmons, and Hague volcanoes) and initiated new mapping at **Frosty Volcano**.
- Participated in a one-month-long oceanographic cruise in the **western Aleutians** that imaged and sampled dozens of previously unknown submarine volcanoes.
- Participated in the response to 2005 unrest and 2006 eruption of **Augustine Volcano**, including serving as Media/Communications Coordinator on the AVO Augustine Crisis Response Team.
- Provided helicopter and ship purchasing and **logistical coordination** for Alaska Volcano Observatory (AVO) field operations. New geologic work and seismic network installations at Semisopochnoi and Little Sitkin volcanoes were a major effort. AVO now seismically monitors 30 of 51 active Alaska volcanoes.
- Maintained the **AVO internal and external World Wide Web sites**, including designing and implementing new automated ways to handle daily and weekly notices of volcanic activity, designing and implementing intra-observatory communication tools, and updating the public site. These pages have become crucial to daily monitoring of volcanoes and are technologically at the cutting edge worldwide.
- Expanded and further developed GeoDIVA (**Geologic Database of Information on the Volcanoes of Alaska**).
- As a member of the Consortium of U.S. Volcano Observatories, participated in the development of the **National Volcano Early Warning System**, including chairing the working group writing the implementation plan for the National Volcano Data Center.

Geologic Information Management and Delivery

- Published 140 **new geologic maps** (127 geophysics, 13 geologic), 15 **new geologic reports**, and 7 **CD-ROMs** (all geophysics), including ***Alaska's Mineral Industry*** annual report for 2004, plus two newsletter issues and a pictorial calendar.
- Sold 634 **professional maps and reports**, distributed approximately 304 **free educational publications**, and responded to **more than 700 significant geologic information requests**.
- Continued the redesign of the **DGGS website** in accordance with new state standards for "look and feel" of State websites.
- Completed inventory, scanning, and web distribution of USGS Alaska-related Open-File Reports, USGS folio map series, and MIRL reports for addition to the **Geologic & Earth Resources Information Library of Alaska** (GERILA) database, achieving another major objective of the federally funded Minerals Data & Information Rescue in Alaska (MDIRA) project.
- Implemented a new **metadata writing tool** to help make writing FGDC-compliant metadata documentation for digital geological and geophysical data products less time-consuming for geologists and project authors.
- Updated the **DGGS internal website** to provide staff members with useful and current information regarding a variety of topics, including database documentation, metadata, publication processes, and major projects.
- Completed metadata documentation for 15 **legacy DGGS projects** and upgraded their products to

current standards for inclusion in the Geologic & Earth Resources Information Library of Alaska (GERILA) database.

- Loaded geochemical data from 58 publications (originating from DGGS, USGS, and other Alaska-related outside publications) into the **DGGS WebGeochem application**, making them available for public download on the DGGS website. With this latest addition, WebGeochem contains 25,144 sample analyses from a total of 73 publications.
- Converted several static DGGS web pages to dynamic, **database-driven pages**, including geophysics order forms, minerals-industry page, new reports, and pages within the Guide to Geologic Hazards in Alaska.
- Developed requirements and an operational plan for **digital distribution of DGGS data**. When programming is completed, the digital data distribution project will enable web users to download digital geologic data, including spatial data and metadata, that are stored in GERILA.

Geologic Materials Center

- Hosted **470 visitations** to the Alaska Geologic Materials Center (GMC) in Eagle River by industry, government, and academic personnel to examine rock samples and processed materials. These visitations helped generate 3,580 new processed oil and gas related microscope slides, including the U.S. Geological Survey "Irv Tailleur" petrographic thin section collection of northern Alaska oil/gas wells, and 12 hard-rock mineral and oil and gas technical data reports.
- Received, stored, and inventoried one 40-foot truck trailer of hard-rock **mineral cores from the Westmin Resources Ltd. Zarembo Island 1996 project** ("Frenchy" claim) near Wrangell, which was provided by the U.S. Forest Service through the U.S. Bureau of Land Management.
- In total, the GMC received **rock samples for more than 24 oil and gas wells**, representing 166,964 feet of well samples, and five hard-rock mineral holes (the Zarembo Island prospect), representing 2,199 feet of core in 244 core boxes.
- Added one 40-foot metal shipping container with "roof supporting" metal shelving to the Alaska GMC. This adds 1,500 cubic feet of shelving space, for a new total of **fifty-five 40-foot containers** and three additional 20-foot metal containers at the GMC.
- Completed an audit and reinventory of the entire **Alaska Oil & Gas Conservation Commission well-sample collection** at the GMC.
- The **Alaska GMC Data Reports** are now available through the Alaska Oil & Gas Conservation Commission website <http://aogweb.state.ak.us/weblink/>, along with a corresponding GMC Data Report Index.

KEY ISSUES FOR FY2007–2008

Reduction of Federal Funding for Geologic Work

- Federal budgets have shown recent trends toward reduction across all levels of government. Examples of proposed presidential budget cuts that will directly affect DGGS include: (1) Zeroing out of the Department of Interior energy and minerals related programs, and (2) USGS STATEMAP cooperative geologic mapping program cuts over the last few years, eroding our ability to leverage state funding and continue a full geologic mapping program on state lands. This erosion phenomenon is nearly ubiquitous for all of our collaborative federal programs.
- Recent changes in the chairmanship of U.S. congressional committees and reduction in the number of so-called "earmarks" have had a dramatic effect on DGGS's ability to secure funds through special appropriations. DGGS submitted four federal appropriations requests (totaling $9.7 million) over the last two years, but we were discouraged by our congressional delegation from submitting any additional requests in FFY07. We will again submit requests for the FFY08 budget, but the growing federal deficit will likely continue to have a negative effect on our overall program budget.
- Many DGGS programs that are critically important to the state and allow fulfillment of the division's mission are partially funded by federal dollars via grants and collaborative work. For example, the FY06 DGGS expense budget was nearly 60 percent federal receipts and included funding for the Minerals & Data Information Rescue in Alaska (MDIRA) project, STATEMAP geologic mapping programs, Alaska Volcano Observatory collaborative program, mineral-resources identification, and other collaboration with MMS, BLM, and USGS. Some of this federal funding is being reduced or eliminated.
- Identifying and securing new funding sources, improving our documentation and outreach effort,

and reallocating personnel to critical areas will be a key component of the coming fiscal year.

Updating and Improving the Geologic Materials Center

- A repository of rock core, samples, and data is critical for any state (or country) that relies on resource development as a key component of its economy.
- The Geologic Materials Center (GMC), located in Eagle River, is Alaska's rock data repository and is the "first stop" for any industry or academic researcher who is attempting to identify and understand the complex geology of the numerous resource-rich areas throughout Alaska.
- Providing efficient and comprehensive access to these data is critically important for viable exploration programs, for both seasoned Alaska explorers and new companies that are trying to identify potential exploration areas.
- Although the current condition of the GMC is being maintained, the facility is more than 100 percent over its sample-storage capacity, and is very poorly designed to handle the regular and frequent requests for reasonable access to the material.
- The GMC currently utilizes 55 portable containers as temporary storage facilities for recent sample acquisitions. These shipping containers are unlighted, unheated, and house thousands of feet of core, some of which will disintegrate with repeated freeze-thaw cycles. It is important to note that this collection represents hundreds of millions of dollars of acquisition and preservation costs and is in significant risk of damage or loss.
- The core and sample observation areas are essentially unusable for confidential work and examination of more than a few feet of core length. An exploration company's ability to keep their activities confidential is critical to exploration success in a fiercely competitive environment. Often the core must be taken off site for substantial projects, creating a significant security threat to the unique core, and an expensive alternative for the exploration company. All of these factors could result in a reluctance by users to make use of the facility because they must go through the onerous effort of transporting and unnecessarily handling the material at risk.
- A facility concept study, funded through a special federal appropriation, was finished in July 2006 (http://www.dggs.dnr.state.ak.us/download/gmc_concept_study_august_2006.pdf). The study identified the most feasible options for design and provided cost estimates for various configurations.
- A significant challenge for DGGS over the near term will be to convince industry, lawmakers, and government officials of the importance of upgrading this facility and providing the funding necessary to keep this critical data source safe and accessible.

Sustained High-level Commodity Prices

- Although this is very good news for State revenue as a whole, increased price structure in most natural resource commodities presents a challenge for DGGS to meet demands for geologic information.
- Dramatic increases in minerals and oil & gas exploration efforts by independent industry put a noticeable strain on all facilities and programs. Our effort to provide critical geologic data to these entities will be challenged as more and more end-users of our products demand quicker and more comprehensive response. The main challenges will arise from a static state budget and our ability to plan for the rapidly changing needs of the resource development community, and to gather the required field information in the face of rising operating costs.
- Spikes in the exploration cycle also create a situation where high-paying jobs become abundant, and opportunities for experienced geoscientists become commonplace. A significant challenge for DGGS will be our ability to attract and retain key personnel in this very competitive environment.

Serving the Geologic Needs of Rural Alaska Communities

- High energy prices have had a significant impact on the economies of rural Alaska and threaten the viability of rural infrastructure. The risk of some rural customers having their electricity shut off because of delinquent bills is in the news.
- Many remote areas of the state lack sufficient geologic information on potential alternate forms of geologic energy such as shallow natural gas, coal, geothermal, and conventional gas.
- Continued population growth and development in Alaska will continue to encroach on areas with heightened geohazard risk.
- The documented warming of the arctic climate will create dramatic changes in many surficial processes that until recently have remained unchanged for many decades. Glacial melt-back and surges, changes in permafrost, and heightened coastal and river erosion are just a few of the potential hazards that will affect many communities and infrastructure around the state.

- Recent media coverage of these phenomena points out the necessity of acquiring reliable geologic data, producing maps, and identifying risks—information that can be used in both short- and long-term planning. In some cases it will be critical to have this data available in a crisis situation.
- DGGS will be challenged to provide pertinent and timely data on numerous fronts, and plans to initiate a long-term program that addresses the existence of locally available energy sources and geologic hazards.

Geologic Mapping and Field Operations Costs

- Rising costs of field operations and a tightening of federal funding sources decrease DGGS's ability to accomplish its mission.
- Much of DGGS's most valuable work in Alaska is done in the frontier areas of the state. Our work provides the geologic framework that is used by the private sector to guide new energy and mineral exploration investments. Providing this kind of information means that our field work is moving farther away from the state's limited transportation infrastructure. This alone adds significantly to logistical supply and operational costs.
- During the past 5 years, DGGS field operation costs have risen about 50 percent for geologic mapping and more than 40 percent for airborne geophysical surveys.
- All remote field programs require fixed-wing and helicopter support for daily operations and these costs continue to rise dramatically, most specifically associated with increased fuel costs.
- A significant and continued challenge will be to provide comparable levels of critical geologic research, while limiting the impacts of a flat or declining budget.

Limited Detailed Geologic Mapping Coverage

- Alaska is a unique place in the United States. Geologically, Alaska contains by far the most diverse distribution of geologic provinces and processes.
- When compared to any other state, the geology in Alaska is still poorly understood and critically under-mapped at a reasonable scale for planning and resource exploration.
- The current coverage of 1:63,360-scale geologic maps is less than 10 percent of the total area of the state. No other state in the United States is so poorly understood geologically. This limited map coverage, when combined with escalating field costs and declining budgets, presents a major challenge to DGGS in its mission to identify potential new resource areas and foster responsible development.
- DGGS will continue to look for innovative ways to attain its goal of geologically mapping the critical areas of the state and will work towards securing both governmental and industry funds in this effort.

Commercial Energy

- New oil and gas exploration in Alaska is increasingly being undertaken by smaller, independent petroleum companies that lack the depth and geologic experience of the major oil companies. The independent companies rely heavily on publicly available geologic data on Alaska's oil and gas basins. In addition to providing this information, DGGS makes available the opportunity for these companies to sponsor and participate in field studies that provide a better understanding of the geologic framework of potential hydrocarbon sources in active and future lease areas. To this end, we actively seek both independent and major company partners in this program through frequent meetings with industry groups.
- DGGS responds to many inquiries from companies seeking the geologic information that will assist their exploration efforts in Alaska. The challenge for DGGS is to meet the geologic needs of accelerated leasing and exploration licensing with limited staff and financial resources. We have redirected internal resources toward oil and gas geology to the extent possible, and have been successful acquiring external funding from the federal government and industry. One way in which we have met these challenges with minimal increase in permanent state staff is to involve contract geologists, university faculty, student interns, industry partners, and occasional nonpermanent employees in multi-organization cooperative geologic projects. A modest increase in the FY08 budget for this program will allow DGGS to provide the exploration-critical geologic data to meet the needs of the state's accelerated leasing schedule.

Infrastructure Projects

- Alaska may be on the threshold of a major development cycle similar in scale to the construction of the trans-Alaska oil pipeline. There are ongoing negotiations between industry and government to seek ways to expedite the construction of a natural-gas delivery system to the Lower 48 and possible extension of the Alaska Railroad to Canada. A fundamental and prudent first step in undertaking infrastructure development enterprises of this

magnitude is a comprehensive, public geologic-resource evaluation and geologic-hazard assessment of the primary land corridors through which such construction must pass. Such assessments should be made prior to finalizing detailed alignments and prior to detailed geotechnical engineering assessments of those alignments and as a basis for evaluating permit applications. By statute (AS 41.08), DGGS is charged to determine the potential geologic hazards to buildings, roads, bridges, and other installations and structures as well as inventorying the state's geologic resources, but current and projected funding is inadequate to fully meet this mandate.

- Prior knowledge of the kind and extent of geologic hazards affecting these projects is the first step in reducing future economic losses and casualties from the hazards. Such knowledge can be factored into design criteria to improve public safety, decrease long-term maintenance costs, and decrease the cost of reconstruction resulting from encountering unforeseen obstacles. Additionally, knowledge of geologic resources in the vicinity of the transportation corridors may improve their projected economic feasibility and identify sources of construction materials.

Limited Public Understanding of Geoscience and the Need for Improved Outreach

- Earth processes have a tremendous impact on everyday life, especially in Alaska where the state is economically dependent on the development of geologic resources and where active earth processes create significant hazards, such as earthquakes and volcanoes. Yet the public has limited understanding of these processes and the importance of reliable earth-science information for making decisions about natural-resource development, land management, and environmental protection.
- Scientists typically do a poor job of communicating their knowledge and information to the nontechnical public. We are keenly aware of this problem at DGGS, where we generate geologic reports and maps that often are understandable only by people who have relatively advanced scientific background. Yet historically our public-outreach efforts, such as the current MapTEACH program, show us that educators, students, and the general public are enthusiastic about learning about earth processes, and they quickly realize the importance of this knowledge for making land-management decisions and understanding natural-resource issues in their local communities.
- DGGS must improve its outreach efforts by generating products that are more "user friendly" to the nonscientific public, while maintaining the scientific quality and detail necessary for providing technical users in industry, government, and academia the information they need to guide exploration programs, make wise land-management decisions, and improve public safety from geohazard risks. Improvements can be in the form of new nontechnical newsletters and reports, geoscience presentations for general audiences, and media appearances. Current DGGS staffing is inadequate to make significant increases in public outreach without jeopardizing the quantity and quality of the products and services it currently provides.

DGGS FY2007 PROGRAM

PROGRAM FOCUS

DGGS develops its strategic programs and project schedule through consultation with the many users of geologic information—state and federal agencies, the federal Congressional delegation, the Alaska State Legislature, professionals in the private sector, academia, and individual Alaska citizens. Their input to DGGS programs comes through the Alaska Geologic Mapping Advisory Board, liaison activities of the Director, and personal contact between DGGS staff and the above groups.

The FY2007 DGGS program is focused on projects designed to foster the creation of future Alaskan jobs and resource revenue and to mitigate adverse effects of geologic hazards. To maintain general prosperity, Alaska must encourage major capital investment for job creation in the state. For the foreseeable future, much of the economy will continue to depend on developing the state's natural resources. Within that future, energy and mineral resources constitute a major portion of the state's wealth. Mitigating the effects of geologic hazards helps preserve public safety and private investments by fostering sound design and construction practices. Both resource development and hazard risk mitigation depend heavily on the availability of reliable geologic information.

The role of DGGS in state revenue generation and the maintenance of Alaska's economy is strategic. DGGS provides objective geologic data and information used by in-state, national, and international mineral and energy companies, construction companies, air carriers, other DNR agencies, Department of Commerce, Community & Economic Development, Department of Transportation & Public Facilities, Division of Homeland Security & Emergency Management, and the Federal Emergency Management Agency. DGGS geologists provide geologic and geophysical information to assist prospectors, mineral, oil, and gas explorationists and others to explore for, discover, and develop Alaska's subsurface resources. DGGS is a central repository of information on Alaska geologic resources and a primary source of information for mitigating geologic hazard risks. To focus attention on Alaska's subsurface resource potential and geologic hazards, DGGS makes the state's geologic information available on statewide, national, and international levels. Through its Geologic Materials Center in Eagle River, DGGS also provides access to physical samples collected by private companies and government agencies.

Minerals Data and Information Rescue in Alaska (MDIRA) Program

Downsizing of federal and state agencies in Alaska during the late '80s and early '90s placed at risk an extensive body of geologic, geochemical, mineral, and mineral-development data that had been collected by federal, state, and private organizations over the past century. These data are archived in various locations offering various levels of storage capacity, quality, and accessibility. The budget shortfalls for federal and state archival functions created a need to develop aggressive plans for assembling, maintaining, and most importantly, creating value from this data legacy. For the purpose of this effort, "at risk data" is defined as any geologic data or voucher samples existing in substandard storage sites or in a mode in which data may be subject to irretrievable loss or degradation, or may be unavailable to meet the needs of its intended users. A liaison committee comprising representatives from the Alaska Miners Association, Alaska Federation of Natives, University of Alaska, Alaska Department of Natural Resources, and independent mining industry consultants guides the implementation of the Alaska minerals data rescue efforts through a Federally funded program entitled *Minerals Data and Information Rescue in Alaska (MDIRA)*. DGGS projects supported in whole or in part by this program are being undertaken by the Mineral Resources and Geologic Communications sections. In the FY2007 Program Summaries that follow, MDIRA projects are indicated by an asterisk (*).

FY07 DIVISION EXPENSE BUDGET
(amounts in thousands of dollars)

Program	General Fund	CIP	Federal Receipts[1]	Interagency & Program Receipts	Total
Energy Resources	650.0	175.4	355.0	250.0	1,430.4
Mineral Resources	475.0	500.0	1,010.0	0.0	1,985.0
Engineering Geology	270.0	0.0	113.4	0.0	383.4
Gas Pipeline Corridor Hazards & Resources	0.0	493.7	0.0	0.0	493.7
Alaska Volcano Observatory	0.0	0.0	1,540.8	0.0	1,540.8
Geologic Communications	525.0	58.0	600.0	10.0	1,193.0
Geologic Materials Center	200.0	0.0	55.0	50.0	305.0
Administrative Services	380.7	0.0	0.0	0.0	380.7
Seismic Hazards Safety Commission	10.0	0.0	0.0	0.0	10.0
Total by funding source	**2,510.7**	**1,227.1**	**3,674.2**	**310.0**	**7,722.0**

[1]*Includes $233.4K in federal funds received through Reimbursable Services Agreements with the University of Alaska Fairbanks and other state agencies*

PROGRAM SUMMARIES

STATE GEOLOGIST/DIRECTOR

The Director's Office provides leadership and coordination for the activities of the Division through the State Geologist/Director, Deputy Director, and administrative staff.

OBJECTIVES

1. Provide executive leadership for the Geological Development Component and act as liaison between the Division and the DNR Commissioner's Office, other state agencies, Legislature, Governor's Office, and local, federal, and private entities.
2. Stimulate exploration, discovery, and development of the geologic resources of the state through implementation of detailed geological and geophysical surveys as prescribed by AS 41.08.
3. Provide geologic information to mitigate the adverse effects of natural geologic hazards.
4. Provide secure archival storage and efficient public access to the state's growing legacy of geologic information, and energy- and minerals-related reference cores and samples.

TASKS

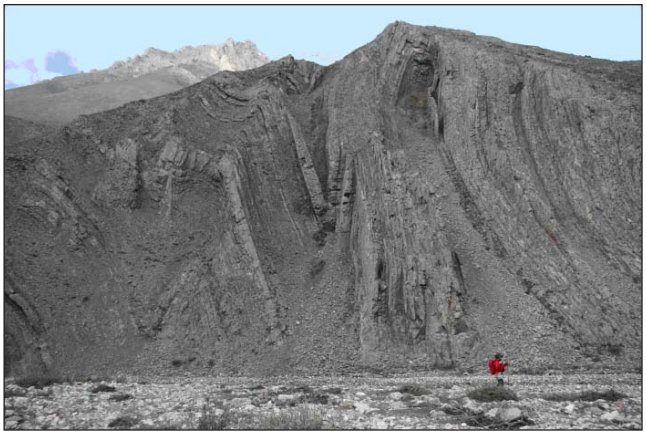
- Prepare annual Division funding plan including Alaska General Fund base budget, Capital Improvement Project budget, interagency programs, and federal initiatives.
- Inform Alaska state legislators, Governor's Office, Alaska federal delegation, and the public about the DGGS geologic program and its significance.
- Focus the Division's geologic expertise on addressing Alaska's highest priority needs for geologic information.

ENERGY RESOURCES

The Statewide Energy Resource Assessment program produces new geologic information about the state's oil, gas, and coal resources. With the current and projected reduction in oil-generated revenue to the state's economy resulting from declining oil production, despite significantly increased oil prices, new significant hydrocarbon discoveries are needed to maintain or increase major revenue payments to the state. There is a continual need for acquisition of fundamental geologic data using modern concepts and techniques to enable industry to better focus its exploration in prospective areas beyond the core production areas. Recent DGGS stratigraphic studies and geologic mapping in the central and eastern North Slope is stimulating exploration interest in the Brooks Range foothills. This underexplored frontier province appears to be dominantly gas-prone and has the potential to yield additional reserves for the proposed natural gas pipeline. In late FY2006, DGGS initiated a geologic mapping project in the Kavik River area of the eastern Brooks Range foothills, partially funded by the federal STATEMAP program, in the interest of providing basic geologic data to support oil and gas exploration in the region.

The Statewide Energy Resource Assessment program is evaluating potential oil and gas reservoirs in the Bristol Bay Basin and Alaska Peninsula region to better assess the hydrocarbon potential of this frontier area. This 3-year project is generating new geologic information that will assist oil and gas exploration on state-owned onshore and three-mile-limit waters of Bristol Bay Basin and Alaska Peninsula that are the focus of state lease sales. FY2006–2007 is the final year of this program.

Rising oil and gas prices combined with looming gas deliverability shortfalls in the south-central Alaska market have resulted in a significant increase in exploration



interest in the Cook Inlet Basin. The exploration focus has shifted to gas in stratigraphic plays and DGGS has initiated a study to provide new publicly-available data to help evaluate resource potential and stimulate successful exploration for hydrocarbons in Cook Inlet.

DGGS is also participating in a state and Federal government project to assess the recoverable resource potential of onshore natural gas hydrate and associated free-gas accumulations on State, Federal, and Native lands on the North Slope of Alaska. These gas hydrates have the potential to be an additional source of natural gas that can be produced by conventional methods and will add to the total gas resources available for the proposed natural gas pipeline. In FY2007, DGGS is initiating a program to evaluate areas of elevated geothermal gradient on the North Slope that adversely affect gas hydrate resources by using temperatures survey data derived from existing oil and gas wells.

The Statewide Energy Resource Assessment program also is collecting new coal quality and stratigraphic data and working to implement a comprehensive statewide coal resource data file as part of an integrated DGGS geologic data management system.

The numerous elements of the Statewide Energy Resource Assessment program are financed from a mixture of funding sources: General Fund, Industry Receipts, Federal Receipts, and Capital Improvement Project funding.

OBJECTIVES

1. Encourage active private-sector oil and gas exploration on the North Slope beyond the Prudhoe Bay–Kuparuk field areas.
2. Generate new geologic data that support oil and gas industry exploration in the Bristol Bay Basin and Alaska Peninsula region.
3. Collect new geologic data to stimulate renewed, successful exploration for hydrocarbons in the Cook Inlet Basin.
4. Provide DNR, other state agencies, and the public with authoritative information relating to the energy resources of the state so that rational policy and investment decisions are made.

FY2007 ENERGY RESOURCES PROJECTS

Detailed project summaries for the following energy resources projects appear in the section *Project Summaries—FY2007*:

In addition to the above projects, the Energy Resources section performs the following tasks:

- Upon request, provide written evaluations of mineable coal potential for lease areas in response to requests from Division of Mining, Land and Water.
- Respond to verbal requests from other State agencies, Federal agencies, industry, local government, and the public for information on energy-related geologic framework and oil, gas, and coal resource data.

MINERAL RESOURCES

The inevitable decline of Alaska's oil reserves base suggests that Alaska must move decisively to strengthen a broader subsurface resource economic base. To achieve this goal, Alaska needs private-sector commitment of capital and talent in non oil-related as well as oil-related industries. The mineral industry, however, has historically shown a reluctance to commit significant company resources until there is a dramatic advancement in our understanding of the geologic environments of the most prospective Alaska lands open to mineral and other geologic resource development.

Alaska has an accessible state land endowment of more than 100 million acres, much of it chosen from a 350-million-acre land pool because of perceived potential to host mineral wealth. Currently the overwhelming majority of these lands are not geologically or geophysically surveyed at a sufficiently detailed level, nor with

the focus needed to optimize mineral discovery and development. Recently, a DNR/DGGS program of integrated geological and geophysical mapping has been effective in attracting new private-sector mineral investment capital to Alaska. The purpose of the FY2007 Statewide Mineral Resource Appraisal Project is to produce, on a prioritized schedule, the critical new geological surveys needed to sustain Alaska's mineral industry investments and provide management agencies with information needed to formulate rational management policy.

The Mineral Resources section shares responsibilities with the Geologic Communications Section in the Division-wide task of implementing a publicly accessible, comprehensive, on-line computerized Alaska geologic information database through implementation of the Minerals Data and Information Rescue in Alaska (MDIRA) program.

The numerous elements of the Statewide Mineral Resource Appraisal Project are financed from a mixture of funding sources: General Fund base budget, Capital Improvement Project funding, Federal Receipts, and Program Receipts.

OBJECTIVES

1. Catalyze increased mineral resource exploration in Alaska's mining districts.
2. Provide DNR, other state agencies, and the public with unbiased, authoritative information on the mineral resources of the state so that rational land policy and investment decisions can be made.
3. Provide an accurate current statistical and descriptive summary of the status of Alaska's mineral industry for calendar year 2006.

FY2007 MINERAL RESOURCES PROJECTS

Detailed project summaries for the following Mineral Resources projects appear in the section *Project Summaries—FY2007*:

* MDIRA-supported project (see p. 15)

In addition to the above projects, the Mineral Resources section performs the following tasks:

- DGGS Mineral Resource geologists provide timely responses to verbal and written requests for mineral information from other State agencies, local government, industry, and the general public.
- Provide authoritative briefings about the status of Alaska's mineral industry, State support for mineral ventures, and recently acquired geophysical and geological data at professional mineral industry conventions and trade shows, and in professional journals.

ENGINEERING GEOLOGY

The Engineering Geology program addresses major engineering-geology and geologic-hazard issues that affect public safety and economic well-being in developing areas of Alaska. DGGS conducts engineering-geologic mapping to determine the distribution and character of surficial deposits, their suitability for foundations, susceptibility to erosion, earthquakes and landslides, and other geologic hazards. Geologic evaluations of areas subject to major hazards like floods, earthquakes, volcanic eruptions, tsunamis, and landslides help to forecast the likelihood of future major events and the severity of hazards associated with them. In addition to General Funds, several elements of the Statewide Engineering Geology Program are partially or largely financed through Federal Receipts.

Alaska's communities at high risk from major geologic hazards comprise the majority of Alaska's citizens and a large majority of the state's corporate headquarters. In many urban areas, the state lacks the fundamental geologic data needed to guide the proper implementation of building codes, land-use zoning, right-of-way siting, property insurance regulation, and contingency planning for adverse natural hazard events. Loss of life and damage to infrastructure and buildings can be reduced through informed construction practices, land-use planning, building-code application, and emergency preparedness. However, economics and practicality dictate that mitigation measures be implemented first where risk is highest. Because hazards are not uniformly distributed, engineering-geologic and hazard maps become the first source of information about where damage is likely to be greatest and, therefore, where mitigation efforts need to be concentrated. These maps are critical for emergency planning and the allocation of emergency-response resources prior to an adverse event.

The type of surficial-geologic mapping conducted for purposes of identifying geologic hazards and locating sources of construction materials is also of benefit for locating placer-mineral deposits. For this reason, engineering-geology personnel often participate in teams with DGGS's mineral-resources geologists to map areas of interest for minerals exploration.

A major component of the Engineering Geology program is the Alaska Volcano Observatory, in which DGGS participates with the U.S. Geological Survey and University of Alaska Fairbanks to monitor Alaska's active volcanoes, map and describe their geology and hazards, and predict and record eruptive activity. DGGS's support for AVO activities comes from the U.S. Geological Survey, which in turns comes partly from the Federal Aviation Administration to support volcanic-ash warnings to aircraft. DGGS provides helicopter logistics for field operations, assists in geologic and volcanic hazards studies, maintains the AVO website, and is developing a database of geologic information on Alaska's volcanoes. These roles are described in detail in five project summaries.

A significant recent effort of the Engineering Geology program has been in support of MapTEACH (Mapping Technology Experiences with Alaska's Cultural Heritage), a multi-year NSF-funded collaborative project with the University of Wisconsin Environmental Remote Sensing Center (ERSC) and the University of Alaska Fairbanks Land Resources Management/Global Change program. MapTEACH is a field-based geoscience outreach program for middle- and high-school students in rural Alaska that emphasizes hands-on experience with geoscience and spatial technology in conjunction with traditional activities. The goal of MapTEACH is to enhance community understanding of landscape processes and natural hazards in rural Alaska, and to foster appreciation of state-of-the-art technology tools and data sets

that can be applied to informed community planning and decision making. The project is described in detail in a project summary.

OBJECTIVES

1. Help mitigate risks to public safety and health by providing information on geologic hazards as they affect human activity.
2. Provide geologic information to help lower the costs of construction design and improve planning to mitigate consequences arising from hazardous natural geologic events and conditions.
3. Provide reliable engineering-geologic data for informed land-use decisions by the government and private sector.
4. Identify sources of sand, gravel, rip-rap, stone, and other geologic construction materials required to create the infrastructure, roads, and other land-based transportation corridor improvements necessary to support expanded development of natural resources and other local economic activities in Alaska.
5. Identify potential sources of placer minerals in conjunction with minerals resources mapping projects.

FY2007 ENGINEERING GEOLOGY PROJECTS

Detailed project summaries for the following Engineering Geology projects appear in the section *Project Summaries—FY2007*:

In addition to the above projects, the Engineering Geology section performs the following tasks:

- Produce written evaluations of potential hazards in areas of oil exploration leases, land disposals, permit applications, etc., and respond to verbal requests for information from other State agencies, local government, and the general public.
- As part of the Alaska Coastal Management Program, conduct reviews of district coastal management plans, Coastal Policy Questionnaires, and consistency applications to determine compliance with the program's natural hazards standards (11 AAC 112.210).
- Conduct post-event hazard evaluations in response to unexpected major geologic events (e.g., earthquakes, volcanic eruptions, and landslides), providing timely information dispersal to the public via electronic as well as traditional methods, and providing event and continuing hazard information to appropriate emergency management agencies.

GEOLOGIC COMMUNICATIONS

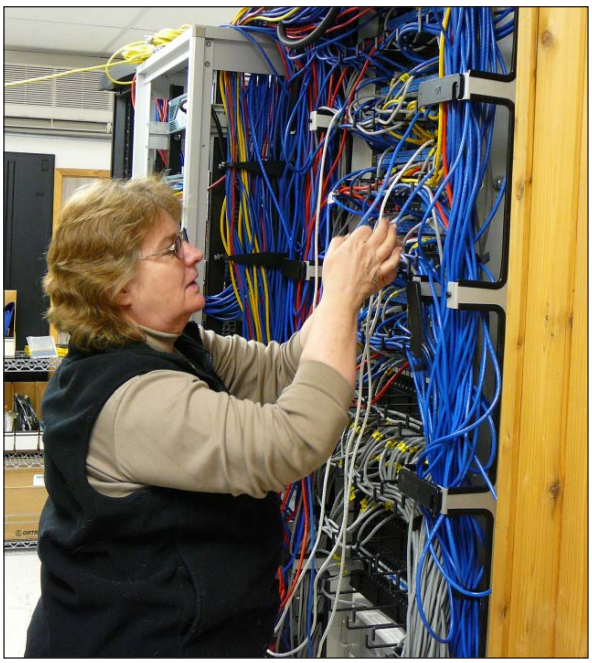
The Geologic Communications Section staff edits, designs, publishes, and disseminates technical and summary reports and maps generated by the Division's technical projects about Alaska's geologic resources. The maps and reports released through this section are the state's primary avenue for widely disseminating detailed information and data relating to its subsurface mineral and energy wealth, its geologic construction materials, and its geologic hazards. These printed and/or digital-format documents focus attention on Alaska's most geologically prospective and useful lands and are the authoritative geologic basis for many of the state's resource-related land-policy decisions. They also encourage geologic exploration investment leading to resource discoveries and subsequent major capital investments. Timely availability of geologic information from DGGS is a significant factor in stimulating Alaska's economy and mitigating the adverse effects of geologic hazards.

The geologic information desk staff provides information to the public on a wide range of topics including mineral and energy resources, prospecting, earthquakes,

volcanoes, and permafrost, and assists customers in understanding geological and geophysical maps and data. Staff also manages sales of geologic reports, maps, and data and prepares displays and represents the division at geologic conferences and events.

The section produces an annual report summarizing division activities and accomplishments; publishes newsletters to communicate division progress and advertise recent publications; designs, edits, and produces technical and educational geologic maps and reports in printed and digital formats; manages the DGGS library so that reports (by DGGS and other related agencies) are available and locatable; and participates in outreach activities such as classroom presentations, science fair judging, or helping teachers plan earth science units.

The division's Digital Geologic Database project was initiated by the federally funded Minerals Data & Information Rescue in Alaska (MDIRA) program and has three primary objectives: (1) to establish a spatially referenced geologic database system in a centralized data and information architecture with networked data access for new DGGS geologic data; (2) to create a functional on-line system that allows the public to find and identify the type and geographic locations of geologic data available from DGGS and then view or download the selected data; and (3) to cooperatively integrate DGGS minerals-related data with data from other agencies through a MDIRA-sponsored website <http://akgeology.info>. This project is led by a geologist from the Mineral Resources Section but is largely implemented by the Geologic Communications section.



The section provides primary computer and GIS service and support to DGGS staff and streamlines information delivery to the public. The section established a website and began extensive use of the Internet in FY1998 to increase the availability of the Division's information and to provide state and worldwide access to the Division's geologic information. These efforts have developed into a major project to establish a state–federal multi-agency Internet-accessible Alaska geologic database management system. Federal funding was obtained to scan, convert to digital format, and post the entire DGGS suite of publications on our website. The U.S. Geological Survey provided additional funds to do the same for all USGS Bulletins and Professional Papers in the DGGS library and make them available via the World Wide Web.

The Geologic Communications Section is financed through the General Fund, Federal Receipts, and Program Receipts.

OBJECTIVES

1. Disseminate new, accurate, unbiased, Division-generated data on the geology of Alaska, as well as selected data from other sources, to the public at large, to DNR policy and regulatory groups, and to all other interested parties within one year of its acquisition.
2. Preserve and manage the data and knowledge generated by the Division's special and ongoing projects in an organized, readily retrievable, and reproducible form consistent with pertinent professional standards.
3. Focus public awareness on Alaska's most prospective mineral and energy lands.

FY2007 GEOLOGIC COMMUNICATIONS PROJECTS

Detailed project summaries for the following Geologic Communications projects appear in the section *Project Summaries—FY2007*:

GEOLOGIC MATERIALS CENTER

The Alaska Geologic Materials Center (GMC) in Eagle River archives and provides public access to non-proprietary oil, gas, and coal drill cores and drill-cutting samples, rock cores from mineral properties, and processed ore, oil, gas, coal, and source-rock samples. These samples are used by government and private-sector geoscientists to improve the odds of finding new oil, gas, and mineral deposits that will maintain the flow of state revenues and provide in-state employment. The Geologic Materials Center Project is financed from the General Fund budget and in-kind contributions directly from industry. Additional financial support is received annually from the Alaska Oil & Gas Conservation Commission and the U.S. Bureau of Land Management. The private sector contributes the cost of delivering all new samples, sample preparation and analyses, sample logs, and data logs.

The holdings of the GMC are a continually growing asset that is compounding in value over time at little cost to the state. The GMC facility is staffed by two Division geologists. The GMC has formal cooperative agreements with the U.S. Geological Survey, the U.S. Minerals Management Service, and U.S. Bureau of Land Management to house and control their Alaska geologic materials. A voluntary 14-member board advises the curator and DGGS on matters pertaining to the GMC.

In cooperation with the Department of Transportation & Public Facilities, DGGS recently completed a concept study for construction of a new materials center to replace the existing GMC. The sample collection long ago exceeded available warehouse space, with the overflow now occupying 55 unheated tractor-trailer type portable storage containers. Limited space and unsuitable site conditions preclude significant expansion at the existing site in Eagle River. DGGS is considering a proposed new site on state land south of Eagle River and is now looking for sources of funding to finance the project. The concept study report is available on the GMC web page <www.dggs.dnr.state.ak.us/GeologicMaterialsCenter.htm>

OBJECTIVES

1. Enhance responsible resource development and in-state employment opportunities by making information concerning oil, gas, and mineral exploration more accessible.
2. Advance the knowledge of the geology and resources in Alaska's low-lying structural basins favorable for oil or gas discovery.
3. Advance the knowledge of Alaska's mineral potential by making available representative samples of ores and drill cores from mineral deposits throughout the state.

A detailed project description for the Geologic Materials Center appears in the section *Project Summaries–FY07* (p. 58).

ADMINISTRATIVE SERVICES

The Administrative Services group provides financial control and administrative support for all other projects in the Geological Development component including: securing lowest costs for goods and services; maintaining, and when necessary, procuring vehicles for field work; coordinating travel arrangements and appropriate paperwork to minimize travel expenses and field party subsistence costs; administering and monitoring grants and contracts; tracking and reporting project expenditures to ensure cost containment within budget for all projects; mail/courier services; assistance in personnel matters; petty cash; and any other support necessary to further increased efficiency or savings in acquiring knowledge of the geology of Alaska.

OBJECTIVE

1. Facilitate the efficient execution of DGGS programs and projects.

TASKS

- Monitor grants and contracts (Federal, Interagency, and Program Receipts) to ensure deliverables are produced on schedule and within budget; ensure expenses are properly billed against grants and contracts and receipts are collected promptly.
- Provide accurate, timely reporting of project expenditures and current balances; encourage prudent money management.
- Minimize the cost of transportation to and from the field by coordinating personnel travel and supply shipments.
- Coordinate Division vehicle use to minimize requests for reimbursement for personal vehicle mileage.
- Make travel arrangements and complete travel authorizations to ensure use of the lowest-cost travel options.
- Assist staff with personnel matters; inform staff about changes in personnel rules or benefits and ensure that all personnel paperwork complies with applicable rules and regulations. Estimate future personnel salaries and benefits to assist management in making human resource decisions necessary to efficiently accomplish the division's mission.

PROJECT SUMMARIES—FY07

Alaska faces the challenge of growing a healthy economy from its natural resources while protecting an environmental legacy that is the envy of many. The Department of Natural Resources' Division of Geological & Geophysical Surveys is an integral partner in the team of state agencies that strive to meet this challenge. The output from our proj-ects provides the fundamental earth-science information required to guide critical policy decisions, encourage explor-ation investment, mitigate the effects of geologic hazards, and improve the quality of life for all Alaskans.

The overviews of the following 39 projects that are being pursued by DGGS in FY06 span the scope of our legislative mission statement. Each of these projects is making a positive difference for Alaska. Many are implemented through various cooperative agreements with other state and federal agencies, universities, in-house project teams, and con-tracts. We leverage state General Funds through these arrange-ments so that the Division's work provides the greatest possible benefit from the public's investment.

CONTENTS

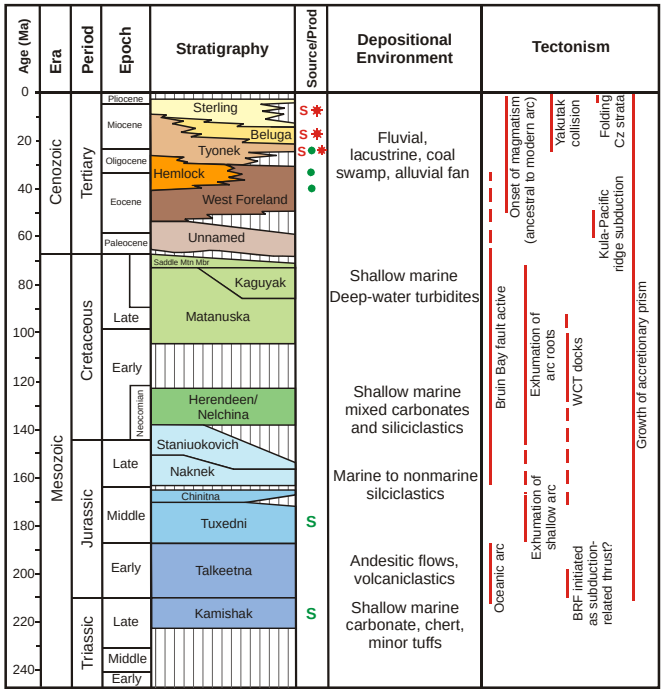
*MDIRA-supported project (see p.15)

COOK INLET GEOLOGY PROGRAM

Rising oil and gas prices combined with looming gas deliverability shortfalls in the south-central Alaska market have resulted in a significant upsurge in exploration interest in Cook Inlet basin. These factors have drawn new companies to the area that now face the task of developing exploration strategies to cope with the basin's complex geology. Now that nearly all large structures in Tertiary strata have been found and tested, the exploration focus is shifting to gas in stratigraphic plays. All companies, but particularly companies new to Cook Inlet need access to unbiased, publicly available detailed technical information on the geology of the basin to be successful in exploring stratigraphic plays. The most detailed relevant work on the subsurface geology of Cook Inlet has been completed by industry, but most of it is proprietary and not available in the public domain. The Alaska Division of Geological & Geophysical Surveys (DGGS) and the Alaska Division of Oil and Gas (DOG) are responding to this need by launching a new multi-year, state-funded program designed to provide high-quality data to the geologic community and public policy makers that will help evaluate resource potential and stimulate successful exploration for hydrocarbons in Cook Inlet basin.

Mesozoic and Tertiary rocks of Cook Inlet basin were deposited in an elongate fault-bounded basin that extends from the Alaska Peninsula to the Wrangell Mountains. The basin is bounded by an active volcanic arc to the west and an active accretionary complex underlying the Chugach Mountains to the east. The Mesozoic succession has a composite thickness of nearly 36,000 feet and represents deposition in marine environments ranging from deep marine to fan delta settings. Commercial quantities of oil and gas have not yet been discovered in Mesozoic rocks of the basin, although all oil found to date has its source in this section. The Tertiary succession is up to 25,000 feet thick and was deposited in alluvial fans along the basin margins and in high-sinuosity and anastomosed fluvial systems along the basin axis. All commercial oil and gas fields in the basin produce from reservoirs in Tertiary strata. Available organic geochemical data indicate that nearly all non-associated gas in producing gas fields is biogenic and originates from coal and carbonaceous mudstones in the Tertiary section.

Cook Inlet Stratigraphy and Tectonic Events



Redrawn from Curry and others (1993) and Swenson (2003); additional information from Plafker and others (1989); Nokleberg and others (1994)

A detailed depositional systems and tectonic framework is essential in complex nonmarine basins like Cook Inlet, and utilizing all available surface and subsurface data is necessary for exploring stratigraphic plays. This new program focuses on developing a time-constrained depositional systems and tectonic framework for Mesozoic and Tertiary strata in Cook Inlet basin. DGGS and DOG will conduct detailed studies of reservoir quality, source rock characteristics, and seal capacity within the context of this depositional systems and tectonic framework. The resulting dataset will be utilized to model basin development, timing of source rock maturation, formation of folds and faults within the basin fill, and petroleum charge. Results will be released in a series of DGGS reports starting in Fall–Winter 2007.

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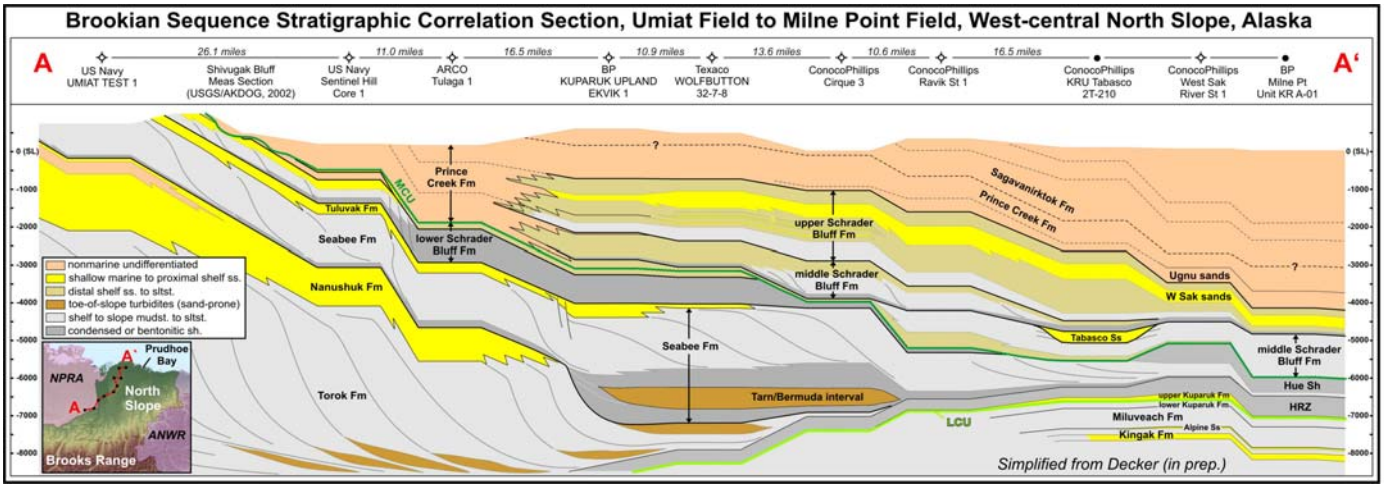
BROOKS RANGE FOOTHILLS & NORTH SLOPE GEOLOGY PROGRAM

Alaska's North Slope remains one of the most promising onshore oil and gas provinces in all of North America. The Division of Geological & Geophysical Surveys (DGGS) continues its leadership role in furthering the geologic understanding of this petroleum system, primarily through investigations of rocks exposed in the foothills of the northern Brooks Range. This program was developed in response to the need for high-quality publicly available geologic data to evaluate state resource potential in northern Alaska, stimulate exploration for hydrocarbons, and foster wise land-use management. The cost of this program is shared by major and independent oil and gas companies. While directed by DGGS, this research effort is a multi-agency collaboration that includes the Alaska Division of Oil & Gas (ADOG), the United States Geological Survey (USGS), the University of Alaska, and others.

During the 2006 field season, the program continued to focus on stratigraphic studies of key reservoir and source rock intervals in the foothills of the Brooks Range. One team of geologists focused on potential reservoir analogs in the mid-Cretaceous Nanushuk Formation of the central foothills, near NPRA. Additional stratigraphic work on selected potential reservoir and source rocks in the east-central foothills was undertaken in concert with geologic mapping (see Kavik River STATEMAP). These types of detailed studies are providing new constraints on the depositional history and correlation of geologic units, leading to an improved understanding of how this hydrocarbon-rich basin evolved. In addition to stratigraphic studies, the program also continued to evaluate the structural geology of the Brooks Range foothills, documenting the geometry and style of deformation. Ongoing apatite fission-track thermochronology is also allowing for the recognition of discrete phases of uplift and erosion that influenced hydrocarbon maturation and migration.

In collaboration with ADOG, we recently acquired access to regional 2-D seismic-reflection data across the North Slope. In the future, interpretations of these data will allow us to extend our outcrop observations into the subsurface, greatly increasing the robustness of our stratigraphic correlations and regional geologic models (see well-log cross section below).



Notable upcoming DGGS publications from this program include: (1) the final report on sequence stratigraphy and reservoir architecture of the Nanushuk Formation, and (2) a report on basin analysis of the Fortress Mountain Formation (both anticipated in spring 2007). Additional products will include reports summarizing measured stratigraphic sections, structural cross sections, paleontologic data, provenance studies, organic geochemical data, and reservoir quality analyses (released during the first half of 2007).

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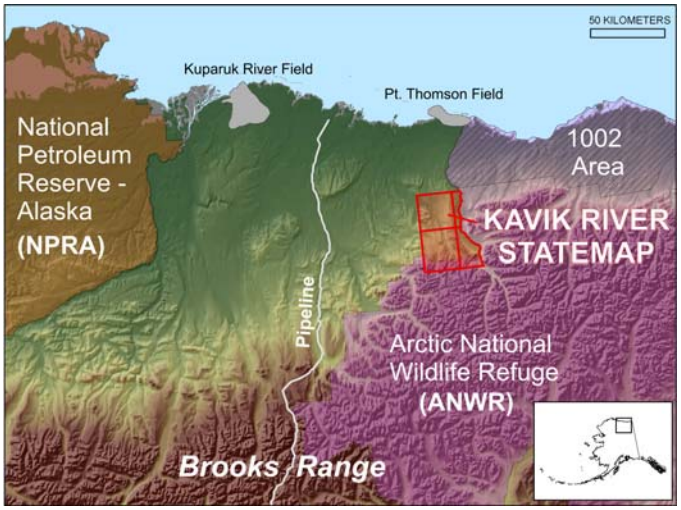
GEOLOGIC MAPPING IN THE KAVIK RIVER AREA, WEST-CENTRAL MT. MICHELSON QUADRANGLE

Despite declining reserves at giant oil fields like Prudhoe Bay, northern Alaska remains a world-class petroleum province and continues to attract exploration by both major and independent oil and gas companies. For more than a decade, the Alaska Division of Geological & Geophysical Surveys (DGGS) has provided publicly available baseline geologic information by conducting geologic mapping along the northern foothills of the Brooks Range. In addition to evaluating the State's resource potential, these efforts serve to entice new exploration and investment in northern Alaska. Many of the geologic relationships delimited by our surface mapping along the mountain front can be projected northward into the subsurface, where the geology is obscured by tundra cover. A long-range objective of DGGS is to eventually produce a contiguous series of detailed geologic maps along the entire foothills belt, thereby establishing a regional geologic framework necessary to understand the evolution of the petroleum system.

During the summer of 2006, DGGS conducted 1:63,360-scale geologic mapping of more than 500 square miles of the eastern North Slope (see map). The Kavik River area includes two undeveloped gas discoveries (Kemik and Kavik fields) and borders the western boundary of the Arctic National Wildlife Refuge (ANWR). The Kavik region is one of few areas that permit examination of all three depositional megasequences on the North Slope in close association. Capitalizing on these unique exposures, the focus of this project was to: (1) better constrain the timing and nature of regional burial and Tertiary uplift events in this part of the North Slope, and (2) further define the depositional environments and sequence stratigraphy of selected Brookian and Beaufortian deposits.



Detailed stratigraphic and structural data, in conjunction with some of the first 1:63,360-scale geologic mapping in the area, provide insight on the complex deformation history in the region. The southern, well exposed portion of map area is dominated by detachment folding. Key structures in the Cretaceous and Tertiary strata to the north (including the trapping structure at the Kavik field) are poorly exposed, although newly acquired 2-D seismic data locally image these structures in the subsurface, and will greatly improve our understanding of key folds and faults within the map area. New observations of Beaufortian stratigraphy (associated with the rift-related opening of the Arctic Ocean Basin) indicate a potentially more complex paleogeography than previously assumed. This Jurassic to Early Cretaceous succession includes a prominent Lower Cretaceous unconformity that is the critical trapping mechanism for many successful oil and gas fields along the northern margin of Alaska (e.g. Kuparuk River, Pt. Thomson, and many other discoveries). Within the Cretaceous Brookian succession, facies considerations suggest structural telescoping emplacing more proximal foreland basin strata northward, likely along a detachment within incompetent Jurassic shale units.

This work was supported in part by the federally funded STATEMAP program; the final map product will be released as a DGGS Report of Investigation late in 2007.

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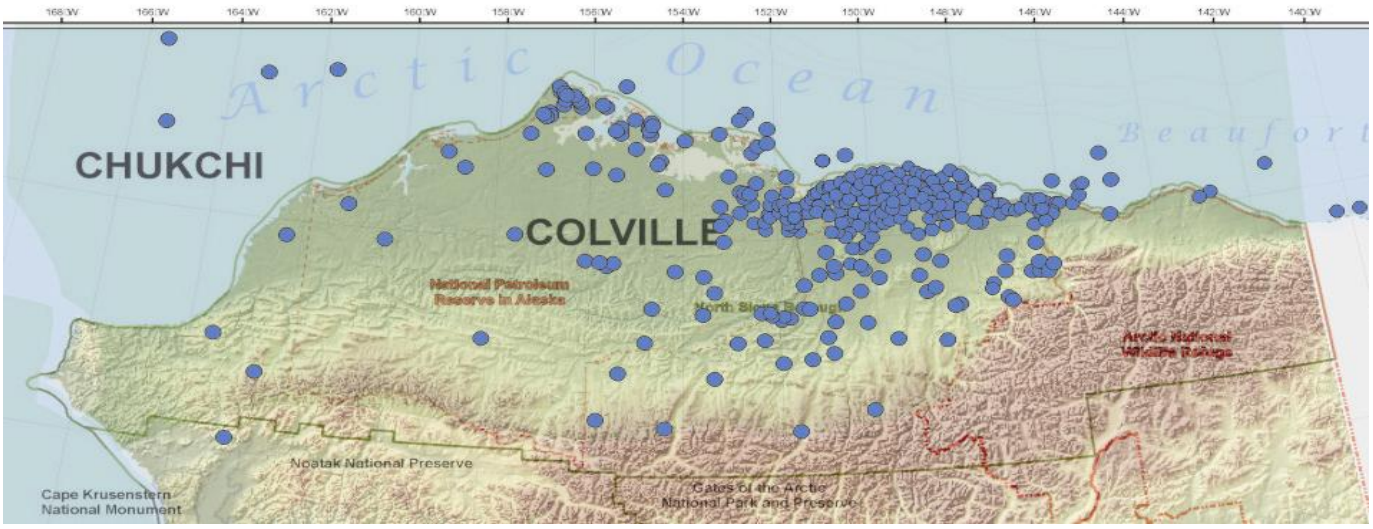
GAS HYDRATES: EVALUATION OF ALASKA NORTH SLOPE GEOTHERMAL GRADIENTS

Gas hydrates are a crystalline solid consisting of gas molecules, usually methane, each surrounded by a cage of water molecules that are stable at low temperatures and/or high pressures. One volume of gas hydrate is typically equivalent to 160 volumes methane gas. The estimated volume of gas trapped within permafrost-associated gas hydrate accumulations in northern Alaska is nearly 600 TCF; the U.S. Geological Survey estimates large volumes of in-place gas (40–100 TCF) exist as hydrates beneath Alaska North Slope development infrastructure. Production models of gas hydrate prospects indicate that significant volumes of gas associated with the gas hydrates in northern Alaska could be technically recoverable.

Small increases in the geothermal gradient can adversely affect the presence and thickness of gas hydrate zones. DGGS is initiating a program to evaluate corrected Bottom Hole Temperatures (BHT) survey data derived from existing oil and gas wells to delineate areas of elevated geothermal gradient that adversely affect gas hydrate resources. A large data set of drill hole temperature survey information (>6,000 wells) drilled in sedimentary basins throughout Alaska make possible the evaluation of variations in geothermal heat flow. The accuracy of BHT data is often affected by the time constraints imposed by the commercial nature of oil and gas wells. Because many wells are logged during or soon after the circulation of drilling fluids, during production flow of gas and fluids, and at high logging speeds, BHT may not precisely represent actual temperature. Therefore, BHT data collected from oil



Location map showing density of available North Slope, Chukchi and Colville Basin oil and gas well data (in blue)

and gas wells after drilling commonly must be evaluated for accuracy and corrected to equilibrium conditions. Additionally, it is important to further correct these data for a number of geological factors including climate, topography, uplift, and erosion to attain maximum accuracy.

This project is funded by a grant from the U.S. Bureau of Land Management–Alaska and will: (1) Compile and correct existing BHT data for a selected subset of publicly-available oil and gas exploration wells from the North Slope; (2) Evaluate drill hole lithologies and formation thermal conductivity, and run heat flow calculations to establish accurate geothermal gradient data; (3) Model and interpret heat flow data in conjunction with the Dr. David Blackwell, Southern Methodist University Geothermal Laboratory. Focus will be on areas of higher density wells outside of the main Prudhoe Bay–Kuparuk fields. The final product will be a database of corrected bottom hole temperatures for selected North Slope oil wells, and a regional map showing the modeled data and contoured isotherms of thermal gradient (where data density allows) for release in December 2007.

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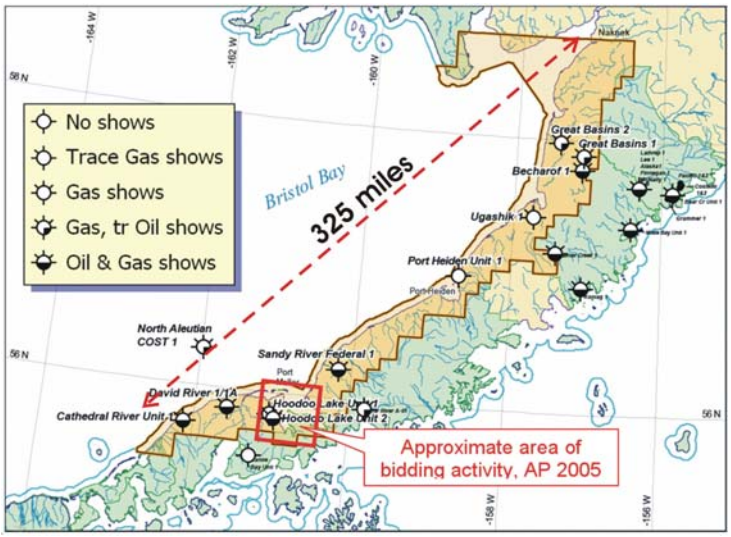
BRISTOL BAY, ALASKA PENINSULA: HYDROCARBON RESOURCES, PETROLEUM RESERVOIR CHARACTERIZATION, AND SOURCE POTENTIAL

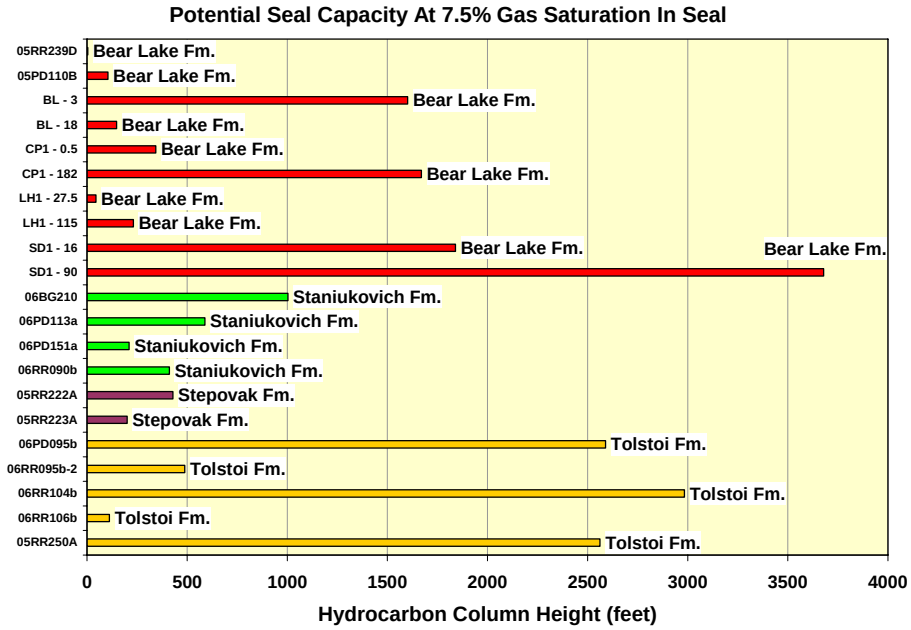
This program is a three-year geologic research effort funded by the U.S. Department of Energy's Alaska Energy Technology Development Laboratory, State of Alaska, and Bristol Bay Native Corporation. Participants include geologists from DGGS, Division of Oil & Gas (DOG), Purdue University, University of Alaska Fairbanks, U.S. Geological Survey, and industry. Summer 2006 was the last of three seasons that focused on the Port Moller, Chignik, and Puale Bay areas. Our new field data codifies fundamental reservoir, source, seal capacity, and thermal maturity characteristics of basin targets, places the Miocene Bear Lake Formation reservoir data in a stratigraphic and sequence stratigraphic framework, and summarizes the hydrocarbon potential of this frontier basin. The first two years of collected data have been published in peer-reviewed DGGS reports. Release of the final, or third-year, report is expected in November 2007.



A State Areawide Oil and Gas Lease Sale (see figure, right) will be held again in 2007. Our project data and publications continue to catalyze lease interest and new exploration, particularly by small independent companies. Rock samples will be archived for future use at the DGGS Geologic Materials Center in Eagle River. Reports will be available in print form and via the DGGS Web site (www.dggs.dnr.state.ak.us).

Resource assessment is unavailable for the onshore area. However, mean resource estimates for offshore federal waters of Bristol Bay basin are 230 million barrels of oil and natural gas liquids and 6.8 TCF gas (U.S. Minerals Management Service report, Sherwood, 2000).

On the southeast side of the Alaska Peninsula, oil seeps (1/2 barrel oil/ day, viscosity API ~18) from the Jurassic-age Shelikof Formation. Kamishak Formation limestone (Triassic) yields total organic carbon up to 2.4 percent (hydrogen and oxygen indices 598 to 474 and 21 to 22). On the northwest side of the Alaska Peninsula the main reservoir may be the 9,000-foot-thick Miocene-age Bear Lake Formation, which yields porosity from 1 to 35 percent and permeability from 0.001 to 1,000 millidarcies (outcrop and North Aleutian COST #1 core). More than 20 wells have been drilled on the Alaska Peninsula; most reported oil and gas shows, but none has produced commercially. New seal capacity data (see graph) indicate a wide range for the Early Cretaceous through Miocene age units; some of these siltstones qualify as good gas and oil reservoir seals.



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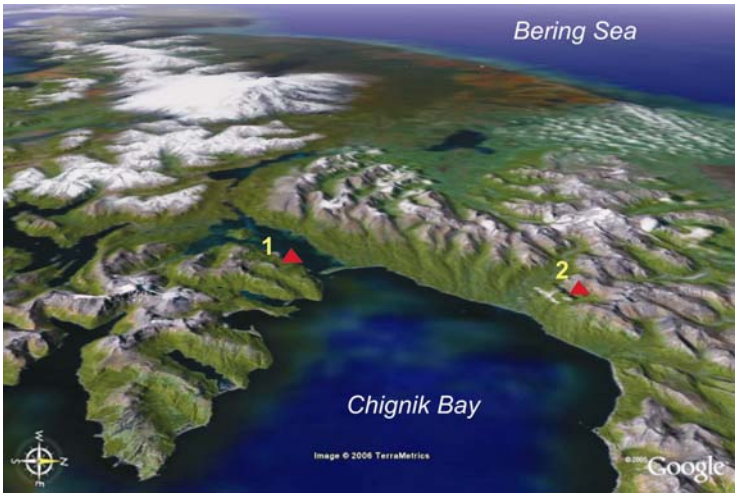
ALASKA COAL DATABASE
NATIONAL COAL RESOURCE DATABASE SYSTEM

The long-term goal of the Alaska Division of Geological & Geophysical Surveys' (DGGS) participation in the U.S. Geological Survey's (USGS) National Coal Resource Database System (NCRDS) cooperative program is to record all known coal occurrences in Alaska and archive the information in a single, readily accessible database available at the USGS Web site: http://energy.er.usgs.gov/products/databases/USCoal/. The NCRDS program is funded by USGS through a multi-year proposal process with final reporting at the end of each funding period. Alaska's coal resources make up about half of the United States' coal-resource base and approximately one-sixth of the total world-resource base. Total identified Alaska coal resources (all ranks) amount to only about 160 billion short tons, yet hypothetical and speculative resources are as high as 5.5 trillion short tons. During the course of gathering information to expand the NCRDS database for Alaska, the need was recognized to collect new coal samples and current stratigraphic data. Sometimes a coal occurrence described in older literature is poorly located and the description is either inaccurate or inadequate for a proper resource assessment. The most frequent problems we have encountered are unverified coal seams and coal sample locations, suspect coal quality analyses, and insufficient stratigraphic control. The current NCRDS project was initiated to examine coal outcrops on the Alaska Peninsula and provide new coal quality data and accurate stratigraphic information for meaningful coal resource assessments. The Alaska Peninsula is an area of renewed oil and gas exploration; stratigraphic as well as coal quality data will benefit the exploration of energy resources in the region.



Two Chignik area coal localities examined in 2006 on Alaska Peninsula. Location 1 is in Chignik Lagoon; location 2 is in McKinsey Valley. View toward west.

Six-foot-thick coal seam examined at locality 1 in Chignik Lagoon, southwest of Chignik Bay (see above) in the Coal Valley member of the Cretaceous-age Chignik Formation.

During 2006, we evaluated two relatively unmapped coal occurrences on the Alaska Peninsula, at Chignik Bay and at Herendeen Bay. Cretaceous-age bituminous and subbituminous coals of the Coal Valley Member of the Chignik Formation are typically less than 7 feet thick. At Herendeen Bay, up to 17 beds crop out, but most are less than 2 feet thick. Identified resources for the Chignik and Herendeen Bay coal fields range up to 200 million short tons; hypothetical and speculative resources range up to 3 billion short tons. Samples were analyzed for proximate, ultimate, and trace elements and a few samples were studied for high-pressure gas adsorption. Final products for release in fall 2007 include a final written report that provides sample localities, coal seam characteristics, coal quality, and point-source data to be placed into the Alaska coal resource portion of the NCRDS. During FY07–FY08, we will sample coals on the Kenai Peninsula as part of the next funding cycle of NCRDS proposed projects.

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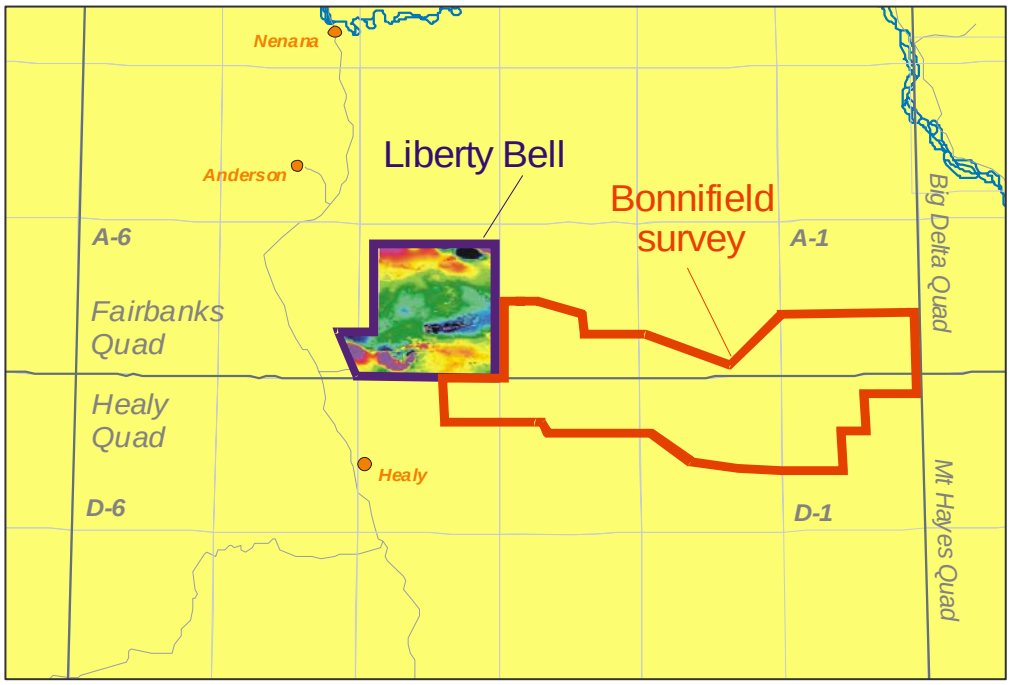
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: AIRBORNE GEOPHYSICAL SURVEY OF BONNIFIELD MINING DISTRICT

The Airborne Geophysical/Geological Mineral Inventory (AGGMI) project is a special 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) potentially 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 on the basis of 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 bedrock and surficial geologic maps; (3) 1:63,360-scale mineral occurrence maps; and (4) and 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.



DGGS is currently acquiring airborne-geophysical data for the AGGMI program for a large area (shown in red) of the Bonnifield mining district. This tract covers 600 square miles of prospective mineral terranes of State, State-selected, and Native lands. Placer gold has been mined from many of the creeks near the center of the survey tract. Abundant prospects throughout the survey tract are generally attributed to either volcanogenic massive sulfides and/or plutonic gold systems. Detailed geologic maps are not available in the area. Airborne geophysical surveys and follow-up detailed geologic mapping will provide a way to map various lithologic units, especially distinguishing between granitic rocks and the various metamorphic units, and to delineate regional structures. By completing an integrated geophysical-geological mineral inventory study, new zones of mineralization may be identified.

Geophysical maps and digital data will be released as DGGS geophysical reports, probably in March 2007. The Bonnifield survey data will be combined with the previously acquired Liberty Bell geophysical data.

DGGS believes that by helping to provide a better understanding of the geologic framework of the areas hosting identified and potential ore deposits in this district, we will stimulate increased mineral exploration investment in the area and surrounding areas. We anticipate that the geophysical and geological data from these studies will be used for decades by mineral explorationists and land managers.

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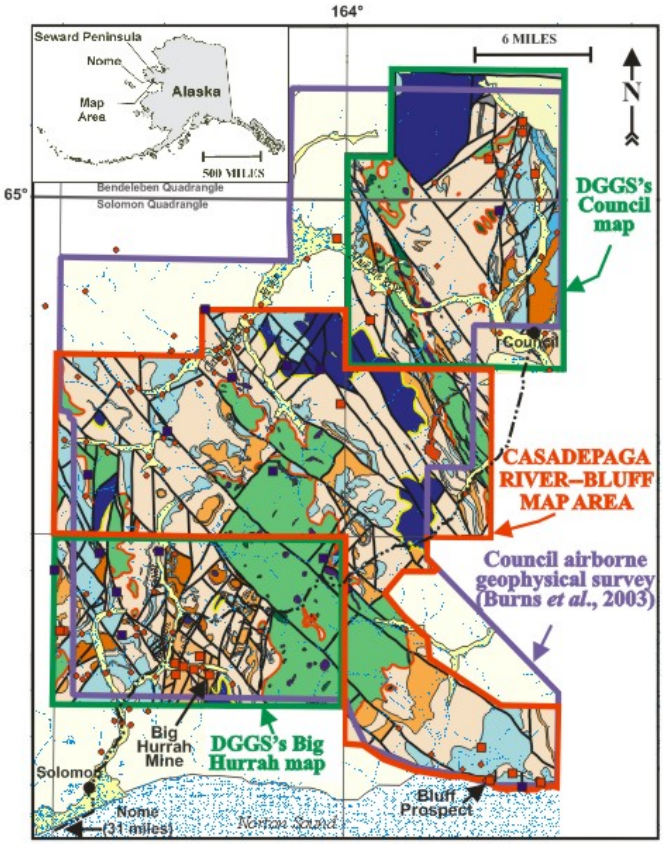
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: GEOLOGIC MAPPING IN THE COUNCIL GEOPHYSICAL SURVEY TRACT



More than 1 million ounces of placer gold have been extracted from the Solomon–Council area of the Seward Peninsula of Alaska during the past century. To encourage renewed industry exploration for lode gold and base-metal deposits in this region and to provide geologic data for land-use management, the Alaska Division of Geological & Geophysical Surveys (DGGS) released an airborne-geophysical survey for the area outlined in purple as part of the State-funded Airborne Geophysical/Geological Mineral Inventory (AGGMI) program in 2003 (see figure; Burns *et al.*, 2003). In 2004, DGGS conducted 1:50,000-scale geologic mapping and geochemical sampling in the Big Hurrah and Council areas (green outline; Newberry *et al.*, 2005; Werdon *et al.*, 2005a; Werdon *et al.*, 2005b). In 2006, DGGS extended this mapping into the Casadepaga River–Bluff area (red outline), and will produce a combined map of the three regions by September 2007. A geochemical report for this area is scheduled for release by January 2007. This project is primarily funded by the AGGMI program, with partial support from 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 (Till *et al.*, 1986). DGGS's recent detailed geologic mapping defines the internal metamorphic stratigraphy of these 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 at ~200 Ma, 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 $^{40}Ar/^{39}Ar$ adularia and white mica ages of ~105 to 115 Ma. Hydrothermal kaolinite, cinnabar, and adularia indicate epithermal-style mineralization is present on the southern Seward Peninsula, as well as the more widely distributed, gold-bearing veins of possible orogenic or extensional origin. Ongoing $^{40}Ar/^{39}Ar$, petrographic, microprobe, Sr isotopic, and other studies by DGGS and University of Alaska personnel will soon provide additional insights into the region's geologic, metamorphic, and structural history, and its lode-gold and base-metal mineral potential.

Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management, 2003, DGGS Geophysical Report GPR 2003-1, 1 CD-ROM.

Newberry, R.J., Werdon, M.B., Stevens, D.S., Athey, J.E., and Szumigala, D.J., 2005, DGGS Report of Investigations 2005-1d, 1 sheet, 1:50,000 scale.

Till, A.B., Dumoulin, J.A., Gamble, B.M., Kaufman, D.S., and Carroll, P.I., 1986, U.S.G.S. Open-File Report 86-276, 71 p., 3 plates, scale 1:250,000.

Werdon, M.B., Stevens, D.S., Newberry, R.J., Szumigala, D.J., Athey, J.E., and Hicks, S.A., 2005a, DGGS Report of Investigations 2005-1a, 1 sheet, 1:50,000 scale.

Werdon, M.B., Szumigala, D.J., Newberry, R.J., Athey, J.E., and Hicks, S.A., 2005b, DGGS Raw Data File 2005-2, 46 p.

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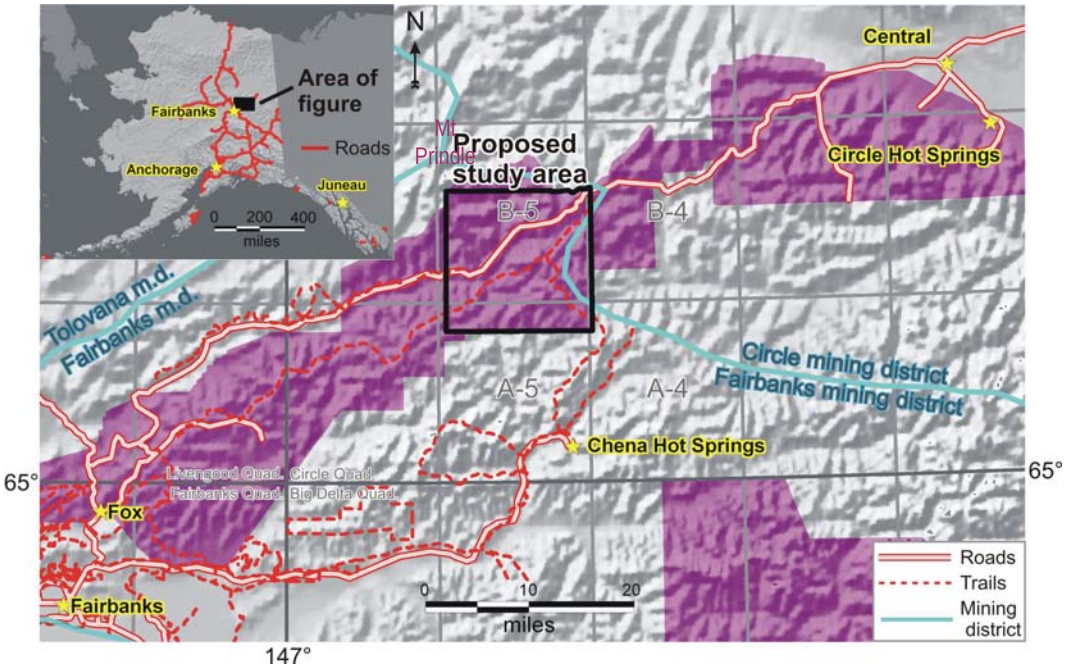
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: GEOLOGIC MAPPING IN THE NORTHEAST FAIRBANKS GEOPHYSICAL SURVEY TRACT

DGGS released airborne geophysical maps for a 404-square-mile area northeast of Fairbanks in January 2006. About 189 square miles of the NE Fairbanks geophysical survey tract are proposed for a geologic mapping project to be conducted in the summer of 2007. The mapping project is 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. Funding sources include the federal STATEMAP program, and State Capital Improvement Project (CIP) funds and General Fund.

The State-maintained Steese Highway bisects the proposed study area from approximately highway miles 60 to 80. Good access from the highway and a few trails, in addition to nearby power from the high-voltage power lines of the Fort Knox gold mine located 25 miles to the southwest, would facilitate possible mineral development. Northeast-trending mineralization in the central and southwestern Fairbanks mining district may extend northeast into the proposed map area. The Fairbanks mining district has the largest historic gold production in Alaska, with just under 12 million troy ounces of lode and placer gold produced as of 2005 (Hughes and Szumigala, 2006). Historic geologic reports and mineral exploration data suggest that lode gold and polymetallic occurrences in the proposed geologic mapping area may be related to plutonic hydrothermal systems similar to those responsible for the majority of the mineralization in the Fairbanks mining district. Placer gold deposits in the study area are believed to have been strongly affected by the extent of ancient glaciations that originated at Mount Prindle.

DGGS mapping will provide timely geologic data to Alaska's Division of Mining, Land & Water to assist in determining whether about 30 percent of the proposed study area should be opened to residential settlement, and closed to mineral exploration and development. Up-to-date knowledge of the area's mineral potential is crucial for the decision on whether to retain the land for subsurface use. The proposed Mount Ryan Remote Recreational Cabin Sites Staking Area coincides with the southeast corner of the proposed study area.



Map showing the locations of the proposed map area (black outline) and airborne-geophysical survey areas (magenta polygons) in relation to rural communities and transportation corridors.

New geologic mapping with interpretation of geophysical data will lead to: (1) a better understanding of the lithologic and tectonic framework of Interior Alaska, (2) baseline geologic-materials and -hazards data for future construction of infrastructure and settlements, and the maintenance of current infrastructure, including the Steese Highway, (3) geologic-resource data critical to land-use decisions, and (4) a foundation of geologic knowledge that will encourage mineral exploration investment in the northern section of the Fairbanks mining district. Proposed products will be a series of bedrock- and surficial-geologic maps at 1:50,000 scale, and reports containing geological, geochemical, and geophysical data compilations. Geologic maps will be completed by fall 2008.

Hughes, R.A., and Szumigala, D.J., 2006, Alaska's Mineral Industry 2005: Alaska Division of Geological & Geophysical Surveys, Special Report 60, 81 p.

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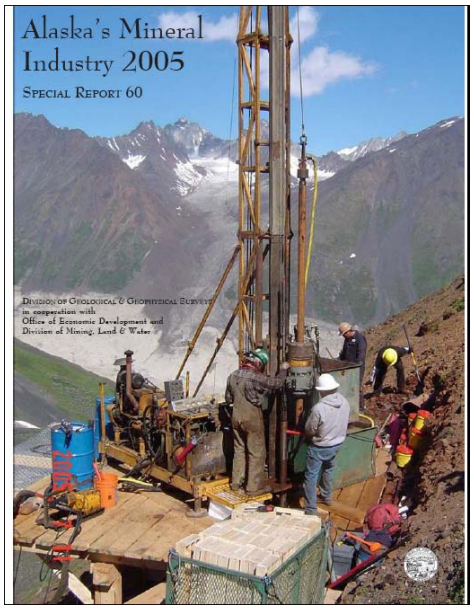
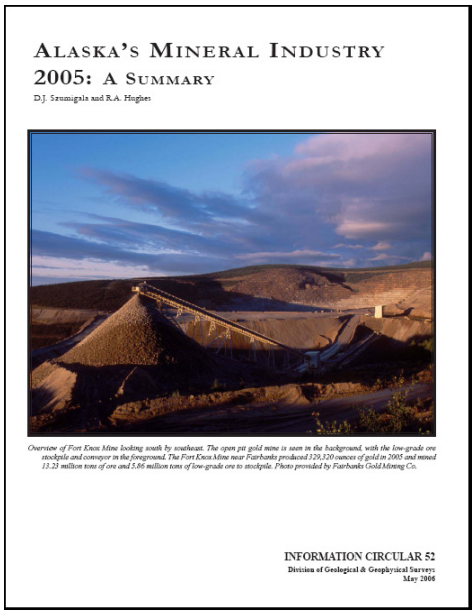
ANNUAL ALASKA MINERAL INDUSTRY REPORT





Alaska Statute 41.08 charges the Division of Geological & Geophysical Surveys *"to determine the potential of Alaska land for production of metals, minerals, fuels, and geothermal resources; the location and supplies of groundwater and construction materials; the potential geologic hazards to buildings, roads, bridges, and other installations and structures; and shall conduct such other surveys and investigations as will advance knowledge of the geology of Alaska."* 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 assists the mineral industry, provides valuable information to the State and the public in terms of the health of the State'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 chamber 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 formulating public policy affecting resource and land management rely on the report as an essential tool.

The 2005 Alaska mineral industry report released in November 2006 summarized information provided through replies to questionnaires mailed by DGGS, phone interviews, press releases, and other information sources. The 2005 cumulative value of Alaska's mineral industry is $1.853 billion, a new record value; this is the tenth straight year that Alaska's mineral industry topped $1 billion. Exploration expenditures for 2005 were $103.9 million, the highest expenditure total over 50 years of record keeping; development expenditures amounted to $347.9 million, the second highest total since records were kept in 1981; and the value of mineral production was $1,401.6 million, also a new record. The Alaska mineral industry will likely see new records in 2006 due to continued high commodity prices.

The annual report has been published for 25 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), with help from the Division of Mining, Land & Water (DMLW) in DNR. A summary of the 2006 Alaska mineral industry activities will be released by February 2007. The 2006 Alaska mineral industry report will be released by early November 2007.

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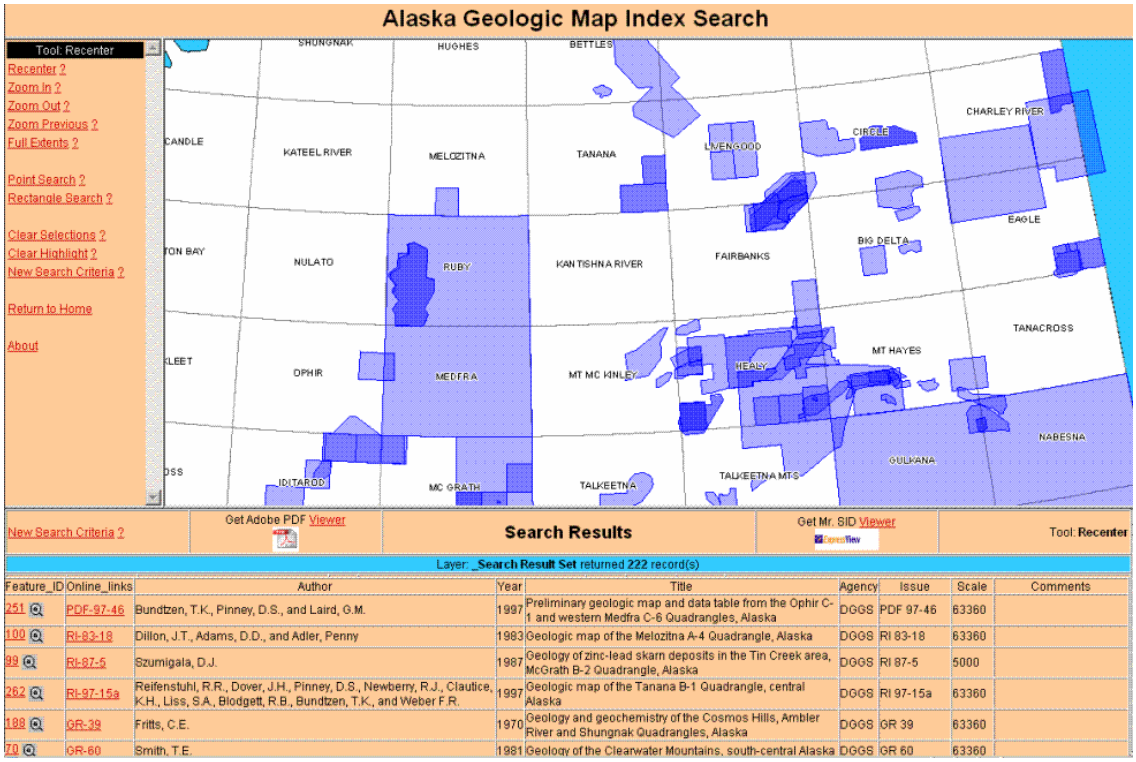
ALASKA GEOLOGIC AND GEOPHYSICAL MAP INDEX

The Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS) and Land Records Information Section (LRIS) released the first version of an application that will portray the locations of geologic maps from all government agencies in a single, interactive, Internet-accessible location. The Alaska Geologic Map Index site <http://maps.akgeology.info> was made accessible to the public in November 2003 and currently contains about 300 citations and outlines for DGGS-authored geologic maps. Outlines for most Alaskan 1:250,000- and 1:63,360-scale geologic maps produced by the U.S. Geological Survey (USGS) and more DGGS maps will be added by the end of February, 2007. LRIS will then modify the interface for the Alaska Geologic Map Index site to enable users to refine the searches. During FY07 and FY08, after that modification is completed, DGGS will add outlines for remaining geologic maps from USGS, U.S. Bureau of Mines (BOM), and U.S. Bureau of Land Management (BLM), and geophysical maps from DGGS and other agencies.



Feature_ID	Online_links	Author	Year	Title	Agency	Issue	Scale	Comments
251	PDF-97-46	Bundtzen, T.K., Pinney, D.S., and Laird, G.M.	1997	Preliminary geologic map and data table from the Ophir C-1 and western Medfra C-6 Quadrangles, Alaska	DGGS	PDF 97-46	63360	
100	RI-83-18	Dillon, J.T., Adams, D.D., and Adler, Penny	1983	Geologic map of the Melozitna A-4 Quadrangle, Alaska	DGGS	RI 83-18	63360	
99	RI-87-5	Szumigala, D.J.	1987	Geology of zinc-lead skarn deposits in the Tin Creek area, McGrath B-2 Quadrangle, Alaska	DGGS	RI 87-5	5000	
262	RI-97-15a	Reifenstuhl, R.R., Dover, J.H., Pinney, D.S., Newberry, R.J., Clautice, K.H., Liss, S.A., Blodgett, R.B., Bundtzen, T.K., and Weber F.R.	1997	Geologic map of the Tanana B-1 Quadrangle, central Alaska	DGGS	RI 97-15a	63360	
188	GR-39	Fritts, C.E.	1970	Geology and geochemistry of the Cosmos Hills, Ambler River and Shungnak Quadrangles, Alaska	DGGS	GR 39	63360	
70	GR-60	Smith, T.E.	1981	Geology of the Clearwater Mountains, south-central Alaska	DGGS	GR 60	63360	

The purpose of the Alaska Map Index Project is to make the information about the current status of bedrock and surficial geologic mapping of Alaska widely accessible to the mineral industry and others. Currently, an up-to-date, geographically referenced index of DGGS, USGS, BLM, and BOM Alaska geologic maps does not exist. This information will make it easier for the public and government agencies to easily find the geologic maps they need to make informed decisions. The program is part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program. The primary objective of the MDIRA program is to ensure that all Alaska minerals-related geologic data are preserved in a safe and readily accessible format for all potential users.

Besides allowing searches by geographic rectangle or by point location, the current interface (shown above) provides links to scanned reports and maps for each DGGS citation. Links to scanned USGS publications that are available at the DGGS Publications web page <http://www.dggs.dnr.state.ak.us/pubs> will be provided after they are added to the Map Index website. Subsets of map outlines based on map categories, such as “bedrock geology,” “surficial geology,” “resources-metals, lode,” and “hazards, permafrost” may also be produced by the user through another page on the website.

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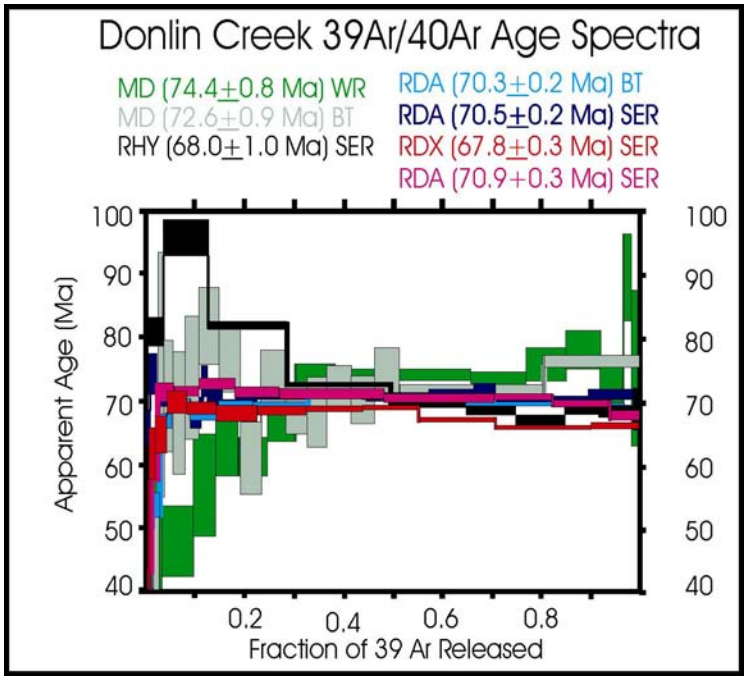
GEOCHRONOLOGIC DATABASE FOR ALASKA



In Spring 2005 the Alaska Division of Geological & Geophysical Surveys (DGGS) began to develop a geochronologic database for Alaska. The geochronologic database will contain age data and associated information for all available radiometric dates for 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 is part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program. The primary objective of the MDIRA program is to ensure that all Alaska minerals data are preserved in a safe and readily accessible format for all potential users. Information on mineral resources is important for management policy decisions in both the public and private sectors. Higher quality data should lead to better economic, legislative, and environmental decisions.

DGGS's existing Oracle-based relational database structure was used as a starting point for the structure of the geochronologic database. Additional fields were added after consulting laboratory analysts and other geologists with a vested interested in using the database. The database will include dates for all available U-Pb, K-Ar, $^{40}Ar/^{39}Ar$, and Rb-Sr data for Alaska. Previous compilations by Wilson and others (1990; 1999) provided the initial source of age data for the database. Additional radiometric dates are being compiled from both published and unpublished sources. In addition to updating the existing compilations, this database project is adding essential basic supporting information that is currently not easily accessible. This information includes items such as 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 where the data are available. Much of the supporting data are present in the original publications for the age data, including unpublished student theses, or are archived in laboratory or industry files. Where data are not available in published form, letters requesting more information will be sent to appropriate geologists, requesting that they provide the data if they have it or, more likely, that they will give permission for the laboratory to provide the information. GeoRef and a dataset currently under construction at DGGS, the *Bedrock and Surficial Geologic Map Index*, are being used to search for additional sources of data.

This geochronologic database provides a centralized, up-to-date, digital source of radiometric ages. Addition of the basic supporting data, where possible, will allow the geoscience community to critically evaluate the validity of these ages and to make their own interpretations. To date, over 3,345 age records have been entered into the database. The final stage of the geochronology project will be to make this database accessible via DGGS's web site and through a link on the MDIRA website (http://akgeology.info). Bibliographic citations for DGGS and U.S. Geological Survey publications will be linked to digital or PDF files of the appropriate publication. A release of the geochronologic database is scheduled for June 2007. The completed database will reside in DGGS's Oracle database, which will serve as a repository for future radiometric data.

Wilson, F.H., Shew, Nora, and Dubois, G.D., 1990, Map and table showing isotopic age data in Alaska, *in* Plafker, G. and Berg, H.C., eds., Geology of North America, The Geology of Alaska, Vol. G-1, Plate 8.

Wilson, F.H., Shew, Nora, Dubois, G.D., and Dadisman, Shawn, 1999, Alaska Radiometric Ages: U.S. Geological Survey, http://minerals.usgs.gov/sddp/mrdata/sddpftp.shtml.

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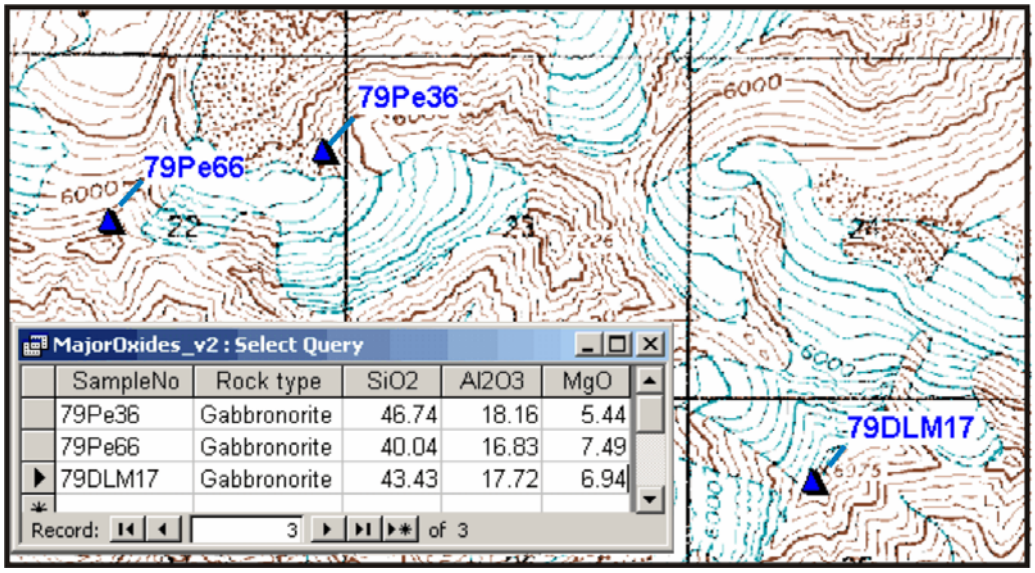
COMPILATION OF ALASKA STATE AGENCY LITHOCHEMICAL DATA

As part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program, all minerals-related Alaska geochemical data sets are being incorporated into a comprehensive interagency digital geochemical database system. The Minerals Section of the Alaska Division of Geological & Geophysical Surveys (DGGS) is involved in two components of the geochemical program—the Alaska State Agency Lithochemical Data Project (described here) and the Compilation of Existing Resource Assessment Geochemical Datasets Project (described in a separate briefing paper).



The objective of the Alaska State Agency Lithochemical Data Project is to make DGGS lithochemical data accessible via the MDIRA program's website <AKgeology.info>. This will be accomplished by compiling the data into the DGGS digital database, and then posting it to the MDIRA website. As part of the MDIRA project, Federal agencies have made a concerted effort to systematically organize their electronic geochemical-data files. That effort is nearly complete for much of the Federal quantitative geochemical data. DGGS possesses a significant amount of Alaska minerals-related geochemical data that has not previously been gathered into organized data sets. Some of the data have not been published; other sets are not in digital format and are in danger of being lost. The vast majority of the data have not been digitally linked with geographic locations.

DGGS is assembling the various at-risk lithochemical data that have been generated by DGGS or, in some cases, by the University of Alaska, organizing these data into rational datasets, and linking them with georeferenced locations. The DGGS system will be designed and implemented in a manner compatible with U.S. Geological Survey PLUTO and RASS datasets and will provide the data for the MDIRA database and website. This project works in conjunction with USGS counterparts and the DGGS MDIRA database project. Geochemical data and latitude and longitude sample locations are being compiled into the DGGS Oracle-based database and previously published data are available on the internet at http://www.dggs.dnr.state.ak.us/webgeochem as data are loaded into the database. Unpublished data will be compiled and released as a DGGS Raw Data File at the end of the project.

We estimate this project will recover 1,200 sets (one sample equals one set) of major oxide analyses, 500 sets of minor element analyses, 3,000 rock trace element data sets, and 500 to 600 mineral compositions data sets. An additional 1,000 major oxide or trace-element datasets from unpublished University of Alaska Fairbanks Master of Science thesis research also will be included. Data will be included for the areas of Haines, Lime Peak, Chugach, Fairbanks, Talkeetna Mountains, Interior Alaska, Valdez Creek mining district, and southwestern Alaska, as well as others. The project is scheduled for completion by December 31, 2007.

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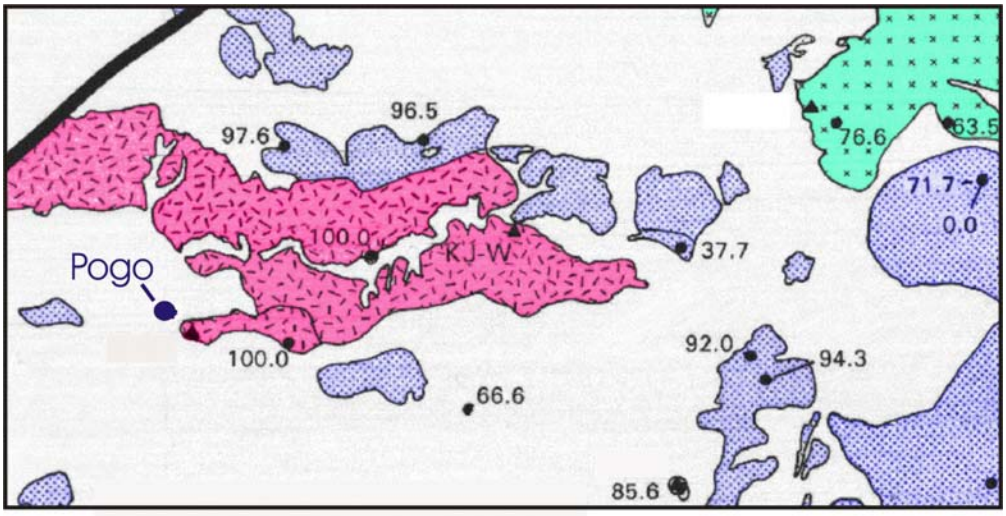
COMPILATION OF EXISTING RESOURCE ASSESSMENT GEOCHEMICAL DATASETS

The objective of the Compilation of Existing Resource Assessment Geochemical Datasets project is to provide three reference datasets to the public that were compiled by the Alaska Division of Geological & Geophysical Surveys (DGGS) for use in resource assessments. The datasets were designed during investigations of tin granites, plutonic gold ("non-porphyry") systems, and mafic and ultramafic plutonic rocks. These datasets contain about 3,400 major oxide and trace element analyses and mineral compositions from mineralized and non-mineralized systems around the world. A small percentage of the rocks in these datasets come from Alaska. Though many of the analyses included in these datasets have been released to the public, they are scattered in hundreds of articles around the world. The data have not been released to the public as a cohesive dataset with a mineral-related purpose. Federal funding, through the Minerals Data and Information Rescue in Alaska (MDIRA) project, will allow DGGS to migrate the data from older computer software to current database standards, document the sources of the data, provide georeferencing for samples where appropriate, and make these refined datasets available to the public.

The datasets can be used to compare compositions between Alaska rocks and those related or non-related to particular ore deposits worldwide. The data for the tin-granite and plutonic gold systems were edited so that characteristic compositions of particular types of mineralized and non-min-eralized systems could be more accurately identified. These two datasets, consisting of about 1,700 analyses, were used successfully for comparison during evaluation of areas containing potential tin granites and plutonic gold systems (non-porphyry type) in Alaska during the late 1980s. For example, we calculated "discriminant scores" by using multivariate discriminant analysis on the plutonic gold dataset (see figure; modified from Burns and others, 1991). At the time the study was done, this area in Interior Alaska was thought to be barren of gold deposits. The scores indicate degree of similarity of the rock analyzed to other plutonic rocks associated with systems that produced gold deposits. Scores in the diagram range from about 63 (considered to indicate very low similarity) to 100 (considered indistinguishable from plutons associated with gold systems). The discriminant scores of '100' near the later-discovered Pogo deposit were an indication that gold-related plutonic systems may well be present in the area. The particular plutonic rock associated with deposition of gold at Pogo is not exposed at the surface. The predictions DGGS made based on the plutonic gold dataset were thought to be a major catalyst of much mineral exploration in this part of the interior in the early 1990s.



The third dataset includes about 1,750 rock and mineral analyses from mafic and ultramafic bodies and shows potentially significant trends among the different types of ultramafic and mafic rocks. This dataset may also eventually be used as an aid for locating platinum-group-element (PGE) mineralization.

The datasets will be released via the DGGS and MDIRA websites (<www.dggs.dnr.state.ak.us> and <akgeology.info>, respectively). The project should be completed by December 31, 2007.

Burns, L.E., Newberry, R.J., and Solie, D.N., 1991, Quartz normative plutonic rocks of interior Alaska and their favorability for association with gold: Alaska Division of Geological & Geophysical Surveys Report of Investigation 91-3, 71 p., scale 1:412,500; 2 sheets.

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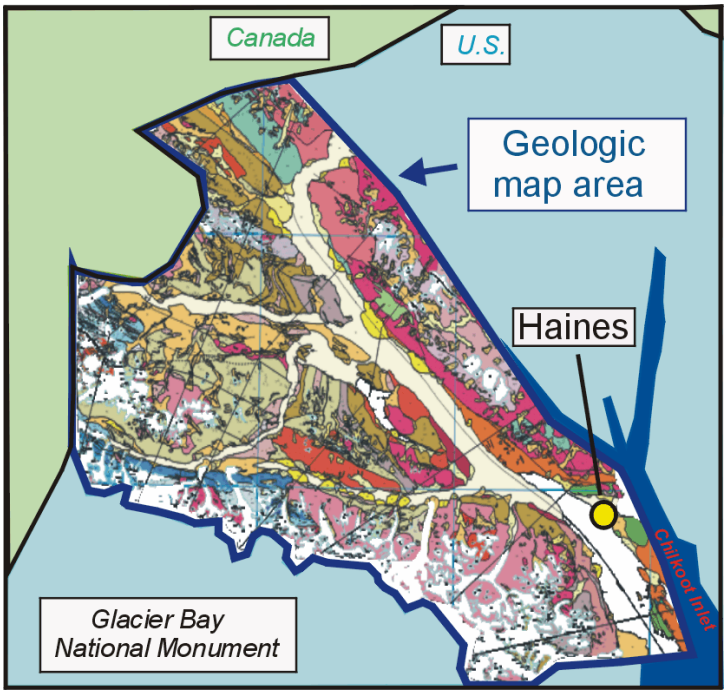
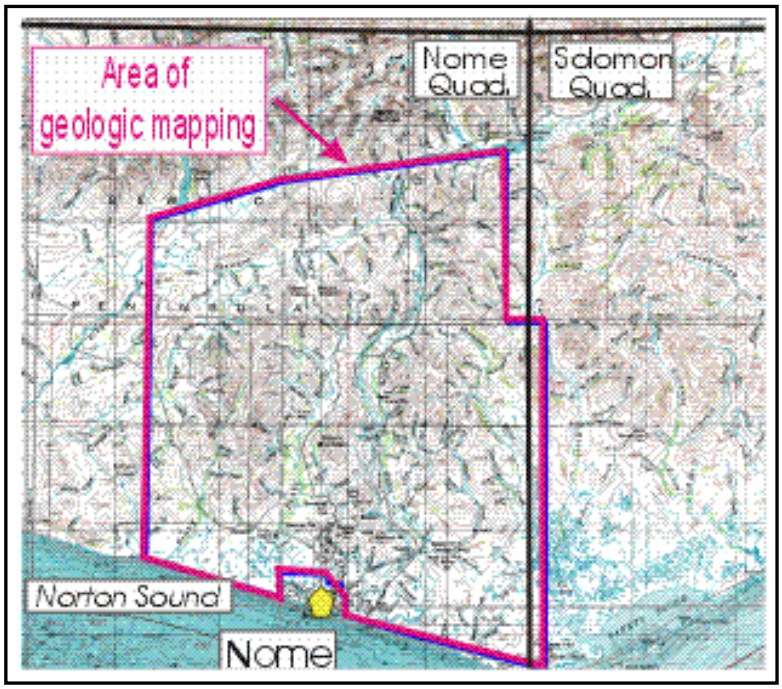
GEOLOGIC MAPS OF THE HAINES AND NOME AREAS



As part of the federally funded Minerals Data Information Rescue in Alaska (MDIRA) project, as many minerals-related Alaska geologic maps as possible will be incorporated in a comprehensive DGGS geologic database system. This project will publish two bedrock geologic maps for which DGGS has completed field work and draft maps but which have not been published, and incorporate them in the division-wide database. The maps include a 900-square-mile geologic map of the Haines area and a 250-square-mile geologic map of a highly prospective mineralized tract near Nome on the Seward Peninsula (see figures). The maps will be published in hardcopy format and posted on the DGGS website.

The Haines map covers the entire Porcupine mining district. This bedrock and surficial geologic map has been reviewed and edited as a Professional Report. The map unifies five geologic maps that DGGS previously published in reconnaissance form for a 900-square-mile area. The authors of the five geologic maps used different nomenclature and mapping styles. The map to be published contains a synthesis of terminology and map units that was worked out by the original authors. The second sheet of the Haines map contains sample locations, radiometric ages, and geochemical data. This area is a major section of southeastern Alaska that has no existing coherent geologic map. This project will complete the digitizing of the geologic map and cross-sections and publish the map both in hardcopy form and digitally on the DGGS website. The Haines map project is scheduled to be finished by September 2007.



The Nome map covers a portion of the Nome mining district. An initial year's worth of geologic mapping was released in 1994 for part of the area, but compiling the mapping of a second summer of geologic work was delayed due to other State priorities. During 2005, the first author of the original map submitted a draft geologic map to the DGGS publication process, and is currently revising the map based on reviewers' comments. The Nome map project is scheduled to be finished by end of June 2007.

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ARCHIVING AND INDEXING DGGS PROJECT FILES AND FIELD NOTES (DGGS LEGACY FILES PROJECT)

A project to provide an index of DGGS legacy projects and field data is being funded through the federal Minerals Data Information Rescue in Alaska (MDIRA) project. DGGS has maps, files, and unpublished reports from about 40 years of fieldwork and office projects to be properly indexed and archived by this project. The indexing project is a joint effort between DGGS and the Department of Mining and Geological Engineering at the University of Alaska Fairbanks. Through a Reimbursable Services Agreement (RSA), both organizations have principal investigators who manage different aspects of the project. Two UAF engineering students have been employed by UAF over parts of the past year for this project; a DGGS intern and a UAF petroleum engineering M.S. candidate are currently working on the project. Methodology of the project is similar to that used for the successful MDIRA-sponsored Alaska Mineral Information Data Index (AKMIDI) Project, which inventoried the Anaconda Minerals Co. and other data collections.

DGGS has boxes and file cabinets full of project maps, files, field notes, associated data, thin sections and rocks accumulated by staff geologists during the past 40 years. These maps and files were not indexed and archived due to lack of time and funding. This current indexing project will enable DGGS to organize, inventory, and store legacy documents to make them accessible to DGGS scientists and the public. DGGS recently split the tasks into two components: Organizing, scanning, and archiving maps; and organizing associated files and rock samples.

Like the AKMIDI Project, the DGGS file project will sort, bar code, and index historic project and field data. Low-resolution digital index images will be linked to or stored in the relational database so that the public can obtain some insight about the content of potentially useful intermediate maps, figures, or photographs without having to retrieve the physical materials from the DGGS archive. The bar code and digital image index will use a variation of the AKMIDI relational database and will ultimately be uploaded into the DGGS Oracle database. The database will be amenable to routine maintenance and query and will provide DGGS with an opportunity to make an organized index of its archived project file materials available to the public through the Internet.

To date, DGGS and UAF have sorted and inventoried file cabinets of project files and manuscripts and have compiled maps, field notes, and other products from several projects. A spreadsheet of over 8,800 historic thin sections has also been completed. All mineral-related DGGS maps are now in the map room and those maps are being sorted and filed prior to coding. More than 40 pallets of partially archived rock samples have been moved from cold storage into the DGGS warehouse for cataloging, boxing, and shipping to the Geologic Material Center (GMC) in Eagle River.

Indexed project and working file data and materials will stored in an organized manner so that they are accessible and archived for the future. The inventoried documents will be stored in DGGS offices and, where appropriate, the GMC. All rock samples shipped to the GMC for this project will be accompanied by a relational database recording as much information as known for each rock sample, including rock sample ID, collector name, project name, and sample location if known (quadrangle and/or spatial coordinates). The project will be completed by September 2009.

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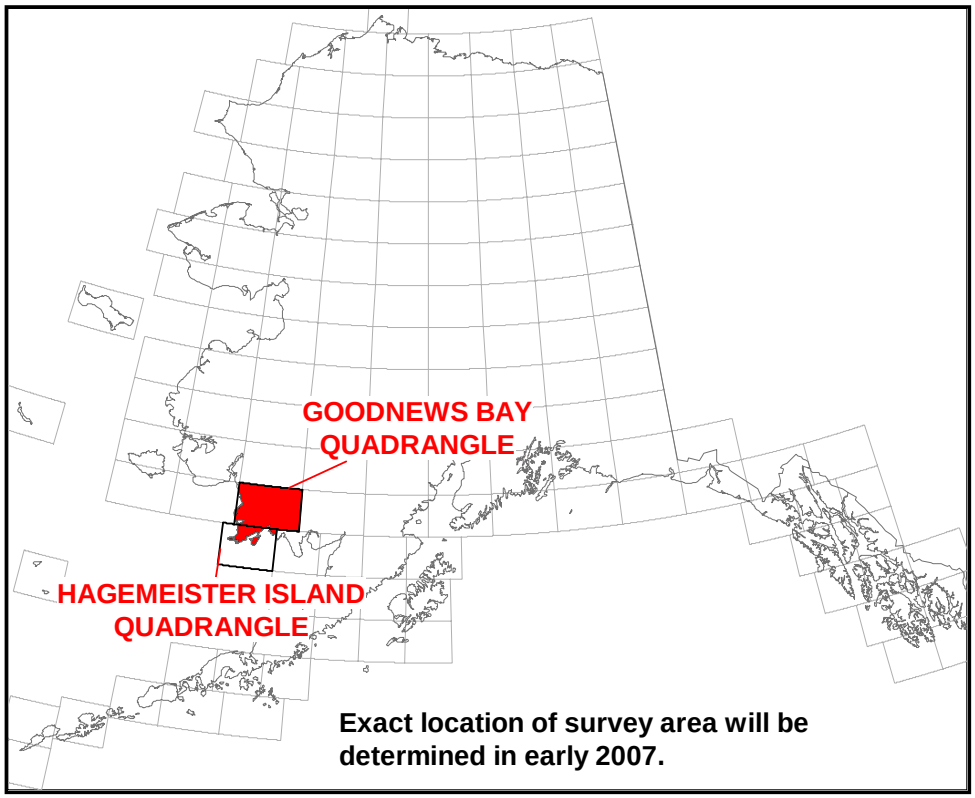
GOODNEWS BAY AEROMAGNETIC SURVEY

The U.S. Bureau of Land Management (BLM) and the Alaska Division of Geological & Geophysical Surveys (DGGS) are preparing to conduct an aeromagnetic survey for a large part of the Goodnews Bay and part of the Hagemeister Island quadrangles in southwestern Alaska. The survey is funded by BLM through a cooperative agreement with DGGS in support of DGGS's statewide airborne geophysical survey program. The BLM is targeting the Goodnews Bay Quadrangle with an airborne geophysical survey in support of their Bay planning area Resource Management Plan and to complement the ongoing mineral assessment of the Bristol Bay Mining District.

The Goodnews Bay area hosts historic production of placer platinum and platinum-group elements (PGE) that at one time represented the only PGE production in the United States. The source of metals for these important deposits in southwestern Alaska is Cretaceous mafic–ultramafic intrusive rocks. Additional gold occurrences are associated with other intrusive rocks in the Goodnews Bay Quadrangle.

In cooperation with the USGS, the BLM selected the Goodnews Bay Quadrangle to help complete the airborne magnetic data coverage of the area. Recent USGS and DGGS aeromagnetic surveys of adjacent areas, along with the proposed BLM survey, will provide a modern, digital, magnetic data package that can be used for mineral assessments and regional geologic interpretations of this mineralogically significant part of Alaska.

DGGS's role in this project is to contract and monitor geophysical data acquisition and processing, and to release the geophysical data to the public. These airborne surveys are an essential element of the State of Alaska's and U.S. Bureau of Land Management's ongoing programs to evaluate the publicly owned resource base, encourage exploration in promising mineral districts in Alaska, and to make mineral information available to the public. Public release of the maps and digital data are expected in late summer 2007.



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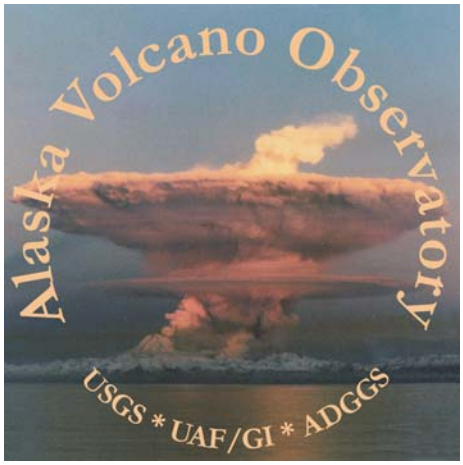
ALASKA VOLCANO OBSERVATORY: PROGRAM MANAGEMENT



The Alaska Volcano Observatory (AVO) is a multi-agency program that uses state, federal, and university resources to monitor and study Alaska's hazardous volcanoes, predict and record eruptive activity, and provide information to implement public safety measures. AVO is a cooperative program of the Alaska Division of Geological & Geophysical Surveys, the U.S. Geological Survey, and the University of Alaska Fairbanks Geophysical Institute. All funds for DGGS participation in AVO are generated through written proposals to the USGS. We build and maintain the AVO website (www.avo.alaska.edu) and the database from which it is derived (both discussed in separate briefing papers). We lead some geologic field programs and serve as team members on others (also discussed separately). In addition, we serve specific program roles not connected to individual geologic projects. These are discussed below.

Volcano Monitoring. AVO continues to excel in integrated monitoring of volcanoes using short-period seismometers, broadband seismometers, continuous telemetered GPS, satellite imagery, gas measurements, web cameras, and local observer reports. AVO maintains seismic networks on 30 active volcanoes (up from four a decade ago), and monitors more than 100 volcanoes twice daily by satellite. We use these data streams to recognize unrest and impending eruptive activity, and we issue formal updates, status reports, and warnings to a wide range of civil authorities, agencies, and concerned businesses and individuals. DGGS provides staff when needed to assist in monitoring and reporting during eruptions.

GIS Expertise. DGGS provides advanced GIS expertise to all component agencies in AVO. This includes producing base maps by combining diverse data derived from satellite and airborne sensors in areas where 1:63,360-scale topographic maps do not exist, retrieving and georegistering maps from discontinued map series, and producing a variety of other georegistered data products. DGGS also provides expertise in finalizing and troubleshooting GIS-based map reports using standard GIS techniques for numerous specific projects in all AVO component agencies.

Helicopter and Ship Logistics. DGGS manages helicopter charter procurement for all major AVO projects. In addition, DGGS manages ship charters for those projects that are far enough from population centers to require ship-based helicopters. Total expenses during the 2006 field season were about $400,000. Having all the helicopters contracted by a single agency results in significant budgetary and logistic efficiencies. As part of managing the helicopter budget DGGS also coordinates all AVO field project schedules so that the appropriate helicopters are available throughout the field season to meet the needs of each field party.

Geochemical Data Procurement and Archiving. DGGS coordinates the procurement of whole-rock geochemical analyses related to Alaska's volcanoes and maintains the archive of those data. In the 18 years AVO has existed, mapping activities have resulted in more than doubling of available data compared to all other combined work since the late 1940s. These data share rigid inter-project quality controls, making the combined data set a major resource for researchers and adding substantially to the value of the data from individual geologic mapping projects.

CUSVO/NVEWS. DGGS is one of the charter members of CUSVO (Consortium of U.S. Volcano Observatories). CUSVO provides coordination among the five volcano observatories in the United States. NVEWS (National Volcano Early Warning System) is a major emerging initiative of CUSVO; the DGGS project leader serves on the NVEWS steering committee and chairs one of the five subpanels developing the program implementation plan. NVEWS aims to standardize monitoring among the nation's volcanoes and to improve monitoring at inadequately monitored volcanoes in Alaska, the lower 48 states, Hawaii, and the Commonwealth of the Northern Mariana Islands.

With DGGS input, AVO issues hundreds of daily, weekly, and periodic volcano status reports every year. DGGS also contributes to whitepapers and committee reports such as the NVEWS implementation plan, which is scheduled for release in late 2006 or early 2007.

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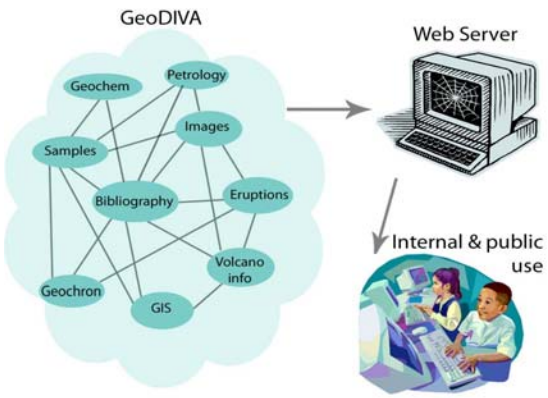
ALASKA VOLCANO OBSERVATORY: GeoDIVA DATABASE

GeoDIVA: DGGS staff design, populate, and distribute the Geologic Database of Information on Volcanoes in Alaska (GeoDIVA) for the Alaska Volcano Observatory (AVO). The mission of GeoDIVA is to maintain complete, flexible, timely, and accurate geologic and geographic information on Pleistocene and younger Alaska volcanoes for scientific investigation, crisis response, and public information in a dynamic, digital format. This information system is the most comprehensive, accurate, and up-to-date source of information on Alaska volcanoes available anywhere, online or in printed form. GeoDIVA is being developed in modules. Each module is released as it is finished in order to streamline the delivery of information to the public. The AVO website (www.avo.alaska.edu, also a DGGS effort, described separately), is the primary means of information dissemination. The GeoDIVA backend to the AVO public web site replaces thousands of individual html pages and is updated dynamically and continuously as new information is added.

Module	Status	Notes
Bibliography	Complete through 2005	Will be updated yearly to include new publications – fully searchable.
Basic volcano information	Complete	130 major and 177 minor volcanic features in Alaska: 52 historically active volcanoes.
Eruption history information	Complete through mid-2006	Information, actual text, and references for more than 400 historic eruptions.
Images	Structure complete – data loading in progress	Currently contains more than 11,000 pictures, figures, and maps – growing daily.
Sample information	Structure complete – data loading in progress	Currently contains information for more than 2,600 samples – growing daily.
Geochemistry	Structure complete – data loading in progress	Geochemistry data loaded for more than 1,000 samples. Working on a better user interface to access the data.
Petrology	Structure complete – data generation and loading in progress	Arc-wide thin section images and descriptions.
Hand sample storage	Structure complete	Sample cataloguing in progress. Fairbanks storage 70% complete.
FieldDIVA	Beta phase	Mini-GeoDIVA for field use.
Ash contact list	Planned for FY07	Statewide individual and agency contacts for ashfall information.
Geochronology	Planned for FY07	Arc-wide age dates and references.
GIS data	Planned for FY07-08	Researching needs, software, and hardware.

Currently GeoDIVA uses MySQL as a database management system, with third-party software: Microsoft Access, and AVO-generated front ends to input and access the data. These software solutions are robust and cost effective. Web interfaces to GeoDIVA are being constructed concurrently with database development and data uploading so that there is minimal lag between database creation and user accessibility.

GeoDIVA is being carefully constructed to serve two distinct user groups—internal geoscientists and the general public. For the information in GeoDIVA to be useful to both groups of users, users must be able to determine where information came from. This requires that every piece of information that goes into the database be referenced to its proper source. The figure (left) shows the interconnected nature of GeoDIVA's many modules, and their dependency on the bibliography.



This project is funded by cooperative agreements with the USGS that support DGGS's participation in AVO. GeoDIVA grows by continual feeding of new data to existing modules and episodic surges of growth as new modules come on line. Completed, in progress, and planned modules of GeoDIVA are in the table above.

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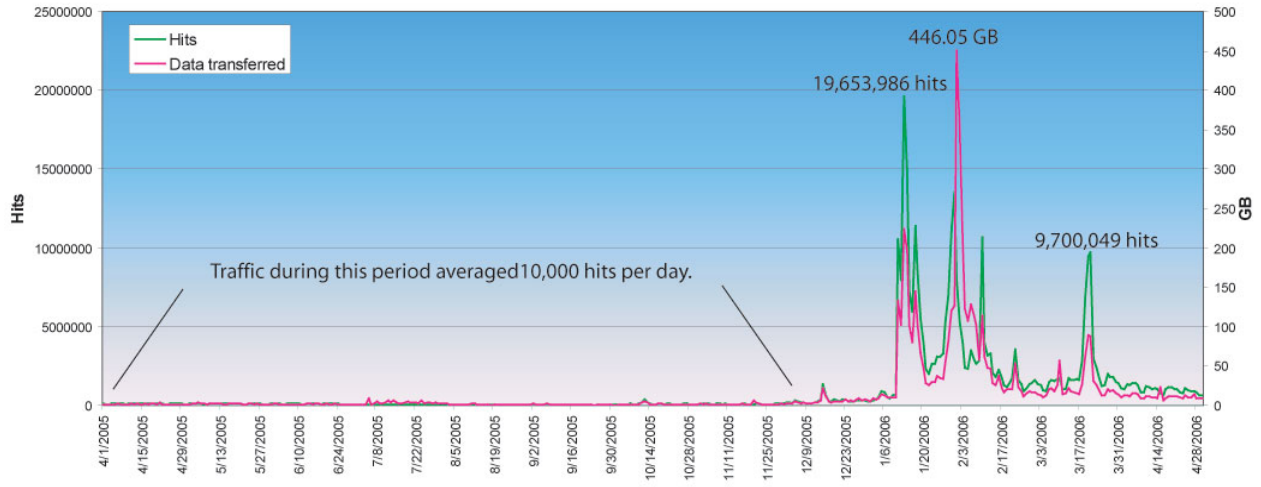
ALASKA VOLCANO OBSERVATORY: WEBSITE

The AVO public website (http://www.avo.alaska.edu) serves about 1,500,000 pages and approximately 300 gigabytes of data to well over 100,000 unique visitors per month, and is among the top ten USGS and USGS-affiliated web sites in the country. DGGS was the original creator of the AVO website more than a decade ago, and continues to be the site manager. This project is funded by cooperative agreements with the USGS that support DGGS's participation in AVO. DGGS has the primary responsibility for producing and maintaining the site, including all the



The eruption of Augustine beginning January 11, 2006, created a surge of traffic to AVO's website. This graph shows a year's worth of traffic to the site and the increase of traffic during the eruption. Primary areas of interest on the website were the webcams pointed at Augustine, and displays of near-real time seismic data. Both are new features.

coding, graphics manipulation, and most of the design. During FY06, AVO's sixth version of the website came online. This new version included a layout change that greatly improved the website's usability.

Besides serving as the primary source for detailed information on all volcanoes in Alaska, the site also facilitates distribution of status reports and information updates to aviation personnel and interested citizens. AVO is a participant in DMIS (Disaster Management Interoperability Services, an emerging federal program to standardize warnings of all types of natural and man-made disasters), and sends daily CAP (Common Alerting Protocol) information to the DMIS backbone through a web interface created by DGGS. The DMIS and CAP combination allows AVO to seamlessly share information with all emergency response organizations. CAP is the first RSS/XML (basic text format) feed. We will make increasing use of this emerging technology.

The site also serves as the digital distribution center for richly formatted AVO print publications such as volcano hazard reports, digital photographs, maps, and fact sheets.

The AVO internal website displays complex near-real-time seismological and satellite data over the web for observatory staff, making distributed monitoring possible, instead of monitoring only from within the lab. The internal Web site is also becoming a central location for managing images, sample, and geochemical data, as well as organization-wide information. This information is stored in the database, where it is easily searched and exported in a variety of useful formats.

AVO is on the leading edge of web development for volcano observatories, and is actively sharing its expertise with other observatories in the U.S. DGGS is following new and emerging technologies that will allow us to further enhance AVO's web presence and data dissemination abilities. We will focus on continual incremental improvements to the site, and serving new database modules as they become available.

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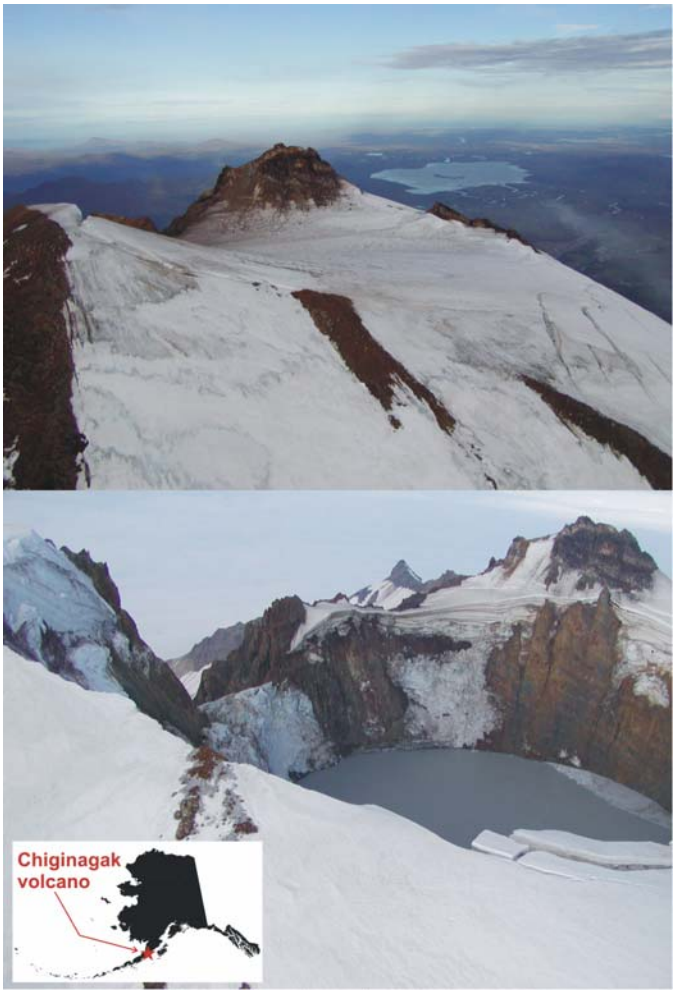
ALASKA VOLCANO OBSERVATORY: CHIGINAGAK VOLCANO VOLCANIC EVENT RESPONSE, GEOLOGIC MAPPING, AND HAZARD ASSESSMENT

Persistent environmental damage from the 2005 Crater Lake Formation, Lahar, Acidic Flood, and Caustic Gas Emission. Mount Chiginagak is a hydrothermally active volcano on the Alaska Peninsula, approximately 170 kilometers (100 miles) south–southwest of King Salmon. Some time between November 2004 and May 2005, a 400-meter-wide, 100-meter-deep lake developed in the formerly snow- and ice-filled crater. In early May 2005, about 3 million cubic meters of sulfurous, clay-rich debris and acidic water exited the crater through tunnels in the base of a glacier that breaches the south crater rim. More than 27 kilometers downstream, the acidic waters of the flood reached 1.3 meters above then-current water levels, acidifying Mother Goose Lake from surface to depth (pH of 2.9 to 3.06) and preventing the annual salmon run in the King Salmon River. A release of caustic gas and acidic aerosols from the crater accompanied the mud-flow and flood, causing widespread vegetation damage along the flow path. A DGGS-led interdisciplinary science team has been monitoring the status of the remaining crater-lake water that continues to flow into Mother Goose Lake. In August 2006, the team conducted a second season of fieldwork to document the environmental damage to the aquatic system and vegetation caused by the event. As of August 2006, the persistently acidic conditions of Mother Goose Lake once again prevented the spawning run of salmon to this drainage. As part of a volcano-hazard assessment, the science team is currently preparing for a 2007 lake bottom sediment coring project with the goal of determining the recurrence interval for this type of acid flood from Chiginagak. Over the winter, AVO/DGGS will monitor activity at the volcano with satellite imagery and with images sent to us from local pilots and residents in the area.



In August 2004 (top photo) the summit crater at Chiginagak volcano was filled with snow and ice. Mother Goose Lake can be seen in the background. By August 2005 (bottom photo) increased heat flow at the summit had melted the snow and ice. Earlier that summer, 3 million cubic meters of sulfurous, clay-rich debris and acidic water drained from the summit crater lake and inundated Mother Goose Lake and the King Salmon River drainage, acidifying the lake and preventing the annual salmon run. Photos by Janet Schaefer.

Geologic Mapping and Volcano Hazard Assessment. The DGGS-led geologic mapping and hazard assessment work that began in 2004 will continue throughout the 2007 field season. Investigations have revealed a long history of hydrothermal activity, debris avalanches, and lava flows at the volcano. Geologic studies at Chiginagak were initiated as part of AVO's core program of describing the history of restless volcanoes. The project is funded by cooperative agreements with the USGS that support DGGS's participation in AVO. A report describing the initial results and observations of the acid flood and acidic aerosol release is being reviewed by coauthors and will be submitted to a peer-reviewed journal in 2007; additional publications in peer-reviewed scientific journals will follow. A geologic map and hazard assessment are scheduled to be published by DGGS in 2008.

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ALASKA VOLCANO OBSERVATORY: AUGUSTINE VOLCANO ERUPTION RESPONSE AND GEOLOGIC MAPPING

2005–2006 Eruption of Augustine Volcano. In May, 2005, seismicity beneath Augustine volcano began to increase, by December reaching levels not detected since its last eruption in 1986. Augustine, an island volcano, is located 280 km south of Anchorage and 115 km west of Homer. Increased seismicity was accompanied by deformation, gas emissions and fumarolic activity. In mid-December, steam explosions produced minor ash deposits on snow around the summit. Thirteen explosive eruptions occurred between January 11 and 29, producing modest ash plumes and disrupting human activity in the Cook Inlet region. These also produced pyroclastic flows, lahars, and mixed avalanches (fig. 1A). Explosive activity was followed in February and March by effusion of a lava dome and two lava flows that moved down the north and northeast flanks of the volcano (fig. 1B). The eruption ceased in late March. DGGS staff participated fully in 24/7 eruption response duties, supported through DGGS's cooperative agreements with USGS for AVO.

Figure 1. *Augustine volcano from the north.* Top: *Pyroclastic flow January 13, 2006. Augustine began a series of 13 explosive eruptions in 20 days on January 11.* Bottom: *Explosive activity was followed by effusion of two lava flows on the north side of the volcano, as seen via incandescence at twilight in March. Both photos were taken by a remote time-lapse camera installed and maintained by AVO.*

Geologic Mapping. Geologic mapping took place during three weeks in August, 2006. Field personnel included scientists from AVO-DGGS, AVO-UAF, AVO-USGS, the Cascade Volcano Observatory, and the American Museum of Natural History geology department. Camp operations were overseen by AVO-DGGS and AVO-USGS geologists. Field work revealed that early pyroclastic flows associated with mid-January explosions produced two scoria-rich deposit types, a veneer-like deposit (not recognized in images), and lobate pyroclastic flow deposits. The lobate pyroclastic flows were associated with lahars, released from lobe-fronts as a result of entrained snowmelt. Mixed pyroclastic flow material and snow also created debris flows. Later pyroclastic flows produced high-silica andesite-rich, lobate deposits. Andesite-rich block and ash flow deposits accompanied March lava flow and dome growth. This eruption provided an unusually good opportunity to observe the results of the interaction with, and incorporation of snow with erupted material. These observations will increase our general knowledge of eruptive processes.

Results from volcano monitoring and field observations were presented in a special session devoted to the recent eruption of Augustine volcano at the American Geophysical Union conference in December 2006. The session was chaired by AVO-DGGS, AVO-UAF, and AVO-USGS geologists. Additional publications in peer-reviewed scientific journals will follow in a planned special volume on the recent eruption of Augustine volcano in the *Journal of Volcanology and Geothermal Research*. An eruption summary was published in *EOS* (Power, J.P., Nye, C.J, Coombs, M.L., Wessels, R.W. Cervelli, P.F., Dehn, J., Wallace, K.L., Freymeuller, J.T., Doukas, M.P., 2006, The Reawakening of Alaska's Augustine Volcano: EOS, Transactions of the American Geophysical Union, v. 87, no. 37, p. 373).

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SURFICIAL-GEOLOGIC MAPPING IN THE COUNCIL GEOPHYSICAL SURVEY TRACT

More than 1 million ounces of placer gold have been extracted from the Solomon–Council area of the Seward Peninsula of Alaska since the turn of the last century. In order to explore new opportunities for development in the Council area, it is critical that the State have an up-to-date inventory of the geologic resources to guide planning activities and identify key features of potential interest. In 2004, with federal STATEMAP support, the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted 1:50,000-scale geologic mapping in the Big Hurrah and Council areas (figure 1; overall project described separately). In 2006, we completed field work to extend this mapping into the Casadepaga River–Bluff area.

The Engineering Geology section of DGGS is mapping the surficial deposits of the area to understand the genesis of the landscape in which the placer gold deposits have accumulated. Previous surficial-geologic mapping in the area has been at a very coarse scale, and we have been able to significantly refine the detail during our mapping efforts. Quaternary deposits in the map area are primarily colluvial and glacial in origin. Glacial deposits of middle Pleistocene age and older have been extensively reworked and modified by significant slope movement resulting from periglacial processes and permafrost. Evidence of glaciation beyond the limits of previous mapping can be seen throughout the northwestern part of the study area in the form of scattered erratic cobbles and boulders on slopes and ridges (figure 2). Prominent gravel-topped terraces up to 16 m thick are preserved along the Casadepaga River (figure 3) and may be related to higher sea level or damming by glacial ice. Carbonate-cemented, shell-bearing beach gravels perched 7 m above modern sea level along the coast west of Bluff provide evidence of ancient higher sea levels (figure 4).

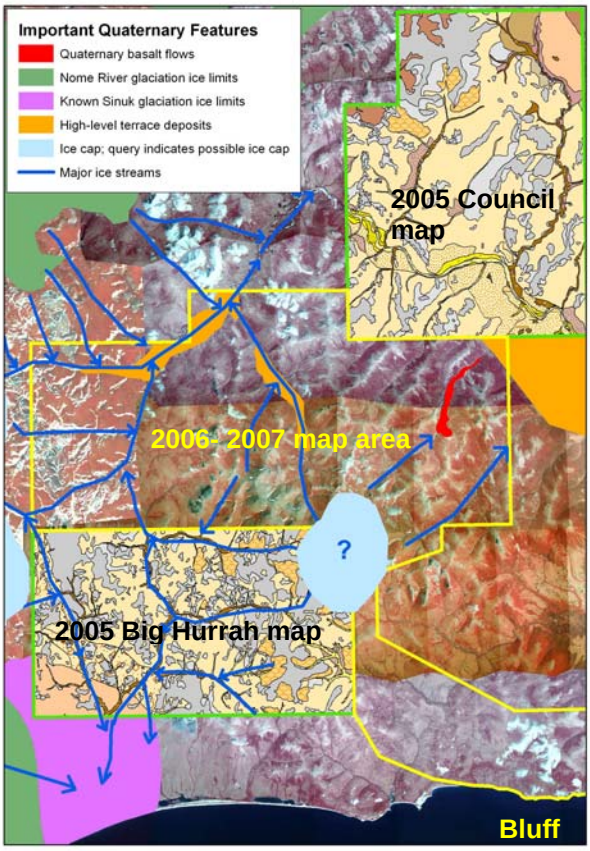

Figure 1 (above). 2006–2007 Council geologic map area. The new mapping links the 2005 Council and Big Hurrah maps.

The anticipated products of this project are geologic-framework maps at 1:50,000 scale, one of which will describe the surficial geology of the area. The maps are scheduled to be completed and released in spring 2007 in fulfillment of DGGS contracts with the federally supported STATEMAP program. We are using the DGGS Geographic Information System (GIS) to generate these maps, and all data for the project will ultimately be stored and made available in a geographically referenced relational database. DGGS will serve these data on its Web site upon completion of the project.

Figure 2 (left). Glacial erratics are the only physical remnants of glaciation in many parts of the field area.

Figure 3 (near right). Helicopter on thick terrace gravels along Casadepaga River.

Figure 4 (far right). Shell-bearing beach gravels on the coast spatially correlate with known Pelukian interglacial deposits elsewhere on the Seward Peninsula.

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MAPTEACH: FIELD-GEOSCIENCE OUTREACH AND EDUCATION IN RURAL ALASKA

DGGS is the lead organization for MapTEACH (Mapping Technology Experiences with Alaska's Cultural Heritage), a multi-year NSF-funded collaborative project with the University of Wisconsin Environmental Remote Sensing Center (ERSC) and the University of Alaska Fairbanks Land Resources Management/Global Change program to develop a field-geoscience outreach program for middle- and high-school students in rural Alaska. This program emphasizes hands-on experience with spatial technology (GPS, GIS, and remote sensing imagery in a local landscape-landform context) in conjunction with traditional activities, and is being piloted in the Minto–Nenana, Nome, and Fairbanks areas. Working directly with DGGS geologists, participants are presented with a chance to authentically emulate scientific activities at a novice level, using real data in a real-world setting. Concurrently, DGGS is learning to incorporate education and outreach into its geological practices when working in rural Alaskan communities.

Figure 1. Eighth-grade students from Effie Kokrine Charter School, Fairbanks, observe a permafrost erosion niche along the Tanana River during a field excursion with a DGGS geologist and local boat captain and river expert Sam Demientieff.

The project is founded on the integration of three focus areas: Geoscience, geospatial technology, and local landscape knowledge. Program materials are being designed for a menu-based model in which users (teachers) can select those portions of the curriculum that are most useful for their classroom objectives. When implementing the full range of MapTEACH curriculum, students and teachers will interact in field settings with Native Elders, traditions-based community leaders, and professional geologists from DGGS (figure 1).

DGGS's primary responsibilities are to: Coordinate with collaborating organizations and manage work flow to meet project goals and NSF contractual requirements; identify and acquire relevant satellite and aerial imagery and GIS data; work closely with teachers and students during pilot sessions; assemble classroom, technology, and field-geology kits; function-test IT (information technology) equipment and software in a field setting; collaborate on curriculum development; serve as the primary liaison with members of the pilot communities, including local and tribal governments, schools, and Native groups; and act as guide and logistics lead for field excursions. Successful pilot sessions with 8th-grade students, predominantly Alaska Natives, were held at Effie Kokrine Charter School in Fairbanks during July–August and October–November 2006. Selected students from the first pilot presented their final projects at the Association of Pacific Coast Geographers annual meeting in Eugene, Oregon (figure 2). Future pilots are scheduled in Nenana for spring 2007 and Nome for fall 2007.

Introducing students to geoscience and geospatial technology in culturally responsive and stimulating classroom and field settings will enhance community understanding of landscape processes and natural hazards in rural Alaska. It will also foster appreciation of state-of-the-art technology tools and data sets that can be applied to informed community planning and decision making.

Figure 2. Four MapTEACH students from the first pilot session were selected to present their final interactive GIS map projects at a national scientific meeting in Oregon.

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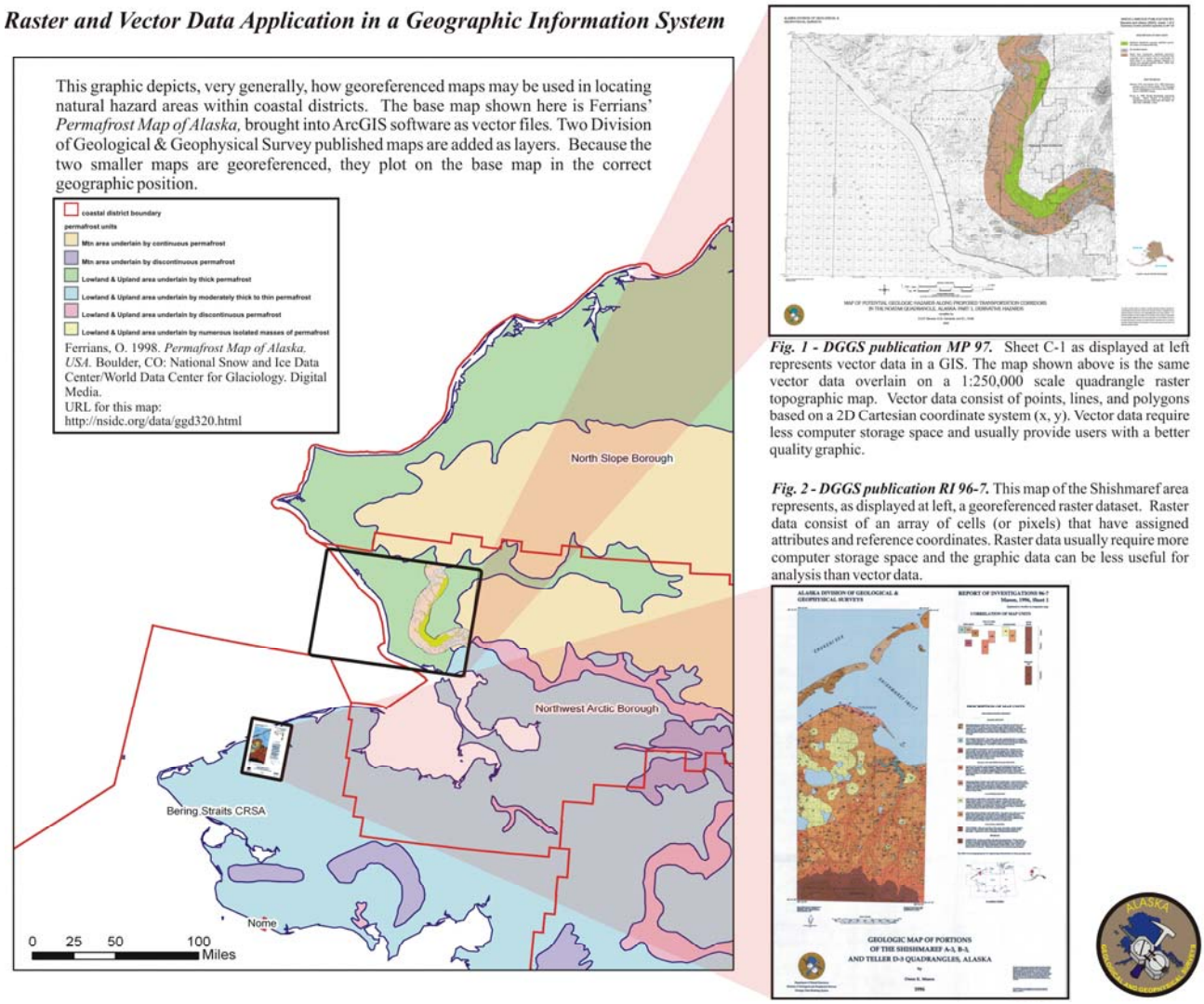
ALASKA COASTAL MANAGEMENT PROGRAM: NATURAL HAZARDS

DGGS provides support to Alaska Coastal Management Program (ACMP) personnel and coastal district planners regarding natural hazard issues through a Reimbursable Services Agreement (RSA). DGGS responsibilities include: Reviewing natural hazard aspects of coastal policy questionnaires during the consistency review process when requested; providing support to coastal district planners in revising coastal management plans; participation in district teleconferences; and periodically reviewing regulatory and planning documents regarding natural hazards issues.

During FY06, DGGS presented information to district planners and project reviewers at an ACMP workshop in Anchorage on the use of geologic maps to assess potential natural hazards.



DGGS staff updated the Natural Hazards Bibliographic Database for Alaskan Coastal Districts to include links to scanned DGGS and USGS publications containing information relevant to hazard assessment. The Natural Hazards Bibliographic Database is served from DGGS's publications database and is searchable by coastal district at http://wwwdggs.dnr.state.ak.us/geologic_hazards_coastal_districts.htm. DGGS is currently georeferencing selected maps from the Natural Hazards Bibliographic Database for use in Geographic Information Systems (GIS) (see figure). The registered maps will be available through the DGGS website.

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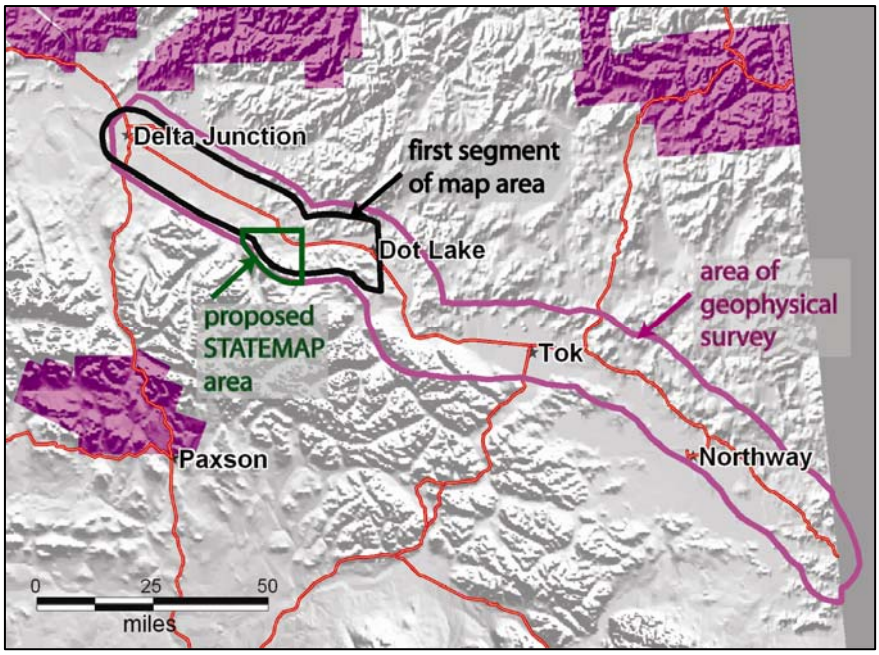
GEOLOGY, GEOLOGIC HAZARDS, AND RESOURCES ALONG THE ALASKA HIGHWAY CORRIDOR FROM DELTA JUNCTION TO THE CANADIAN BORDER



The Alaska Highway corridor serves as the only land transportation route to interior Alaska and is likely to become the locus of increasing development, especially if the proposed natural gas pipeline and/or the proposed 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 project will provide a framework of geologic data upon which engineering and design decisions may be based for any future development along the corridor from Delta Junction to the Canadian border. DGGS will have the benefit of recent airborne geophysical surveys (described separately), as well as modern satellite and aerial imagery, digital elevation modeling, and analytical techniques to provide more-detailed mapping than has been previously available.

The Denali Fault, which ruptured most recently in November 2002, is only about 25 miles south of the project area. Based on the airborne geophysics, we expect that major structural breaks in the rocks cross the corridor, posing potential risk to infrastructure. One goal of this project is to identify these faults in the field and, where possible, evaluate their potential for seismic activity based on observed features on the ground. We are also evaluating the potential for permafrost in the soil using a combination of aerial photograph interpretation, ground observation, geophysical data, and the limited available subsurface information from testhole logs. Other potential geologic hazards to be addressed include earthquake-induced liquefaction, slope stability, and possible flooding.

Materials resources for use in construction are critical to development of any infrastructure. The surficial-geologic mapping for this project will serve as the basis for deriving engineering-geologic maps describing the basic engineering properties to be expected from the surficial deposits and their potential as construction materials. In addition, the potential for mineralization in the bedrock units will be evaluated and laboratory analyses of soil and rock samples will provide baseline data for construction and mineral exploration companies. The broad area covered by this project should also contribute to our regional geologic understanding of this important transect through a major break in Alaskan topography along the Tanana River valley.

Collecting, interpreting, and publishing airborne geophysical data has been the first phase of the DGGS gas pipeline corridor project. The second phase of the project consists of mapping bedrock and surficial geology and evaluating geologic hazards and materials resources. DGGS began reconnaissance geologic mapping in the corridor during summer 2006 and will complete the first segment of mapping in 2007. The first segment extends from Delta Junction as far southeast as Dot Lake. Final map products will be at a scale of 1:63,360 and will show bedrock geology and surficial deposits. We anticipate publication of the bedrock and surficial-geologic maps for this segment in spring 2008. Funding consists of FY2005 state supplemental funding and FY2007 CIP funding, to be augmented by proposed federal STATEMAP funding for a portion of the corridor (as shown in the accompanying figure).

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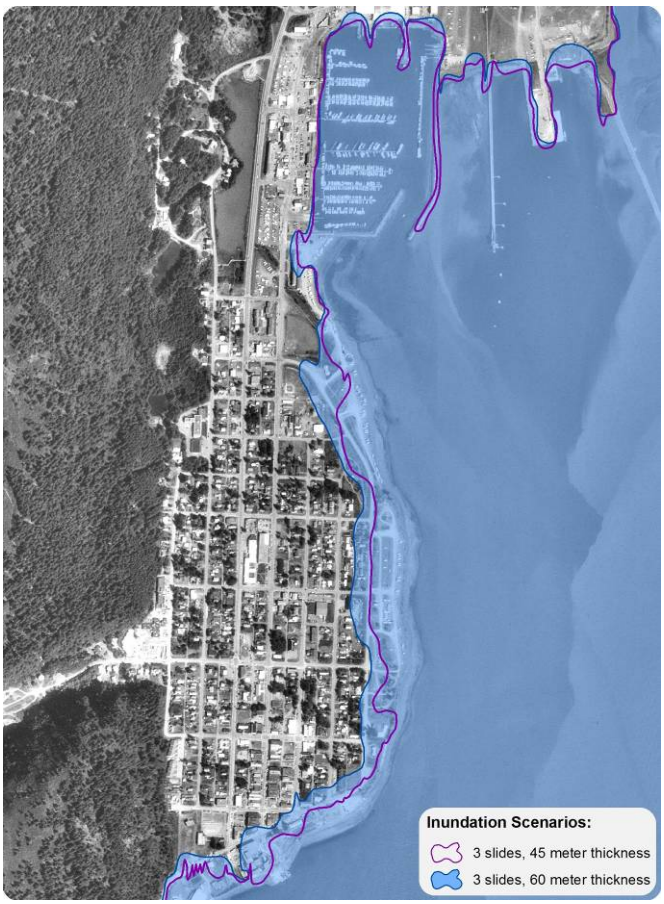
TSUNAMI INUNDATION MAPPING FOR ALASKA COASTAL COMMUNITIES

With funding from Congress, the National Oceanic & Atmospheric Administration (NOAA) initiated the National Tsunami Hazard Mitigation Program in 1997 to assist Pacific states in reducing losses and casualties from tsunamis. The program included funding for five states (Alaska, Hawaii, Washington, Oregon, and California) to address four primary issues of concern: (1) quickly confirm potentially destructive tsunamis and reduce false alarms, (2) address local tsunami mitigation and the needs of coastal residents, (3) improve coordination and exchange of information to better utilize existing resources, and (4) sustain support at state and local level for long-term tsunami hazard mitigation. In 2005, following the catastrophic Sumatra earthquake and tsunami, the U.S. program was expanded to include Atlantic and Gulf of Mexico states and territories.

As part of this program, DGGS participates in a cooperative project with the Alaska Division of Homeland Security & Emergency Management (DHSEM) and the University of Alaska Geophysical Institute (UAGI) to prepare tsunami-inundation maps of selected coastal communities. Communities are selected on the basis of tsunami risk, infrastructure, availability of bathymetric and topographic data, and willingness of a community to use results for emergency preparedness. For each community, DGGS develops multiple hypothetical tsunami scenarios that are based on the parameters of potential underwater earthquakes and landslides. We have completed and published tsunami inundation maps for three communities in the Kodiak area as well as for Homer and Seldovia. For the next community, Seward, we have compiled and merged bathymetric and topographic data and are conducting numerical wave modeling for tsunamis generated both tectonically and by submarine landslides (see figure). Tsunami inundation maps and a report for Seward will be published by December 2007. Data compilation for the next community, Sitka, is underway.

To develop inundation maps, we use complex numerical modeling of tsunami waves as they move across the ocean and interact with the seafloor and shoreline configuration in shallower nearshore water. UAGI conducts the wave modeling using facilities at the Arctic Region Supercomputing Center. DGGS imports the results of this modeling into a Geographic Information System (GIS) database for use in projecting inundation limits on suitable base maps. DGGS, UAGI, and DHSEM meet with community leaders to communicate progress and results of the project, discuss format of resulting maps, and obtain community input regarding past tsunami effects and extent. DGGS publishes the final maps along with explanatory text, which are available in both hardcopy and digital formats. DGGS also makes the GIS files of inundation-limit lines available to the local communities for use in preparing their own tsunami-evacuation maps.

We have presented results of this project at international tsunami symposia in Istanbul, Turkey, and Seattle, Washington, in 2001, at the Tsunami Society symposium in Honolulu, Hawaii, in 2002, and at the American Geophysical Union annual meetings in 2003 through 2006. In addition, this project has been the subject of articles in *Geotimes* and *TsuInfo Alert Newsletter*.



Draft inundation map for two hypothetical submarine landslide-generated tsunamis at Seward.

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DIGITAL GEOLOGIC DATABASE PROJECT

In 2000 the Division of Geological & Geophysical Surveys (DGGS) began developing a geologic database system that will provide consistent data input and organization. The database system will also provide data identification and retrieval functions that will guide and encourage users to access appropriate data online. This project is part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program.

The Digital Geologic Database Project has three primary objectives: (1) To establish a spatially referenced geologic database system in a secure, centralized information architecture with networked data access for new and legacy DGGS geologic data; (2) to create a functional online system that allows the public to find and identify the types and geographic locations of geologic data available from DGGS and then view or download the selected data; and (3) to cooperatively integrate DGGS minerals-related data with data from other agencies for public delivery through a MDIRA web page <http://akgeology.info>.

During the first six years, the project work group identified geologic data for inclusion in the database, established a secure and stable database structure, started loading data into the database, and created interfaces to access the data. The public can access DGGS reports and maps through browseable listings and search engine <http://www.dggs.dnr.state.ak.us/pubs> and can access DGGS geochemical data though a search engine <http://www.dggs.dnr.state.ak.us/WebGeoChem>, all on the DGGS website. DGGS reports and maps can be searched along with geology and minerals reports from other agencies through an integrated bibliography on the AKGeology.info website at <http://bib.akgeology.info>.

Currently, the project group is developing an index of DGGS project-based GIS data with the goal of delivering data though an extension to the DGGS publications pages by June 2007. Additionally, the project team is supporting other DGGS MDIRA projects by extending the DGGS database and designing web-based search engines for the Alaska Geologic Map Index, Resource Assessment Geochemical Datasets, and Geologic Materials Center Catalog projects. Team members are also planning to integrate DGGS data and MDIRA datasets with other MDIRA datasets on the MDIRA web page <http://akgeology.info>. A map-based web portal is in development by DNR that will incorporate DGGS and MDIRA data, making a true online "one stop shop" for Alaska minerals data.

The core of the project is the DGGS geologic database, which contains spatially referenced geologic and earth resources information. The information contained in the database, such as geochemical analyses, geologic map indices, and bibliographic citations are all tied to a geographic feature. Without this spatial reference the geologic information would have no context.

The database infrastructure that supports this project consists of a data server, spatially capable relational database management software, and utilities to interface with the DGGS Local Area Network (LAN) and Geographic Information System (GIS). The database is available to DGGS staff through the DGGS LAN using GIS software, database client software, and web-based forms.

The public can access the information contained in the DGGS geologic database through the DGGS website <http://www.dggs.dnr.state.ak.us> and the AKGeology.info portal <http://akgeology .info> via searchable listings of publications and their associated data as well as through a variety of search engines allowing customized selection criteria.

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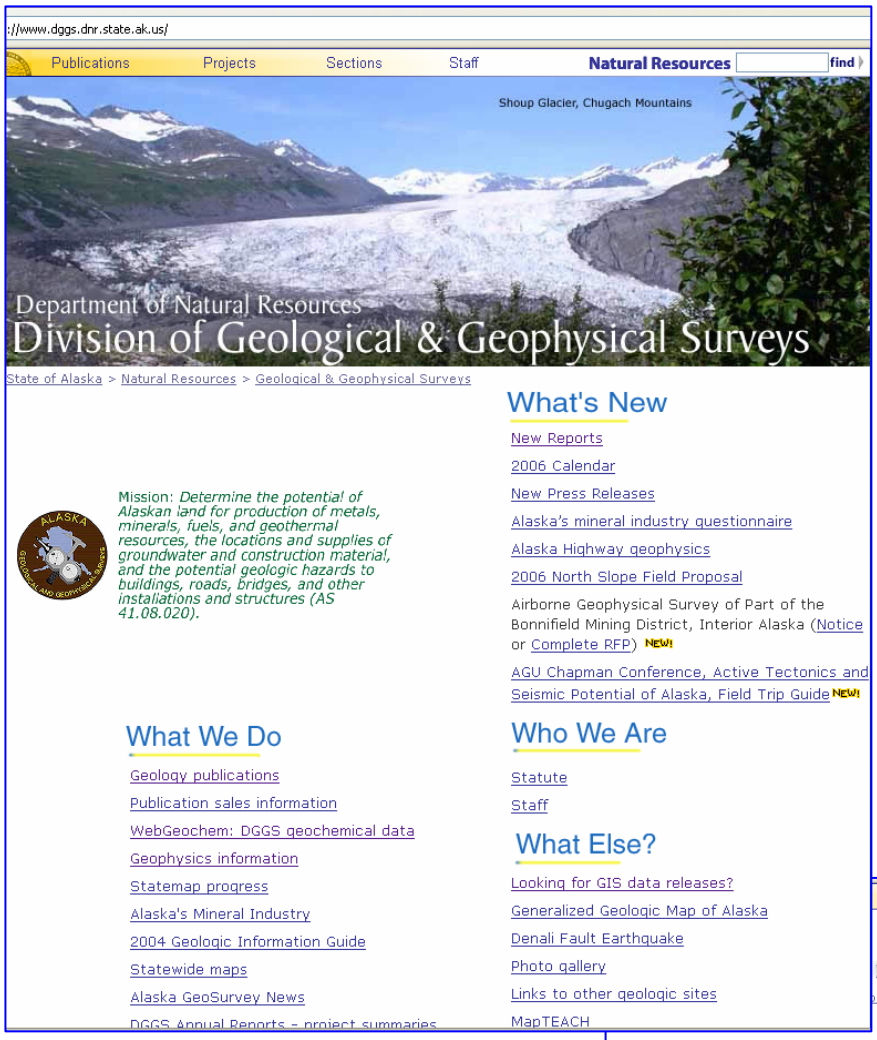
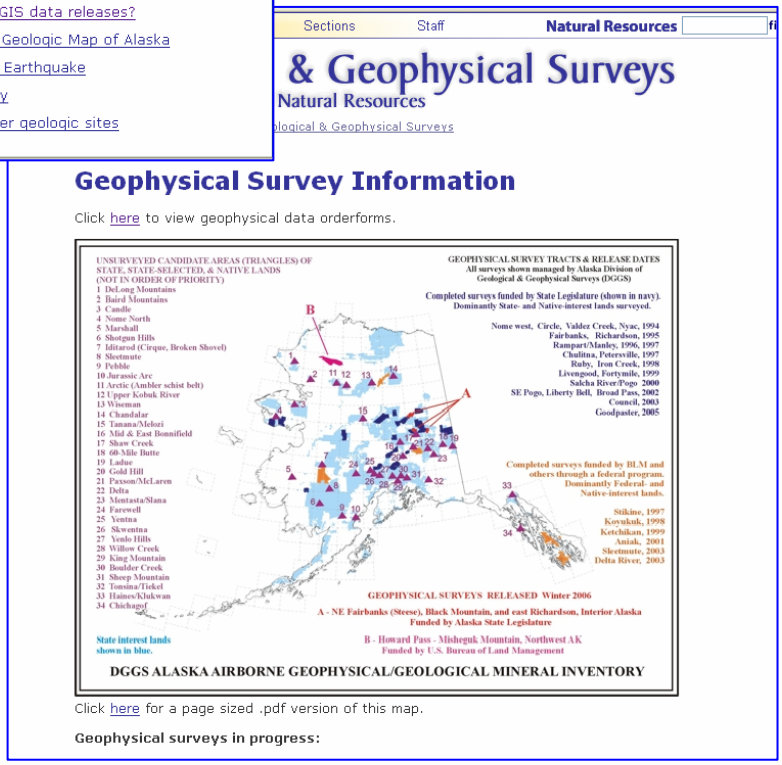
DGGS WEB PAGE



Since its inception in the late 1990s the DGGS website has grown from a few static HTML pages to the division's primary mechanism for publication and information distribution. As the cumulative result of a series of multi-year projects, our online customers are currently able to: Search our publications catalog, download DGGS and USGS publications, view and download DGGS geochemical results, and find current information about various geologic projects and topics of interest.

Public users can currently select and download, at no charge, approximately 7,000 text reports and 9,000 oversize sheets.

During FY04 and FY05, major progress was made to improve the functionality, organization, appearance, and efficiency of the DGGS web and online distribution infrastructure. This work has continued through FY07. DGGS staff



are currently researching and working to implement a significant behind-the-scenes code overhaul designed to bring our website into compliance with W3C (World Wide Web Consortium) web accessibility guidelines. Over the last several years the W3C has strongly encouraged its users to utilize CSS (cascading style sheets) to separate presentation from content in order to maximize web accessibility. DGGS is currently working on code revisions throughout the site that modernize our code so that it is compliant with W3C recommendations and, as a result, is more efficient and accessible to our users.

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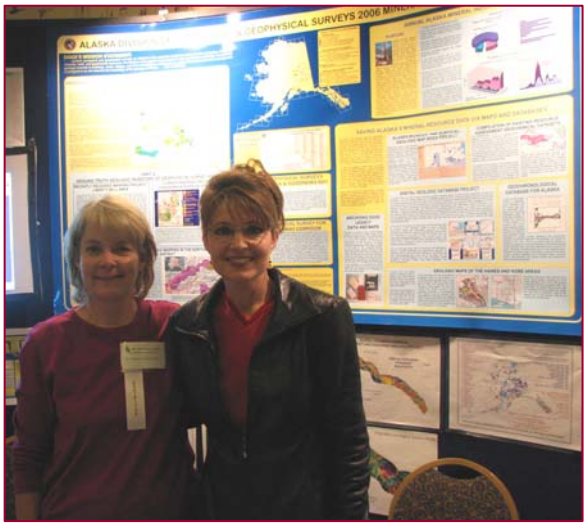
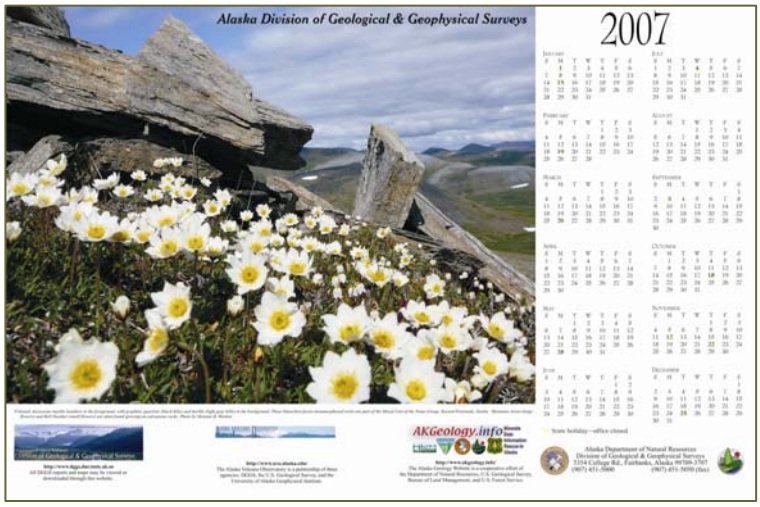
PUBLICATIONS AND OUTREACH PROJECT

The Publications Project team publishes and distributes the geologic data collected, analyzed, and assembled by staff in the Minerals, Energy, and Engineering Geology sections of DGGS. Team members are involved in many of the division's publication and outreach activities. Some of the functions they perform are:

- Perform design, layout, and editing, and oversee final production of technical and educational geologic maps and reports in printed and digital formats.
- Produce an annual report for the Legislature and public, required by statute and written by the geologic staff, summarizing DGGS activities and communicating plans for its future projects.
- Publish a twice-yearly newsletter that communicates DGGS progress and announces the latest publications.
- Prepare displays and represent DGGS at geologic conferences and meetings by providing staff and assembling and transporting the display booth.
- Staff DGGS's information desk to provide information concerning Alaska's geologic resources and hazards.
- Manage sales of DGGS geologic reports, maps and data.
- Review metadata for each project and ensure it is filed electronically in the appropriate repository.
- Manage the DGGS library so that reports are available and locatable and information is on hand that staff needs for reference or research when writing their reports.
- Maintain as full a collection as possible of Alaska-related publications of the U.S. Geological Survey, the former U.S. Bureau of Mines, and the U.S. Bureau of Land Management.
- Participate in school outreach activities such as helping prepare classroom presentations, judging science fair entries, or helping teachers by presenting earth science units.
- Design, produce, and distribute an annual informative DGGS calendar.



The publications produced by this group record and preserve geologic data such as: Definitive statistics for Alaska's mineral industry; detailed (1:63,360-scale) bedrock, surficial, and engineering geologic maps for specific areas in the state; sources of Alaska's geologic information; annual information about DGGS's programs and accomplishments; airborne geophysical data for areas with promising mineralization; and educational brochures and pamphlets explaining Alaska's geology or natural-science features. Some of the most recent DGGS publications include *Alaska's Mineral Industry 2005; AKGEOLOGY. INFO: An online portal for Alaska geologic and mineral resources information; Exploration history (1964–2000) of the Colville High, North Slope, Alaska; Bedrock geologic map of the Liberty Bell area; Yukon Flats Basin, Alaska: Reservoir characterization study;* and geophysical mapping of the Alaska Highway corridor, northeast Fairbanks area, parts of the East Richardson, Liscum, and Black Mountain areas, headwaters of the Little Chena River area, Chulitna mining district, Petersville mining district, and parts of southern National Petroleum Reserve–Alaska. Publications are available on paper (printed on demand and sold for the cost of printing) and as PDF documents and scanned compressed maps on the DGGS web page (no charge).



Work will continue in FY2006 to increase the availability of digital datasets from which GIS maps are produced, so that customers can manipulate data in any way they choose, and publishing documents in digital format first, then using the digital publication to produce a paper copy when necessary. The availability of geological and geophysical data encourages exploration of Alaska's natural resources and mitigation of risks from the state's geologic hazards.

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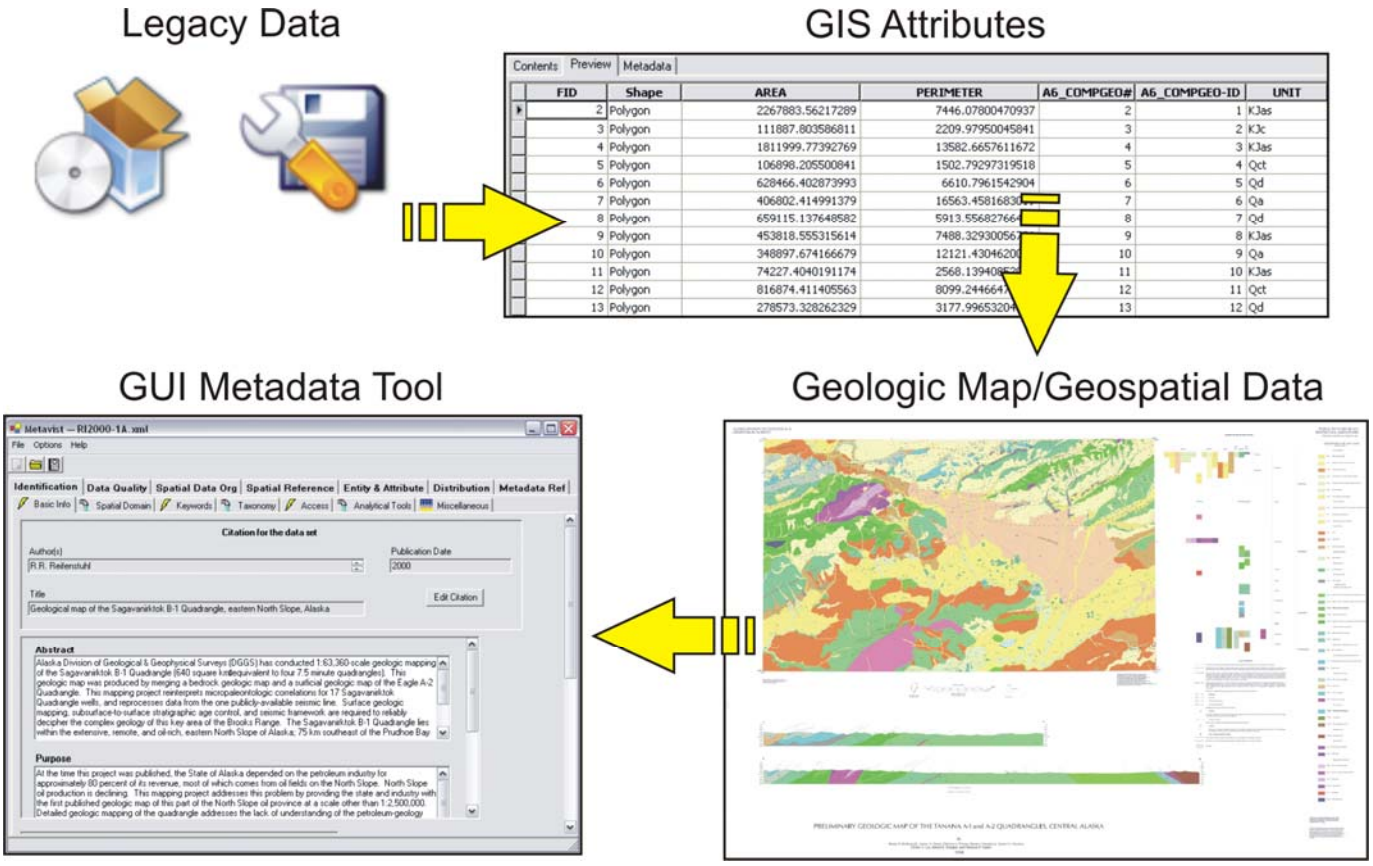
CONVERSION OF LEGACY DIGITAL GEOLOGIC MAP DATA TO MODERN FGDC STANDARDS

The Division of Geological & Geophysical Surveys (DGGS) has been generating geologic maps using GIS software since the early 1990s. Over the years the documentation of those geospatial data sets has been neglected because of the geologists' need to initiate new mapping projects. This project is designed to document those legacy geospatial data sets and upgrade the existing data to modern formats and documentation practices.

As part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) project, DGGS is creating a database of geologic information that will ultimately be made available to the public over the Internet through a series of Web-based application interfaces. A significant portion of the "Data at Risk" to be preserved in this database is geographically referenced geologic mapping and minerals-related data, created over the past 15 years using Geographic Information Systems (GIS) technology. Documentation of entity-attribute information and data-quality information for our legacy digital data sets is an essential step in making this legacy data meaningful and available to the public. The existing GIS data must be converted to modern geodatabase format with accompanying documentation, known as metadata, a superset of data that describes and documents the content of GIS data files.

The primary objective of this project is to produce FGDC-compliant metadata for DGGS legacy GIS files in preparation for conversion to modern GIS data formats. This will require recovering much of the data from backup sources such as tapes and CD-ROMs, interviewing geologists who produced the data, and extracting as much information about the data as possible from available electronic and paper files. As of December 2006, approximately 85 percent of legacy data has been recovered and its affiliated metadata has been written. DGGS is currently utilizing a new graphical user interface (GUI) to write the FGDC-compliant metadata. The GUI metadata writing tool will, at the end of the project, be distributed for use by all DGGS staff who generate metadata for project data files. The result will be to make DGGS GIS data more widely available; the project will facilitate loading and integration of DGGS GIS data and metadata into the MDIRA-funded interagency database system.



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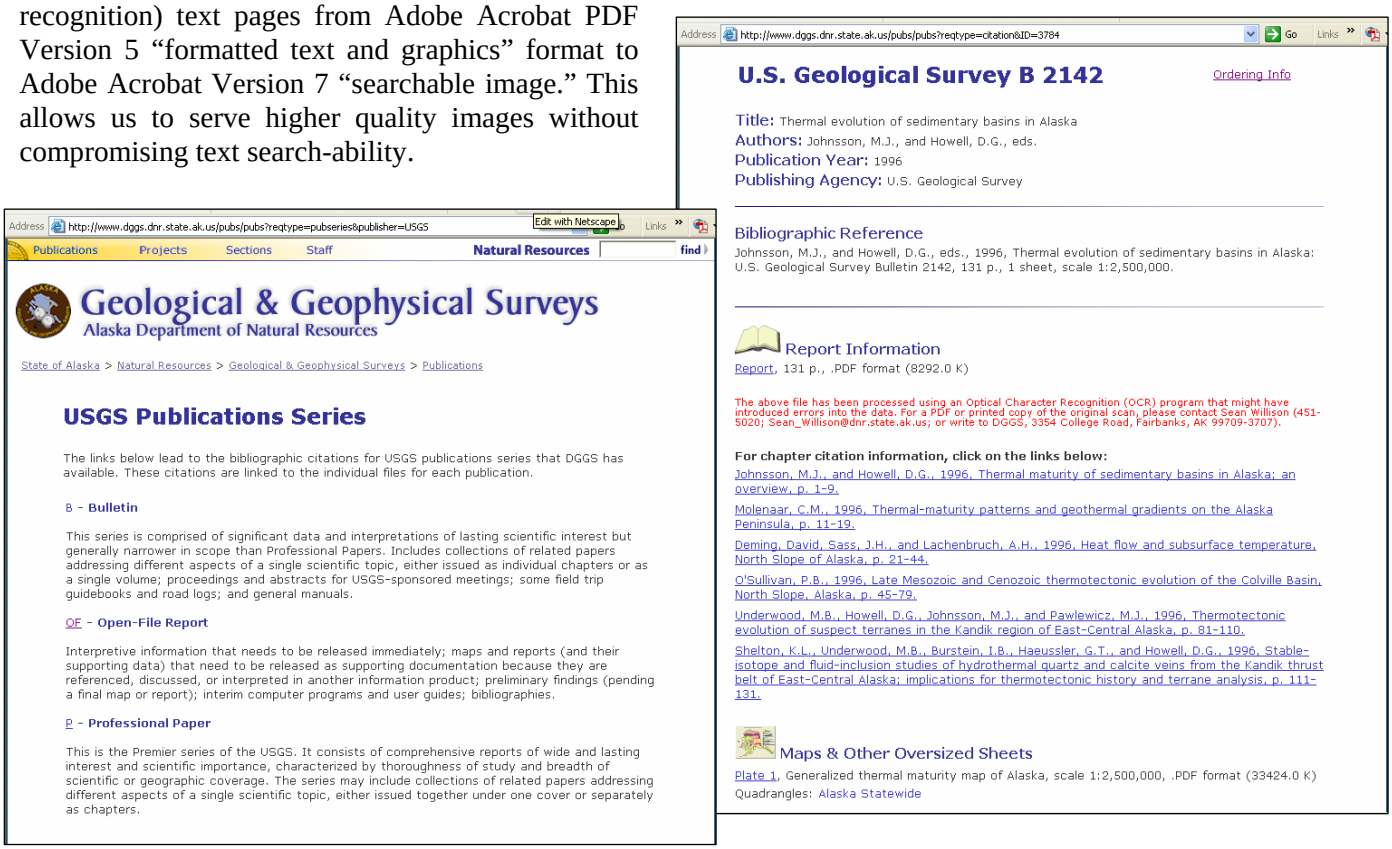
SCANNING AND DIGITAL DOCUMENT CONVERSION PROJECT

Over the past century DGGS and its predecessors, United States Geological Survey (USGS), and the University of Alaska's Mineral Industry Research Laboratory (UAF-MIRL) have published a wealth of research and information about the geology, natural resources, and geologic hazards of Alaska. Alaska's difficult terrain and logistical challenges contribute to a very high cost per square mile for geologic research. Consequently, legacy reports published by these agencies remain important sources of geologic information. These maps, reports, and informational publications are widely utilized by oil companies, mining companies, other resource-based companies, consultants, universities, schools, government agencies, scientists, and private individuals. A great majority of Alaskan geologic publications are rare and out of print. Convenient access to these publications has been effectively restricted to patrons of the UAF, DGGS and USGS libraries.

Funded by a series of cooperative agreements with the USGS under the Minerals Data and Information Rescue in Alaska (MDIRA) Program, in FY06 DGGS completed a 6-year publication rescue and digital conversion project. The paper documents in our USGS, DGGS, and MIRL collections were scanned, digitally archived, and posted online for public download. The dataset includes approximately 10,000 citations, 7,000 text reports, and 9,000 oversize sheets. Citation information and links to the reports are available via the MDIRA Interagency Bibliography Index and through the DGGS publications pages.

In addition to completing the USGS scanning project, DGGS continues its work to improve the accuracy of the citation dataset, enhance document accessibility, improve citation search functionality, and ensure digital storage and formatting compatibility. The fast pace of technological advances over the span of the project has required several adjustments to the original product specifications. This year the files scanned in 2000–2003 were moved from CD to hard-drive space on our UNIX servers. Significant work was also done to convert oversize sheets from MrSID format to the more accessible Adobe Acrobat PDF Version 7 and convert OCR (optical character recognition) text pages from Adobe Acrobat PDF Version 5 "formatted text and graphics" format to Adobe Acrobat Version 7 "searchable image." This allows us to serve higher quality images without compromising text search-ability.



Contact: Simone Montayne, Geologist, 907-451-5036, simone_.montayne@dnr.state.ak.us

GIS–IT INFRASTRUCTURE PROJECT

The Geographic Information Systems–Information Technology (GIS–IT) team provides the network infrastructure, primary microcomputer and GIS service and support to DGGS staff, and streamlines information delivery to the public. The team is made up of a Microcomputer/Network Specialist, a Microcomputer/Network Technician, and a GIS Manager.

The DGGS IT staff conducts projects that will provide improved computer services to users. DGGS has made major improvements to the network this past year to improve that service. A SunFire V440 server has replaced a 13-year-old Enterprise 450 server, and the addition of two Sun StorEdges has increased the storage capability to over 7 terabytes of space. This will allow for all files on the Enterprise server and files that presently are stored on individual PCs to be transferred to the network and be part of the backup process.

In the past year DGGS has installed an Overland NEO 4000 tape device to back up all stored data on the network.

A Mitsubishi uninterruptible power supply was recently purchased and is being installed. This unit will provide an hour of battery support for the servers and an automatic shutdown of servers when the power outage exceeds that timeframe.

GIS users in the Division have benefited from the maintenance, upgrade, and support for ArcGIS licenses. The desktop GIS, Arc 9.1, implemented a year ago, has required new approaches to GIS that depart from the division's long-term Unix/ArcInfo background. To enable GIS project work, the GIS Manager maintains plotters and digitizers and advises and assists other users so they can complete maps for publication.

While providing DGGS staff with computers, network, and GIS, support is the primary function of the GIS–IT infrastructure project. Each year new projects provide better customer support and improve the stability of the network infrastructure or the efficiency of the support services provided to DGGS, and ultimately to the public.

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ALASKA GEOLOGIC MATERIALS CENTER

The Alaska Geologic Materials Center (GMC) in Eagle River holds nonproprietary rock core and cuttings that represent nearly 12 million feet of exploration and production drilling on Federal, State, and private lands of Alaska, including the Alaska outer continental shelf. Of this footage, 216,000 feet are diamond-drilled hard-rock mineral core. The GMC collection includes rock materials from more than 1,400 oil and gas exploratory or production wells, rock core from nearly 1,100 exploratory hard-rock mineral holes, and numerous surface rock samples. The collection also includes extensive geochemical data, petrographic thin sections, and paleontological glass slides derived from this rock.

The GMC is operated by the Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys, with support from cooperating government agencies that include the U.S. Bureau of Land Management, U.S. Geological Survey, U.S. Minerals Management Service, and Alaska Oil and Gas Conservation Commission. The basic mission of the GMC is to archive all worthwhile rock samples collected in Alaska and on the Alaska outer continental shelf. The chief users of the GMC are the oil and gas industry, although use by the minerals industry, government, and academic institutions is increasing.

As of mid December 2007, the GMC had 200 visitations with another 1,120 contacts (by phone, mail, or e-mail) during FY07. To date in FY07, the GMC has also received 2,083 processed oil/gas petrographic, microfossil, or geochemical glass slides and five technical data reports.

In FY06, there were 470 total visitations with another 2,572 contacts with the facility. The GMC also received a total of 3,580 processed slides and 12 data reports.

For FY07, the GMC has successfully received, stored, and is in the process of inventorying the equivalent of half of a 40-foot trailer load of rock samples representing the U.S. Geological Survey's Irv Tailleur rock and oil sample collection, and the "released" Alaska Oil and Gas Conservation Commission well samples. So far this fiscal year, the GMC received samples for 43 oil and gas wells.

Because the volume of samples has far exceeded its warehouse capacity, the GMC now has a total of 56 portable CONNEX containers, 48 of which are occupied with samples. For FY07, no CONNEX containers have been added, but we have added shelf space to one entire container and the same amount of shelving to GMC buildings. No large rock donations are presently anticipated for the rest of FY07.

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PUBLICATIONS RELEASED IN 2006

ANNUAL REPORTS

AR 2005. Alaska Division of Geological & Geophysical Surveys Annual Report, by DGGS Staff, 2006, 65 p. Free.

GEOPHYSICAL MAPS & REPORTS

GPR 2006-1. Line, grid, and vector data and plot files for the airborne geophysical survey data of parts of the southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 3 disks. Line data in ASCII format; gridded data in Geosoft and ER Mapper formats; vector files in AutoCAD version 13 dxf files. Includes 19 maps (aeromagnetic or resistivity) listed below as GPR 2006_1_xy as plot files in both HPGL/2 format, postscript printer format, and as Adobe Acrobat format files. For the plotter files, software is needed with ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter or postscript files designed for an HP Design Jet 5000/5500 using Postscript 3 printer driver v5.0. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. $30

GPR 2006-1-1A. Total magnetic field of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-1B. Total magnetic field of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains magnetic contour lines. $52.

GPR 2006-1-2A. 7200 Hz coplanar resistivity of parts of southern National Petroleum Reserve-Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-2B. 7200 Hz coplanar resistivity of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $52.

GPR 2006-1-3A. 900 Hz coplanar resistivity of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-3B. 900 Hz coplanar resistivity of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $52.

GPR 2006-1-4A. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Misheguk Mountain C-1, C-2, D-1, and D-2 quadrangles, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4B. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass C-5 and D-5 quadrangles, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4C. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass C-4 Quadrangle, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4D. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass C-3 Quadrangle, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4E. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass C-2 Quadrangle, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4F. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass C-1 Quadrangle, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4G. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum

Reserve-Alaska, Northwest Alaska, parts of Howard Pass B-5 and C-5 quadrangles, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4I. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass B-3 Quadrangle, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4J. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass B-2 Quadrangle, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-4K. Total magnetic field and detailed electromagnetic anomalies of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, parts of Howard Pass B-1 Quadrangle, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-1-5A. 56,000 Hz coplanar resistivity of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains topography. $52.

GPR 2006-1-5B. 56,000 Hz coplanar resistivity of parts of southern National Petroleum Reserve-Alaska, Northwest Alaska, by Burns, L.E., U.S. Bureau of Land Management, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 4 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $52.

GPR 2006-3. Line, grid, and vector data and plot files for the airborne geophysical survey data of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 0 disk. Line data in ASCII format; gridded data in Geosoft and ER Mapper formats; vector files in AutoCAD version 13 dxf files. Includes 13 maps (aeromagnetic or resistivity) as GPR2005-1-xy as plot files in both HPGL/2 format and postscript printer format and as Adobe Acrobat format files. For the plotter files, software is needed with ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter or postscript files designed for an HP Design Jet 5000/5500 using Postscript 3 printer driver v5.0. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. $10

GPR 2006-3-1B. Total magnetic field of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 sheets, scale 1:63,360. Full color; contains magnetic contour lines. $26.

GPR 2006-3-2A. 56,000 Hz coplanar resistivity of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 sheets, scale 1:63,360. Full color; contains topography. $26.

GPR 2006-3-2B. 56,000 Hz coplanar resistivity of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $26.

GPR 2006-3-3A. 7200 Hz coplanar resistivity of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 sheets, scale 1:63,360. Full color; contains topography. $26.

GPR 2006-3-3B. 7200 Hz coplanar resistivity of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $26.

GPR 2006-3-4A. 900 Hz coplanar resistivity of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 sheets, scale 1:63,360. Full color; contains topography. $26.

GPR 2006-3-4B. 900 Hz coplanar resistivity of northeast Fairbanks area, Fairbanks and Circle mining districts, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 sheets, scale 1:63,360. Full color; contains resistivity contour lines. $26.

GPR 2006-3-5A. Total magnetic field and detailed electromagnetic anomalies of northeast Fairbanks area, Interior Alaska, parts of Circle B-5 and B-6 quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-3-5B. Total magnetic field and detailed electromagnetic anomalies of northeast Fairbanks area, Interior Alaska, parts of Circle B-4 and B-5 quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-3-5C. Total magnetic field and detailed electromagnetic anomalies of northeast Fairbanks area, Interior Alaska, parts of Circle B-4 Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-3-5D. Total magnetic field and detailed electromagnetic anomalies of northeast Fairbanks area, Interior Alaska, parts of Circle A-6 Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-3-5E. Total magnetic field and detailed electromagnetic anomalies of northeast Fairbanks area, Interior Alaska, parts of Circle A-4, A-5, B-4 and B-5 quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-5. Line, grid, and vector data and plot files for the airborne geophysical survey data of parts of the East Richardson, Liscum, and Black Mountain areas, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 2 disks. Line data in ASCII format; gridded data in Geosoft and ER Mapper formats; vector files in AutoCAD version 13 dxf files. Includes 29 maps (aeromagnetic or resistivity) listed below as GPR 2006_5_xy as plot files in both HPGL/2 format, postscript printer format, and as Adobe Acrobat format files. For the plotter files, software is needed with ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter or postscript files designed for an HP Design Jet 5000/5500 using Postscript 3 printer driver v5.0. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. $20

GPR 2006-5-1A. Total magnetic field of the east Richardson area, Fairbanks mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-1B. Total magnetic field of the east Richardson area, Fairbanks mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains magnetic contour lines. $13.

GPR 2006-5-2A. 56,000 Hz coplanar resistivity of the east Richardson area, Fairbanks mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-2B. 56,000 Hz coplanar resistivity of the east Richardson area, Fairbanks mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains resistivity contour lines. $13.

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GPR 2006-5-5A. Total magnetic field and detailed electromagnetic anomalies of the east Richardson area, Fairbanks mining district, Interior Alaska, parts of Big Delta B-5 and C-5 quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-5-5B. Total magnetic field and detailed electromagnetic anomalies of the east Richardson area, Fairbanks mining district, Interior Alaska, parts of Big Delta B-4 and C-4 quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-5-7A. Total magnetic field of the Liscum area, Goodpaster mining district, Interior Alaska, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-7B. Total magnetic field of the Liscum area, Goodpaster mining district, Interior Alaska, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains magnetic contour lines. $13.

GPR 2006-5-8A. 56,000 Hz coplanar resistivity of the Liscum area, Goodpaster mining district, Interior Alaska, by Burner, S.A., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-8B. 56,000 Hz coplanar resistivity of the Liscum area, Goodpaster mining district, Interior Alaska, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains resistivity contour lines. $13.

GPR 2006-5-9A. 7200 Hz coplanar resistivity of the Liscum area, Goodpaster mining district, Interior Alaska, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-9B. 7200 Hz coplanar resistivity of the Liscum area, Goodpaster mining district, Interior Alaska, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management

Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains resistivity contour lines. $13.

GPR 2006-5-10A. 900 Hz coplanar resistivity of the Liscum area, Goodpaster mining district, Interior Alaska, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-10B. 900 Hz coplanar resistivity of the Liscum area, Goodpaster mining district, Interior Alaska, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains resistivity contour lines. $13.

GPR 2006-5-11A. Total magnetic field and detailed electromagnetic anomalies of the the Liscum area, Goodpaster mining district, Interior Alaska, parts of Big Delta A-3, A-4, B-3, and B-4 quadrangles, by Burns, L.E., AngloGold Ashanti (U.S.A.) Exploration Inc., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-5-13A. Total magnetic field of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-13B. Total magnetic field of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains magnetic contour lines. $13.

GPR 2006-5-14A. 56,000 Hz coplanar resistivity of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-14B. 56,000 Hz coplanar resistivity of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains resistivity contour lines. $13.

GPR 2006-5-15A. 7200 Hz coplanar resistivity of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-15B. 7200 Hz coplanar resistivity of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains resistivity contour lines. $13.

GPR 2006-5-16A. 900 Hz coplanar resistivity of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-5-16B. 900 Hz coplanar resistivity of the Black Mountain area, Goodpaster mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains resistivity contour lines. $13.

GPR 2006-5-17A. Total magnetic field and detailed electromagnetic anomalies of the Black Mountain area, Goodpaster mining district, Interior Alaska, parts of Big Delta B-1 Quadrangle, by Burns, L.E., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-5-17B. Total magnetic field and detailed electromagnetic anomalies of the Black Mountain area, Goodpaster mining district, Interior Alaska, parts of Big Delta A-1, B-1, and B-2 quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:31,680. Full color; contains topography and detailed electromagnetic anomalies. $13.

GPR 2006-6. Line, grid, and vector data, and plot files for the airborne geophysical survey of the Alaska Highway corridor, east-central Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 0 disk. DVD format. Line data in ASCII format; gridded data in Geosoft and ER Mapper formats; vector files in AutoCAD version 13 dxf files. Includes maps listed below as GPR 2006-6-xy as plot files in both HPGL/2 format and as Adobe Acrobat format files. The HPGL2 files will only plot with software that has ability to plot HPGL2 files produced for an HP Design Jet 5000/5500 series plotter. $10.

GPR 2006-6-1A. Total magnetic field of the Alaska Highway corridor, east-central Alaska, parts of Big Delta and Mt. Hayes quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-1B. Total magnetic field of the Alaska Highway corridor, east-central Alaska, parts of Mt. Hayes Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-1C. Total magnetic field of the Alaska Highway corridor, east-central Alaska, parts of Tanacross Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-1D. Total magnetic field of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-1E. Total magnetic field of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-1F. Total magnetic field of the Alaska Highway corridor, east-central Alaska, parts of Nabesna Quadrangle

and Canada 115K, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-2A. 140,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Big Delta and Mt. Hayes quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-2B. 140,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Mt. Hayes Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-2C. 140,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Tanacross Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-2D. 140,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-2E. 140,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-2F. 140,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna Quadrangle and Canada 115K, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-3A. 40,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Big Delta and Mt. Hayes quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-3B. 40,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Mt. Hayes Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-3C. 40,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Tanacross Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-3D. 40,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-3E. 40,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-3F. 40,000 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna Quadrangle and Canada 115K, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-4A. 8200 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Big Delta and Mt. Hayes quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-4B. 8200 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Mt. Hayes Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-4C. 8200 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Tanacross Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-4D. 8200 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-4E. 8200 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-4F. 8200 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna Quadrangle and Canada 115K, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-5A. 1800 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Big Delta and Mt. Hayes quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-5B. 1800 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Mt. Hayes Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-5C. 1800 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Tanacross Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-5D. 1800 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-5E. 1800 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna and Tanacross quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-5F. 1800 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Nabesna Quadrangle and Canada 115K, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-6A. 400 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Big Delta and Mt. Hayes quadrangles, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-6B. 400 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Mt. Hayes Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

GPR 2006-6-6C. 400 Hz coplanar apparent resistivity of the Alaska Highway corridor, east-central Alaska, parts of Tanacross Quadrangle, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2006, 1 sheet, scale 1:63,360. Full color; contains topography. $13.

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