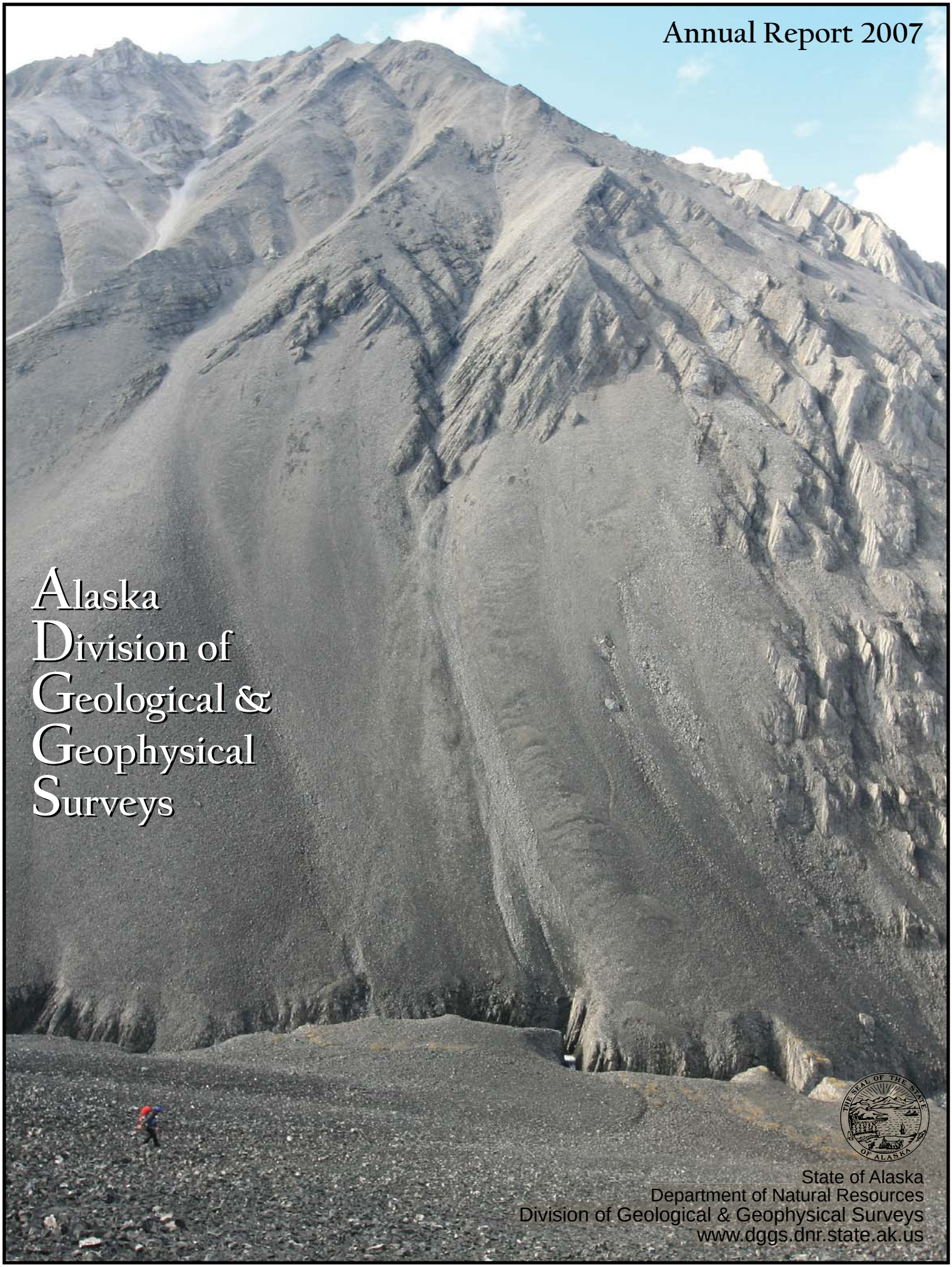
Annual Report 2007

Alaska Division of Geological & Geophysical Surveys



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

Alaska Division of Geological & Geophysical Surveys
Annual Report
2007

Cover Photo: Continuous outcrops of bedded Lisburne Limestone that was deposited in shallow seas some 310 million years ago and later folded and uplifted during development of the Brooks Range thrust belt. *Photo taken by Rocky Reifenstuhl near the headwaters of the Canning River (note person in lower left corner for scale).*

State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
January 2008

STATE OF ALASKA
Sarah Palin, *Governor*

DEPARTMENT OF NATURAL RESOURCES
Tom Irwin, *Commissioner*

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

Division of Geological & Geophysical Surveys publications can be inspected on the web at http://www.dggs.dnr.state.ak.us/ or at the following locations.
Address mail orders to the Fairbanks office.

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Fairbanks, Alaska 99709-3707

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3211 Providence Drive
Anchorage, Alaska 99508

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Alaska Resource Library
3150 C Street, Suite 100
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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.

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Commissioner's Foreword

I am pleased to present the Division of Geological & Geophysical Surveys (DGGS) Annual Report documenting 2007 as one of the busiest years in the division's history. The information contained in the following pages provides evidence that DGGS is a critical resource to the Department of Natural Resources and to Alaska as a whole. The staff at DGGS work hard to provide unbiased scientific information on geologic resources and natural hazards that is essential in helping facilitate responsible development of Alaska's rich resource endowment. Of the many issues facing the division, assessing the state's renewable energy resources and addressing the impacts associated with climate change will remain top priorities over the coming year. For example, a current project to identify and inventory all existing data on Alaska's renewable energy, such as geothermal, tidal, wind and hydroelectric, is nearing Phase I completion and will provide web-based data access that will enable local planners to make informed energy decisions. Additionally, the coming years will challenge the division to provide pertinent information on risks associated with inevitable environmental change in Alaska. Our economic future and the wellbeing of our social fabric depend on important decisions being made today, and I assure you that the staff at DGGS, as well as at DNR, are fully dedicated to making sure that all natural resource policy decisions are based on sound science and objective data.

From the active volcanoes at the tip of the Aleutian Chain to the North Slope oilfields; and from Southeast Alaska to the Seward Peninsula, DGGS is involved in acquiring and disseminating geologic information that will help keep the state moving forward on a safe and economically sustainable path. Please join me in congratulating the staff at DGGS for another successful year. I encourage you to remain engaged in the protection and development of your resources, and become involved in determining the future of this great state.

Tom Irwin, Commissioner, Department of Natural Resources

Director's Foreword

We appreciate your interest in the 2007 Annual Report for the Alaska Division of Geological & Geophysical Surveys (DGGS) and hope you find it useful and informative. The year was highlighted by many challenges—and milestones—during our effort to provide the State of Alaska with information on its vast geologic resources and natural hazards. I am especially proud of the staff at DGGS, and their dedication to the relentless pursuit of applied geologic science. The importance of making relevant, timely and unbiased scientific data available to Alaskan decision-makers cannot be overstated. Staying focused on the job at hand, and doing so within a system that can at times be bureaucratically overwhelming, warrants DGGS staff a "standing ovation" for their efforts.

The year 2007 was very exciting at DGGS. Record activity in the minerals sector put our Minerals Resources Section to the test in providing the necessary data and expertise to help facilitate responsible industry exploration and development. Fundamental changes in the energy sector, most notably the dramatic increase in exploration for natural gas reserves across the state, have moved our Energy Resources Section into high gear in many areas once perceived as having relatively low development potential. Continued infrastructure development in areas with high geologic hazards risk has challenged our Engineering Geology and Volcanology sections to provide the vast amounts of geologic hazards and construction materials information needed for permitting and pre-construction planning. High commodity prices, as well as unprecedented resource and infrastructure development around the state, have tested our newly developed data distribution system. I am happy to report that the Geologic Communications Section has passed the test with flying colors and won national acclaim in the process. Finally, the near ubiquitous public realization of potential environmental change associated with a changing global climate has affected nearly every sector of the survey's responsibilities. Public education and presentation of objective scientific information will be important as we move forward into an uncertain, but secure future.

I strongly encourage you to read the program descriptions included in this report, and welcome any feedback you might have. You will readily see that your Alaska Division of Geological & Geophysical Surveys is meeting many of the challenges that face all Alaskans by providing unbiased geologic information to make sound, science-based policy and development decisions. We will remain diligent in this effort, and will help to ensure Alaska remains prosperous, safe, and environmentally sound—well into the future.

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

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
ANNUAL REPORT 2007

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.

Division of Geological & Geophysical Surveys offices in Fairbanks

Current DGGS staff totals 34 permanent full-time professional and support personnel, one non-permanent professional geologist, a Director, Deputy Director, and six 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 and a student intern.

Geologic Materials Center in Eagle River

ORGANIZATION

DGGS is one of eight divisions and five 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 five sections and the Geologic Materials Center (fig. 1). The Division also administers the Alaska Seismic Hazards Safety Commission.

L to R: April Woolery, Rod Combellick, Rhea Supplee, Bob Swenson, Vickie Butherus

The **Director's Office** provides strategic planning for the Division's programs to ensure that DGGS is meeting the needs of the public under 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.

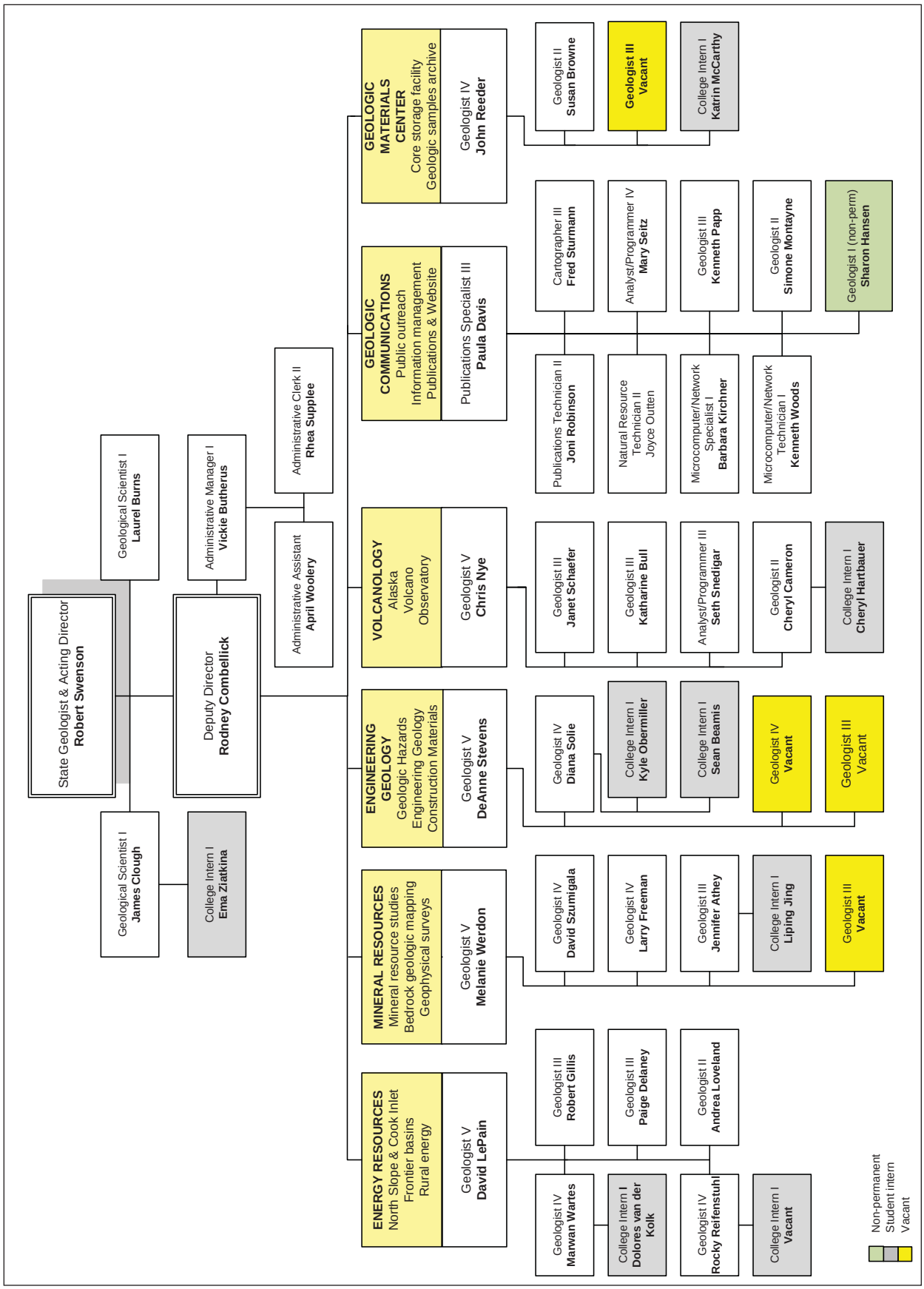


Figure 1. *Organizational chart for the Alaska Division of Geological & Geophysical Surveys.*

The **Energy Resources Section** generates new information about the geologic framework of frontier areas that may host undiscovered oil, gas, 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.

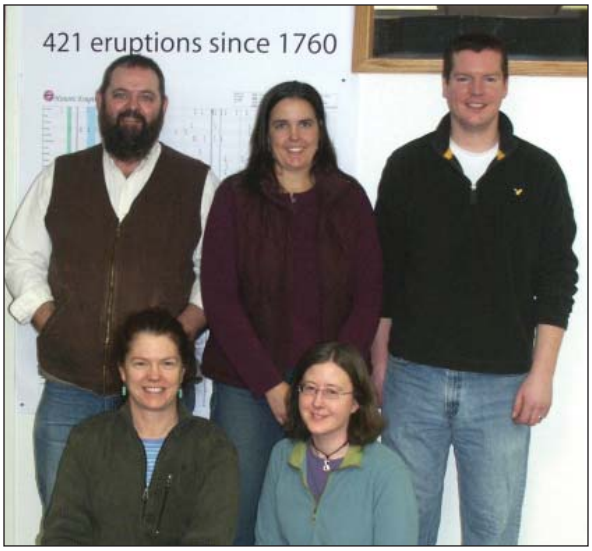
L TO R: Dave LePain, Bob Gillis, Jim Clough, Andrea Loveland, Rocky Reifenstuhl, Paige Delaney, Marwan Wartes

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. These data help to encourage mineral exploration in Alaska and aid in the state management of mineral development, which provides employment opportunities and revenue for Alaska's citizens.

BACK L TO R: Laurel Burns, Dave Szumigala, Larry Freeman
FRONT L TO R: Jen Athey, Liping Jing, Melanie Werdon

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 tsunamis result in reports outlining potential hazards in susceptible areas and estimated frequencies of occurrence.

BACK L TO R: Kyle Obermeier, DeAnne Stevens, Rod Combellick, Diana Solie



Back L to R: Chris Nye, Janet Schaefer, Seth Snedigar
Front L to R: Kate Bull, Cheryl Cameron

The **Volcanology Section,** established in 2007, focuses on processes and hazards associated with the more than 50 active volcanoes in Alaska. The section contains the DGGS portion of the Alaska Volcano Observatory (AVO; an interagency collaboration between the U.S. Geological Survey, University of Alaska Fairbanks Geophysical Institute, and DGGS). Volcanology Section staff conduct geologic studies of active volcanoes to estimate their future eruptive potential and behavior, thus aiding in mitigating volcanic-hazard risks. Results of these studies are released as maps and reports. The section also creates and maintains a large, public web-accessible database of information on volcano history and current activity (www.avo.alaska.edu) as well as an internal website providing communication, record keeping, and data sharing within AVO.

Back L to R: Sharon Hansen, 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 use of computer technology is resulting in faster preparation of maps and reports and a wider awareness of Alaska geologic information available from DGGS. This section manages the design, implementation, and maintenance of a computer-hosted database for the Division's digital and map-based geological 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).

L to R: Katrin McCarthy, John Reeder, and Susan Browne

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 and has its own website at http://www.dggs.dnr.state.ak.us/seismic_hazards_safety_commission.htm.

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 DGGS also works with the Alaska Energy Authority (AEA) to identify viable alternatives for energy development in rural Alaska.

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 several communities 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. Collaborative research projects and program oversight help provide both organizations with focused work plans that complement one another. 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 prepa-

ration 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), National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF). DGGS receives some federal funds from matching grants for which the Division must compete nationally with other organizations on a yearly basis. In the past DGGS has 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 established in 1988 and consisting of USGS, DGGS, and the University of Alaska Fairbanks Geophysical Institute. 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 has completed 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 usually 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:

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
Mill Rock Resources, President
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.

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.

Peter Haeussler
U.S. Geological Survey, representing the federal government, earthquakes hazards, and mapping interests.
Peter Haeussler is a geologist in the Anchorage office of the USGS Geologic Division, specializing in earthquake hazards, tectonics, and geologic mapping.

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.

Tom Homza
Shell Exploration and Production, Alaska
Tom Homza is a Staff Geologist at shell with more than 10 years experience in oil & gas exploration and development in Alaska and represents the oil industry in mapping advice and structural interpretation.

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.

David Stanley
Alaska Department of Transportation & Public Facilities (DOTPF), representing state government and the engineering geology and geotechnical community
David Stanley is Chief Engineering Geologist of the DOTPF, overseeing geotechnical studies in support of development and maintenance of the state's highways and airports.

FY2007 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 FY2007 the Division successfully performed geological and geophysical mineral inventory mapping, generated new geologic data to support energy exploration, conducted hazard investigations, performed geologic and hazards studies on active volcanoes, and streamlined geologic data archival and dissemination.

MAJOR ACCOMPLISHMENTS IN FY2007

Energy Resources

- Conducted **detailed outcrop studies in the North Slope foothills** between the Toolik and Ivishak rivers in collaboration with the Division of Oil and Gas and U.S. Geological Survey to investigate the deposits for **oil and gas potential** on state and federal lands.
- Prepared a **field tour for industry geologists** to present new technical results bearing on the petroleum geology of northern Alaska, including a two-day geologic tour of field localities between the Kavik and Ivishak rivers illustrating geologic relationships that are key to oil and gas exploration.
- Released a **regional geologic cross-section of the North Slope** from the central foothills to Milne Point field illustrating key stratigraphic relations that are objectives for oil and gas exploration.
- Conducted **geologic studies in Cook Inlet basin** aimed at collecting and releasing data relevant to assessing the remaining hydrocarbon potential in upper Cook Inlet and extending the production life of existing oil and gas fields. This work is funded in part with industry contributions and done in collaboration with the Division of Oil & Gas personnel.
- Prepared and led a field tour for industry geologists to examine geology in bluff exposures near Homer to better understand reservoir geometries and apply to current activities in **Cook Inlet oil and gas fields**.
- Completed a three-year field program as part of a U.S. Department of Energy and state-funded geologic evaluation of the **petroleum potential in the Bristol Bay and Alaska Peninsula region**.
- Conducted a two-day technical review meeting in Anchorage for government and industry representatives to present **new data relevant to oil and gas exploration** in the North Slope foothills, Bristol Bay and Alaska Peninsula region, and upper Cook Inlet.
- Initiated a new project evaluating bottom hole temperature data from available North Slope oil and gas exploration drill holes to delineate areas of elevated geothermal gradient that adversely affect the presence of **gas hydrate resources**.
- Sampled **coal deposits in the Bristol Bay–Alaska Peninsula region** during the first year of a five-year study of coal occurrences as part of Alaska's participation in the U.S. Geological Survey's National Coal Resource Database System.
- Co-organized the **Alaska Geological Society's 2007 Technical Conference** in Fairbanks, which included six talks and 26 posters on Alaska geology.
- Co-organized an American of Association of Petroleum Geologists **Forum on Re-exploring Mature Fields** for Independent Producers at the AAPG Annual Convention in Long Beach, California. The two featured Alaskan talks were on Cook Inlet historical natural gas prospecting and Cook Inlet current resource potential.
- Consulted with DNR's Division of Oil & Gas on potential **geothermal resources at Mt. Spurr** in preparation of the State's Best Interest Finding in advance of the upcoming geothermal lease sale.
- Consulted with the Alaska Energy Authority on a wide variety of geothermal issues and served on the **Alaska Geothermal Working Group**.

Mineral Resources

- Published ***Alaska's Mineral Industry*** (Special Report 60), an authoritative annual report of statewide mining activity, in collaboration with the Alaska Department of Commerce, Community and Economic Development.
- Completed analysis and draft **bedrock geologic map** of 308 square miles of the **Council mining district** on the Seward Peninsula.
- Initiated **bedrock geologic mapping and mineral-resource assessment** of 188 square miles of the **Northeast Fairbanks** airborne-geophysical survey tract.
- Initiated **bedrock geologic mapping and mineral-resource assessment** of 808 square miles of the proposed **Gas Pipeline Corridor** along the Alaska Highway between Delta Junction and Dot Lake.
- Released **airborne geophysical survey data** of 613 square miles of the **Bonnifield area** in the northern Alaska Range.
- Initiated **airborne geophysical surveys** of 245 square miles of the **Fortymile area** in eastern Interior Alaska. This project is funded by the U.S. Bureau of Land Management and data will be used to aid land management recommendations and decisions.
- Initiated **airborne geophysical surveys** of 520 square miles of the **Lime Hills and Tyonek quadrangles** of southwestern Alaska.
- Published a **geochemical report** for the **Fairbanks mining district**.

Engineering Geology, Hazards, & Construction Materials

- Completed surficial-geologic mapping of **300 square miles of the Council mining district**. Final publication is in progress.
- Completed geologic mapping and geohazards evaluation investigations for more than 750 square miles along the Alaska Highway as the first of a multi-year study of the proposed **natural gas pipeline corridor**. Field work included surficial and bedrock mapping, permafrost investigations, and evaluation of potentially active faults in and near the corridor.
- Initiated surficial-geologic mapping of **188 square miles of the Northeast Fairbanks** airborne-geophysical survey tract.
- Supported the Alaska Coastal Management Plan (ACMP) by providing **natural hazards review** for coastal planners, and a presentation that included a **needs assessment for planners dealing with natural-hazard identification** at the annual ACMP Regional District Workshop.
- Completed year 3 of **MapTEACH** (*Mapping Technology Experiences with Alaska's Cultural Heritage*), a pilot project funded by the National Science Foundation (NSF) to develop a geoscience-education program for middle- and high-school students in Alaska. The project is a collaborative effort with the University of Alaska Fairbanks and University of Wisconsin Madison. Provided administrative and technical support for the **Alaska Seismic Hazards Safety Commission**.

Volcanology

- Cored Mother Goose Lake on the Alaska Peninsula to determine frequency of acidification resulting from episodic drainage of the acid crater lake at **Chiginagak Volcano**. These events kill all life in the lake, and terminate runs of all salmon species up the King Salmon River. Submitted a manuscript on this event to *Bulletin of Volcanology and Geothermal Research.*
- Co-led and managed a helicopter- and fixed wing-supported field camp on **Augustine Volcano**, involving more than 30 scientists and a complex schedule of field studies as follow-up to the 2005 eruption.
- Participated in the response to the 2006 eruption of **Fourpeaked Volcano**, including monitoring and field-based studies.
- Maintained the **Alaska Volcano Observatory (AVO) internal and external World Wide Web sites**, including designing and implementing new automated ways to handle daily and weekly notices of volcanic activity, implementation of internal communication tools, and updating the public site. These pages have become crucial to daily monitoring of Alaska volcanoes and are technologically at the cutting edge worldwide.
- Expanded and further developed GeoDIVA (**Geologic Database of Information on the Volcanoes of Alaska**).
- Initiated the first-ever systematic multi-volcano study of the occurrence, abundance, and texture of minerals in **Alaska lavas** as an aid to understanding their origin.

Geologic Information Management and Delivery

- Published 22 **new geologic maps**, 14 **new geologic reports**, and 1 **CD-ROM**, including ***Alaska's Mineral Industry*** annual report for 2005, plus two issues of **Alaska GeoSurvey News**.
- Sold 673 **professional maps and reports**, distributed approximately 596 **free educational publications**, and responded to **significant geologic information requests**.
- Continued to add U.S. Geological Survey (USGS) Alaska-related reports and map series, as copies were located, to the **Geologic & Earth Resources Information Library of Alaska** (GERILA) database under federal support through the Minerals Data & Information Rescue in Alaska (MDIRA) project. The USGS publications are accessible at no charge through the DGGS website, and are sometimes the only available copy of the report or map.
- Completed metadata documentation for all remaining **legacy DGGS projects** and upgraded their products to current standards for public access through the Geologic & Earth Resources Information Library of Alaska (GERILA) database.
- Added geochemical data from 31 publications (originating from DGGS, USGS, and other Alaska-related outside publications) to the DGGS **WebGeochem database**, making the data available for public download on the DGGS website. With this latest addition, WebGeochem contains 36,282 sample analyses from a total of 99 publications.
- Continued to host and facilitate updates to the **Alaska Seismic Hazards Safety Commission website** and the general **DGGS website**. Redesigned and recoded significant portions of the DGGS web pages to enhance the look and feel

and bring it into compliance with coding standards and accessibility recommendations.

- Added "**Ask a Geologist**" function to the website. Provided timely, informative responses to nearly 30 geology-related questions submitted via the website since December 19, 2007.
- Completed significant work, including database design and map cataloging, on a MDIRA-funded project to archive and index unpublished **minerals-related data**.
- Completed development of a web-based tool to provide **public access to DGGS digital geologic maps and other data** on-line, in response to strong industry demand.

Geologic Materials Center

- Hosted **407 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 2,880 processed oil and gas related microscope slides and 9 hard-rock mineral and oil and gas technical data reports.
- Received **rock samples for 20 new oil and gas wells**, representing 147,798 feet of well samples, from the Alaska Oil and Gas Conservation Commission.
- Retrieved the U.S. Geological Survey's Irv Tailleur **rock sample collection for northern Alaska** from Sequim, Washington, just before the collection was going to a landfill. This collection (nearly a 40-foot trailer load) consists of 33 large cabinets of Brooks Range surface samples and 5 cabinets of core samples from 39 old northern Alaska exploratory oil and gas wells. These samples represent 24 U.S. Navy exploratory wells and 14 Husky Oil NPR wells, as well as crude oil samples from wells and natural seeps of northern Alaska.
- Completed a detailed inventory of the **Marathon Oil Company oil and gas well-sample rock collection** from Alaska.
- Added the inventory of the **Alaska Oil and Gas Conservation Commission well and sample rock collection** to the main MasterGMC inventory database.
- Created a prototype **ONEGMC database** as a test model combining the processed and unprocessed hard-rock mineral core and oil and gas well samples into a single, searchable network system.
- Assisted DGGS with definition and systems analysis for a future planned **web-accessible sample-inventory database**.

KEY ISSUES FOR FY2008–2009

Response to data needs for adaptation to a changing arctic climate

- Alaska will, over the coming years, be a national focal point for indications and impacts of climate change. Our ability to provide reliable, unbiased data for the development and evaluation of emerging policy and statute changes will be very important for achieving reasonable, long-range planning and mitigation. Given the current heightened state of awareness and media coverage, it will be important to collect and make available the geologic and hazards data needed to help mitigate and adapt to the changing environment.
- There are many areas where geologic information will be needed. Most importantly, these data will be required in areas of coastal development and critical infrastructure where ground settlement from thawing permafrost, increased erosion and landslide hazards, and changes in hydrologic systems (both surface and subsurface aquifers) will be prevalent.
- Historically the state has relied on site-specific hazards analyses related to ongoing development or permit approval. The recognition of significant change across the arctic will require that regional baseline data be gathered and made available to communities and local planners so that mitigation and new development can progress with physical and environmental change in mind.
- Sustained population growth and development in Alaska will continue to encroach on areas with heightened geohazard risk.
- DGGS will be tasked with acquiring 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 crisis situations.
- DGGS will work with many other agencies (with a wide range of mandates) in a coordinated effort so that the most important needs are addressed, and redundancy is minimized.

Updating and improving the Alaska 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 150 percent over its designed 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 at 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 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 of 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. It is the basis for our FY2009 CIP request to support the next phase, which is architectural and engineering design of the facility.
- 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. We plan to include a request for Congressional appropriations in the federal FY2010 budget to leverage state funding and help build a new facility. However, considering recent major reductions in federal earmarks, the likelihood of receiving significant Congressional support for this project may be low.

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 and gas exploration efforts by independent industry puts 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.

The changing face of local energy supply and consumption

- High energy prices have had a significant impact on the economy of rural Alaska and threaten the viability of rural infrastructure.
- Many remote areas of the state lack sufficient geologic information on potential alternate forms of energy such as shallow natural gas, coal, geothermal, and conventional gas.
- Misinformation about viable alternate energy sources is rampant and many expensive mistakes will be avoided by getting accurate information in the hands of the local governments and decision makers.
- DGGS will be challenged to provide pertinent and timely data on numerous fronts, and has begun a long-term program that addresses the occurrence of locally available energy sources and makes that data available on an interactive public website.

Geologic mapping and field operations cost

- Significant increases in the cost of field operations continues to decrease DGGS's ability to accomplish its mission.
- Innovative methods for remote camps, sharing logistical costs, and decreasing the number of flight hours will play a major role in keeping geologic field mapping viable and continuing the collection of needed information.
- Much of DGGS's most valuable work 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 more than 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.
- When compared to any other state, the geology in Alaska is 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% 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.
- Geologic mapping is distinctly different from orthoimagery or Digital Elevation Model (DEM) mapping. The latter types of detailed mapping are badly needed as base maps for geologic data so that the geologic mapping can be accurately placed in proper geographic context. DNR is pursuing this type of mapping for the state under separate funding requests.

Infrastructure projects

- Development of Alaska's vast resource base requires reasonable access to world markets. Providing geologic data for infrastructure maintenance and development will remain a key challenge for DGGS.
- The AGIA pipeline will require vast amounts of construction materials information and geologic hazards data to allow timely and safe design and development. DGGS is currently acquiring those data, but will need to accelerate the current pace to supply the needed maps and information.
- Continued arctic warming will undoubtedly increase maintenance requirements on much of Alaska's current roads and transportation corridors. To mitigate this change, it will be necessary to identify geologic hazards and areas prone to failure. Increased materials requirements will likewise strain DOTPF's ability to address this issue. DGGS will work with other state agencies to provide modern analytical techniques for this work.

Reduction of federal funding for geologic work

- 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 grant proposals and collaborative work. For example, the FY2006 DGGS expense budget was nearly 60% federal receipts and included funding for the Minerals & Data Information Rescue in Alaska (MDIRA) project, STATEMAP geologic mapping programs, Alaska Volcano Observatory (AVO) collaborative program, mineral-resources identification, and other collaboration with U.S. Minerals Management Service (MMS), Bureau of Land Management (BLM), and USGS. Much 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.

DGGS FY2008 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 FY2008 DGGS program is focused on projects designed to foster the creation of future Alaskan natural-resource jobs and revenue and to mitigate adverse effects of geologic hazards. 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

FY08 DIVISION EXPENSE BUDGET
(amounts in thousands of dollars)

Program	General Fund	CIP	Federal Receipts	Interagency & Program Receipts	Total
Energy Resources	809.0	360.5	176.8	150.0	1,496.3
Mineral Resources	543.0	550.4	393.8	229.6	1,716.8
Engineering Geology	475.0	685.5	131.6	15.0	1,307.1
Volcanology	0.0	0.0	871.2	0.0	871.2
Geologic Communications	593.5	205.0	15.0	10.0	823.5
Geologic Materials Center	285.0	0.0	51.5	50.0	386.5
Administrative Services	512.9	0.0	0.0	0.0	512.9
Seismic Hazards Safety Commission	10.0	0.0	0.0	0.0	10.0
Total by funding source	**3,228.4**	**1,801.4**	**1,639.9**	**454.6**	**7,124.3**

the needs of its intended users. A liaison committee comprising representatives from the Alaska Miners Association, Alaska Native corporations, 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 FY2008 Program Summaries that follow, MDIRA projects are indicated by an asterisk (*).

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 of DNR's program budget 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, natural gas, coal, and geothermal resources. Despite substantially increased oil prices, the current and projected reduction in oil-generated revenue from declining production will require that significant new hydrocarbon discoveries are brought on line to maintain the current level of revenue payments to the state. As a consequence, there is a continual need for acquisition and dissemination 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 are 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 FY2007, DGGS resumed stratigraphic studies of an area straddling the Trans-Alaska Pipeline corridor in the Sagavanirktok Quadrangle of the east-central Brooks Range foothills. This area encompasses approximately 600 square miles, and includes stratigraphic and structural elements important to understanding the oil and gas potential of Alaska's North Slope. This work was initiated in anticipation of a bedrock-geologic mapping project during late FY2008 that will be 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 finishing an evaluation of potential oil and gas source and reservoir rocks in the Bristol Bay Basin and Alaska Peninsula region that provides baseline geologic data 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 3-mile-limit waters of Bristol Bay Basin and the Alaska Peninsula that are the focus of state lease sales. FY2007 is the final year of this program.

Rising oil and gas prices combined with predicted 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 tight sandstone formations and in stratigraphic plays. DGGS initiated a study of this basin in FY2007 to provide new publicly-available data to help evaluate resource potential and stimulate successful exploration for hydrocarbons in Cook Inlet. This project is focused on building a robust model of the basin's stratigraphy to help predict the distribution of potential sandstone reservoirs and to provide a better understanding of parameters controlling reservoir quality. This new information will be important in exploring for new oil and gas resources in tight sand reservoirs and in stratigraphic traps, and in maximizing production from existing fields.

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 initiated a program to use temperature survey data derived from existing oil and gas wells to evaluate areas of elevated geothermal gradient on the North Slope that adversely affect gas hydrate resources. 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) will be released in February 2008.

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.

DGGS is participating in a multi-agency effort to inventory Alaska's energy resources. This project includes development of a user-friendly web-based interactive map to display the location, type, and, where applicable, a risk-weighted quantity estimate of energy resources available in a given area or at a specific site.

The numerous elements of the Statewide Energy Resource Assessment program are financed from a mixture of funding sources: General Fund, Program 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.

FY2008 ENERGY RESOURCES PROJECTS

Detailed project summaries for the following energy resources projects appear in the section *Project Summaries—FY2008*:

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

- 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 minerals industry has been a significant and steadfast partner in the economic wellbeing of Alaska since the late 1800s. In more recent times, global demand for strategic minerals is at an all-time high and Alaska's minerals reserves will play a significant role in helping meet that rising demand. The mineral industry, however, has historically been reluctant to commit significant company resources to exploration without sufficient understanding of the geologic framework of their areas of interest. For this reason, and to support responsible stewardship of Alaska's mineral endowment, DGGS conducts geological and geophysical surveys of the most prospective Alaska lands that are open to mineral and other geologic resource development.

Alaska has an accessible state land endowment of more than 100 million acres, much of it selected under the Statehood Act 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. Projects of the Mineral Resources section are designed to produce, on a prioritized schedule, the critical new surveys and reports needed to sustain Alaska's mineral industry investments and provide management agencies with information needed to formulate rational management policy.

The Mineral Resources section also 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 Mineral Resources section 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 geologic framework and mineral resources of the state so that rational land policy and investment decisions can be made.
3. Provide, in cooperation with the Department of Commerce, Community and Economic Development, an accurate annual statistical and descriptive summary of the status of Alaska's mineral industry.

FY2008 MINERAL RESOURCES PROJECTS

Detailed project summaries for the following Mineral Resources projects appear in the section *Project Summaries—FY2008*:

* *MDIRA-supported project (see p. 14)*

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, some elements of the 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 development and implementation of building codes, land-use zoning, right-of-way siting, 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 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.

FY2008 ENGINEERING GEOLOGY PROJECTS

Detailed project summaries for the following Engineering Geology projects appear in the section *Project Summaries—FY2008*:

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.

VOLCANOLOGY

The Volcanology program of DGGS works as part of an interagency consortium to mitigate hazards from Alaska volcanoes. The consortium is the Alaska Volcano Observatory (AVO), formed by Memorandum of Understanding in 1988. AVO cooperators are DGGS, the U.S. Geological Survey (USGS), and the University of Alaska Fairbanks Geophysical Institute (UAF/GI). In the past, the Volcanology program has existed as a sub-program in the Engineering Geology section; the Director established Volcanology as a separate section in early 2007.

AVO studies volcanoes to increase understanding of hazards at particular volcanoes and how volcanoes work in general; monitors volcanoes using seismology, geodesy, satellite remote sensing, field studies, and local observers; and provides timely and accurate warning of increasing unrest and eruptions to emergency management agencies, other government entities, the private sector, and the public. Most Alaska volcanoes are remote from human settlements, but all underlie the heavily traveled north Pacific passenger and cargo air routes between North America and Asia; thus the aviation sector is an important recipient of AVO monitoring and reporting.

The three component agencies of AVO (DGGS, USGS, UAF/GI) each bring particular strengths to the observatory, while sharing general expertise in volcanology (see figure). Among these agencies, DGGS has the primary AVO mandate for baseline geologic mapping and the state's mandate for hazards studies. DGGS's administrative flexibility has allowed us to build and maintain the AVO website, serving a large database of descriptive material about volcanoes, providing a cutting-edge system for intra-observatory communication and data sharing, and providing notices of eruptions and unrest to users in public, private, and government sectors. The database and information dissemination tools built around the database (see GeoDIVA project description, p. 48) has emerged as the most powerful such tool among volcano observatories worldwide. Particular strengths of the USGS are the federal hazards mandate and direct ties federal agencies. UAF/GI brings a research mandate and access to technological resources (such as satellite data downlink centers) beyond the financial capability of AVO.

Funds for DGGS participation in AVO come from cooperative agreements with the USGS. The majority of these funds in turn come from the USGS Volcano Hazards Program base budget. The remainder come to USGS as specially mandated congressional programs ("earmarks") though other agencies in other departments, such as Transportation and Defense.

OBJECTIVES

1. Help mitigate risks to public safety and health by providing information on volcanic hazards as they affect human activity.
2. Represent the State of Alaska's interests within the multiagency Alaska Volcano Observatory.
3. Develop and maintain the Alaska Volcano Observatory website as a primary communications vehicle to deliver information about Alaska's volcanoes to the public and provide internal communications and data exchange among AVO personnel.
4. Provide comprehensive information on Alaska volcanoes, including past history and current activity, to the general public, agencies, and volcanologists worldwide.

FY2008 VOLCANOLOGY PROJECTS

Detailed project summaries for the following Volcanology projects appear in the section *Project Summaries—FY2008:*

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

- Assist AVO in volcano monitoring. AVO monitors 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 in the mid-1990s), and monitors more than 100 volcanoes twice daily by satellite. While not a primary DGGS activity, DGGS assists in volcano monitoring when needed during eruption events.
- Provide advanced GIS expertise to all component agencies in AVO. This includes producing base maps in areas where 1:63,360-scale topographic maps do not exist, retrieving and georegistering maps from discontinued map series, and produc-

ing a variety of other georegistered data products. DGGS also provides expertise in finalizing and troubleshooting GIS-based map publications using standard GIS techniques for numerous projects in all AVO component agencies.

- Provide helicopter and ship logistics. DGGS manages helicopter charter procurement for all major AVO projects, ship charters for projects that are far enough from population centers to require ship-based helicopters, and fixed-wing charter for volcanic gas measurement flights. Having all the contracting done by a single agency results in significant budgetary and logistic efficiencies.
- Perform geochemical data procurement and archiving, coordinating geochemical analyses, and maintaining the archive of those data. 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.
- Represent DGGS to CUSVO/NVEWS. DGGS is one of the charter members of the Consortium of U.S. Volcano Observatories (CUSVO), which provides coordination among the five volcano observatories in the United States. The National Volcano Early Warning System (NVEWS) 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.

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 Alaska's 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. The front desk also assists customers in understanding geological and geophysical maps, and manages sales of geologic reports, maps, and digital data. Additionally, the section 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. Staff established a website and began extensive use of the Internet in FY98 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 collection of publications on our website. The U.S. Geological Survey provided additional funds to do the same for all Alaska-related USGS Bulletins and Professional Papers and make them available via the DGGS website.

The Geologic Communications Section is supported by the General Fund, Program Receipts, and Federal Receipts.

OBJECTIVES

1. Disseminate new, accurate, unbiased, Division-generated data on Alaska's geology, 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.

FY2008 GEOLOGIC COMMUNICATIONS PROJECTS

Detailed project summaries for the following Geologic Communications projects appear in the section *Project Summaries—FY2008*:

** MDIRA-supported project (see p. 14)*

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 supported by the General Fund budget and in-kind contributions from industry. Additional financial support is received annually from the Alaska Oil & Gas Conservation Commission. The private sector contributes the cost of delivering all new samples, sample preparation and analyses, sample logs, and data logs, and occasionally donates storage containers and/or shelving.

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 geologic materials from Alaska. A voluntary 14-member board advises the curator and DGGS on matters pertaining to the GMC.

With federal funding and 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. In 2007, DGGS used information from this report to develop a brochure explaining the functions and services of the GMC and the need for an upgraded facility. The brochure is presented in the appendix of this report.

OBJECTIVES

1. Encourage responsible resource development and in-state employment opportunities by increasing accessibility to representative geologic samples and information concerning oil, gas, and mineral exploration.
2. Advance the knowledge of the geology and resources in Alaska's 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–FY2008* (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 and disseminating 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.
- Provide accurate, timely processing of employee timesheets, invoices, procurement records, and other documentation required by the State; ensure strict adherence to State archiving requirements.
- 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—FY2008

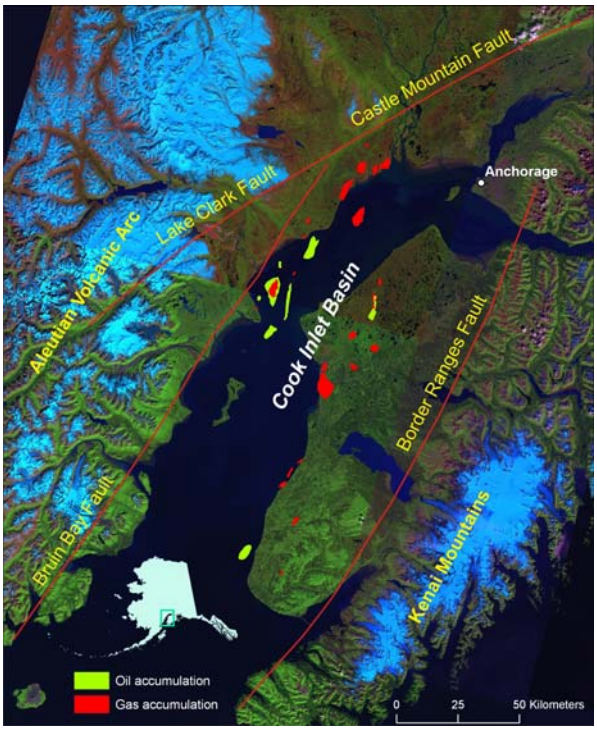
Alaska faces the challenge of growing a healthy economy from its natural resources while protecting an environmental legacy that is the envy of many. The Department of Natural Resources' Division of Geological & Geophysical Surveys is an integral partner in the team of state agencies that strive to meet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

The overviews of the following 34 projects that DGGS is pursuing in FY2008 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 contracts. 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. 14)*

COOK INLET GEOLOGY PROGRAM



Rising oil and gas prices combined with looming gas deliverability shortfalls in the southcentral 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 traps in formations with low porosity and permeability (tight sands).

All companies, particularly companies new to Cook Inlet, need access to unbiased, publicly available detailed technical information on the regional geology of the basin to be successful in exploring stratigraphic and tight sand prospects. The only detailed relevant studies of the subsurface geology of the basin are those completed by industry, which are proprietary and unlikely to ever be 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 carrying out relevant applied geologic research in a multi-year, state- and industry-funded program designed to provide high-quality data to the geologic community and public policy makers. The technical objectives of this program are to develop a detailed depositional systems framework for the basin, evaluate the reservoir potential of sand bodies within a deposition systems context, and determine the compositional parameters controlling reservoir quality. The resulting data and interpretations will help attract new exploration companies to the basin and assist in exploration activities already active in the basin. This will ultimately stimulate successful exploration for natural gas to fuel southcentral Alaska's economy.

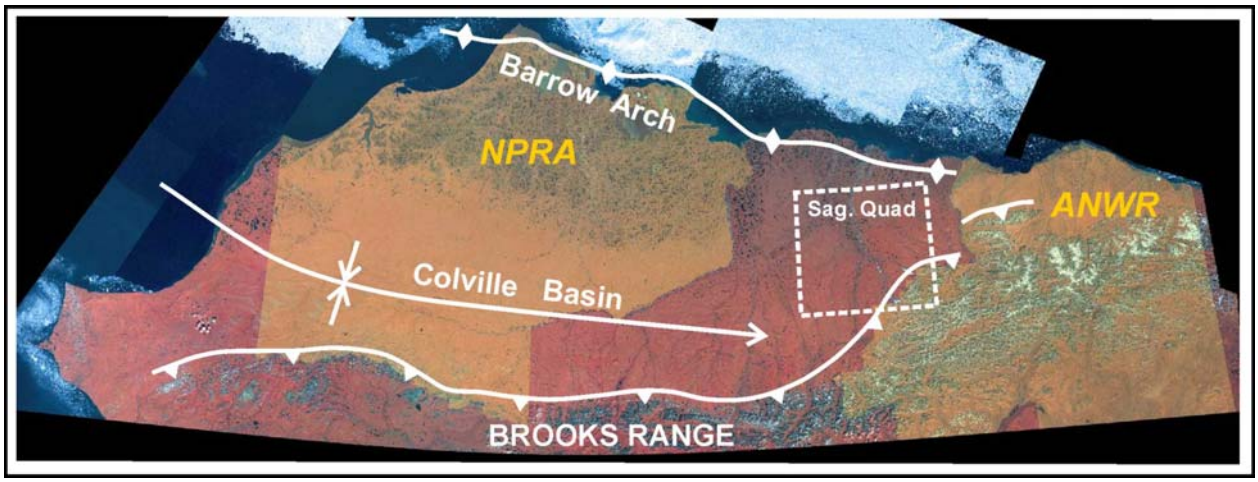
Cook Inlet basin is an elongate fault-bounded forearc basin situated above a north-dipping subduction zone formed by convergence between the Pacific plate and southern Alaska. The basin is bounded by an active volcanic arc to the west and an active accretionary complex underlying the Kenai and Chugach Mountains to the east (see figure above). Mesozoic-age rocks are present at depth, are greater than 36,000 feet thick, and represent deposition in marine environments. Commercial quantities of oil and gas have not been discovered in these rocks, although all oil found to date has its source in this section. The Tertiary succession is up to 25,000 feet thick in upper Cook Inlet and was deposited as alluvial fans along the basin margins and as river and floodplain deposits along the basin axis. All commercial oil and gas fields in the basin produce from reservoirs in Tertiary strata in fields associated with northeast-trending faulted anticlines (note northeast trend of fields on map above). Available organic geochemical data indicate that most of the gas in these fields is biogenic and originates from coal and carbonaceous mudstones in the Tertiary rocks.

Work by DGGS and DOG in 2007 documented depositional systems along the eastern and western basin margins and began evaluating the range of sandbody (reservoir) geometries associated with these depositional systems. A suite of samples was also collected from a wide range of sand bodies for use in determining sand body composition to evaluate reservoir quality. Preliminary results from the 2007 field season will be released in early 2008 in digital format via the DGGS website, www.dggs.dnr.state.ak.us.

Contact: David L. LePain, 907-451-5085, dave.lepain@alaska.gov

BROOKS RANGE FOOTHILLS & NORTH SLOPE 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 stimulate exploration for hydrocarbons in northern Alaska. Although supported primarily by the state General Fund, 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 (DOG), the U.S. Geological Survey (USGS), the University of Alaska Fairbanks, and others.



During the 2007 field season, the program continued to focus on stratigraphic studies of key reservoir and source rock intervals in the foothills of the Brooks Range. The collection of detailed sedimentologic data is providing new constraints on the depositional history and correlation of units, leading to an improved understanding of how this hydrocarbon-rich basin evolved. In particular, recent work on Upper Cretaceous rocks exposed in the south-central Sagavanirktok Quadrangle (see map) has provided valuable insight into the time-transgressive northeastward progradation of genetically related shelf, slope, and deep water facies. In collaboration with DOG, we have begun integrating detailed outcrop observations with available well and 2-D seismic data, greatly increasing the robustness of our stratigraphic correlations and regional geologic models. In addition to stratigraphic studies, the program also continued to evaluate the structural geology of the inner Brooks Range foothills, documenting the geometry and style of deformation that influenced hydrocarbon maturation and migration.

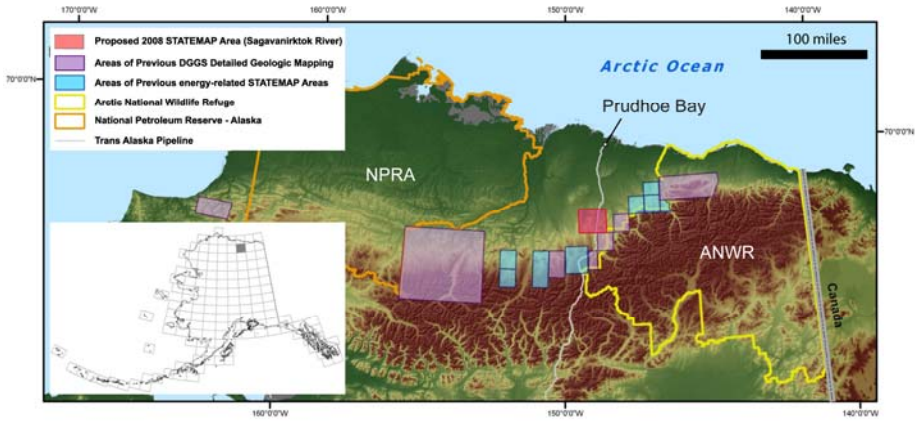
Notable upcoming DGGS publications from this program include a series of six reports on Cretaceous stratigraphy, as well as recent geochemical results from a gas seep along the Colville River (anticipated publication in January 2008). Additional reports to be released in 2008 will also summarize biostratigraphic results, organic geochemical data, and reservoir quality analyses.

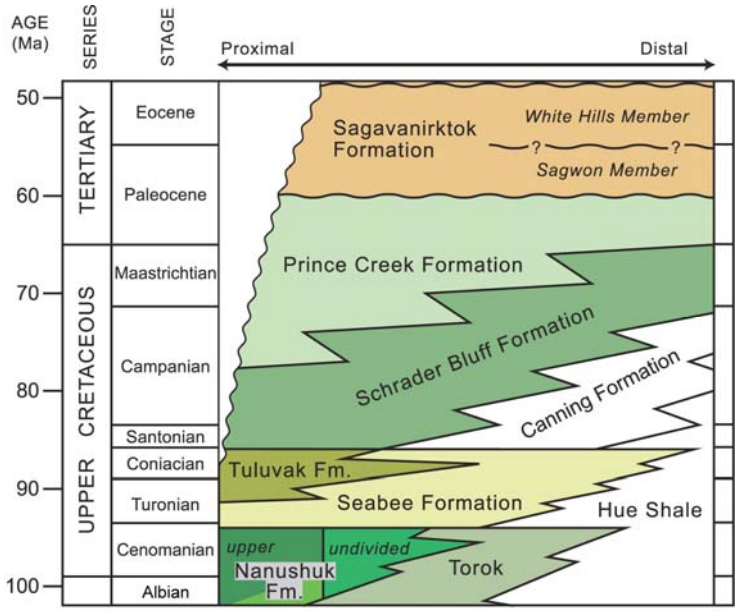
Contact: Marwan A. Wartes, 907-451-5056, marwan.wartes@alaska.gov

GEOLOGIC MAPPING IN THE SAGAVANIRKTOK RIVER AREA

Alaska's North Slope provides a significant percentage of our nation's domestic oil production. This world-class petroleum province is likely to continue playing an important role in meeting our country's future energy needs. Given the current decline in production from most North Slope fields, the market price of oil pushing record highs, and the current interest in bringing North Slope natural gas to Lower 48 markets, the State of Alaska is continuing its framework-geologic studies of the region to encourage new exploration investment.

With many of the prospective areas on the North Slope covered by tundra, detailed geologic investigation of available outcrops is critical to understanding structural and stratigraphic relations that can provide valuable insights to the subsurface distribution of hydrocarbon resources. Moreover, geologists have determined that the Brooks Range foothills region is likely to hold sizable natural gas resources. DGGS has proposed a new geologic mapping project that will provide important data for understanding the natural gas resources of the foothills region and the long-term supply to the proposed natural gas pipeline.





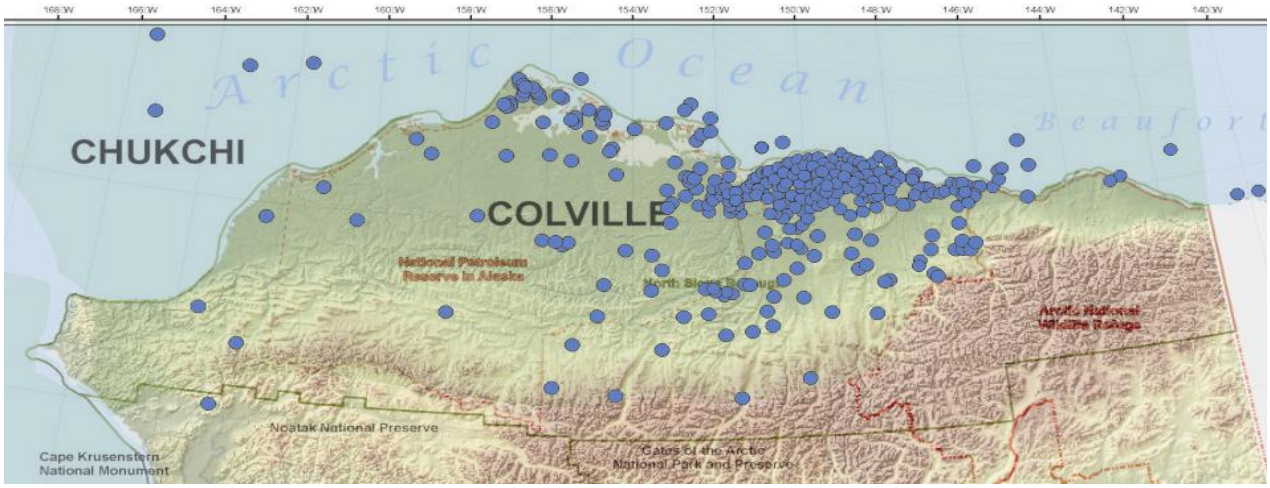
This project, planned to begin in June 2008, is aimed at new 1:63,360-scale bedrock geologic mapping in the Sagavanirktok Quadrangle during the 2008 field season. This area straddles the Trans-Alaska Pipeline corridor and encompasses approximately 600 square miles of State-owned land in the northern foothills of the Brooks Range (see red shaded area on map above). No detailed geologic mapping exists in this area and the proposed work will fill an important gap in our knowledge of the evolution of the petroleum system. Concurrent with bedrock mapping, the source and reservoir potential of selected stratigraphic units in the map area will be evaluated. Through collaboration with the Alaska Division of Oil and Gas, surface geologic mapping will be correlated with available seismic and nearby well data. This integration greatly expands the utility of our mapping and interpretations in support of subsurface hydrocarbon exploration efforts.

Pending receipt of partial federal funding through the U.S. Geological Survey's STATEMAP program, a preliminary geologic map will be produced for delivery in late Spring 2009. Supplementary analytical data and related structural and stratigraphic results will be released as preliminary reports via the DGGS website by winter 2008-09. A final version of the map will be released in a digital format via the DGGS website by summer 2010.

Contact Robert J. Gillis, 907-451-6835, robert.gillis@alaska.gov

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 equivalent volume of gas trapped within permafrost-associated gas hydrate accumulations in northern Alaska is nearly 600 TCF; the U.S. Geological Survey estimates that large volumes of in-place gas (40–100 TCF) exist as hydrates beneath the 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.



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

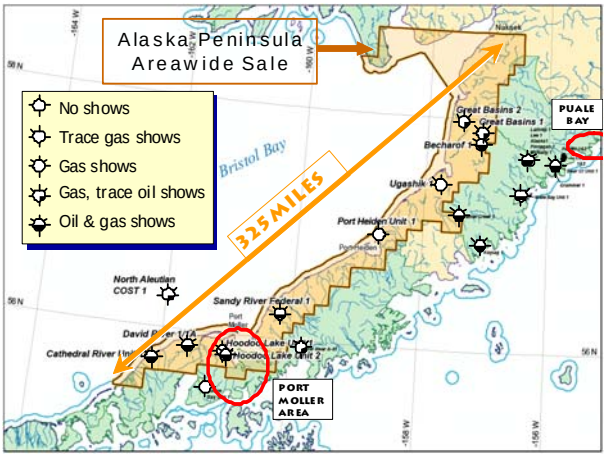
Small increases in the geothermal heat flow can adversely affect the presence and thickness of gas hydrate zones. DGGS is initiating a program to evaluate corrected Bottom Hole Temperatures (BHT) survey data derived from existing oil and gas wells to delineate areas of elevated geothermal gradient that adversely affect gas hydrate resources. A large data set of drill-hole-temperature survey information of more than 6,000 wells drilled in sedimentary basins throughout Alaska makes 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 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; and (2) evaluate drill hole lithologies and formation thermal conductivity, and perform heat flow calculations to establish accurate geothermal gradient data. 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). Products are scheduled for completion in December 2007.

Contact: Jim Clough, 907-451-5030; jim.clough@alaska.gov

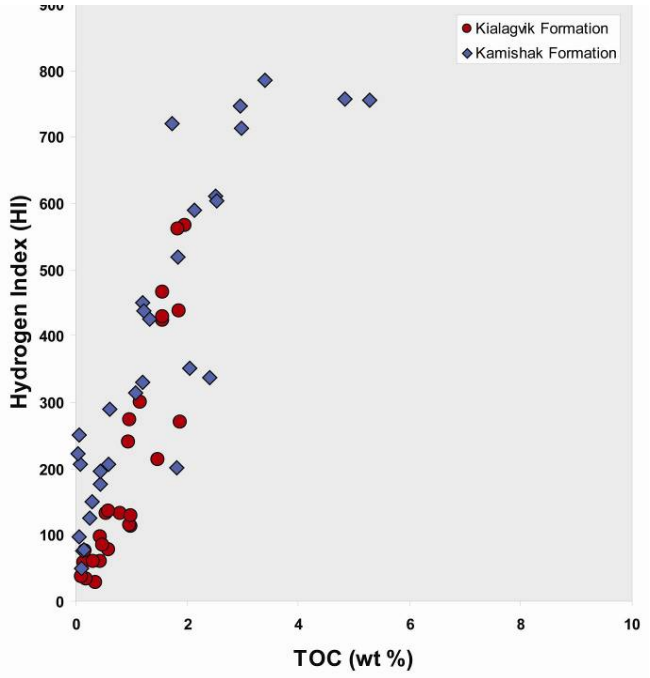
BRISTOL BAY–ALASKA PENINSULA FRONTIER BASIN STUDIES: Characterization of Hydrocarbon Source Rock and Reservoir Potential

This program is a four-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 the Division of Geological & Geophysical Surveys (DGGS), Division of Oil & Gas, Purdue University, University of Alaska Fairbanks, U.S. Geological Survey, and industry. Field work during 2007 was the last of four field seasons and focused on the Port Moller, Chignik, Ugashik Lakes, and Puale Bay areas.



Our new field data identify all of the elements required for a functioning petroleum system, including: (1) potentially good reservoirs in the 9,000-foot-thick Miocene Bear Lake Formation, with porosity ranging from 1 to 35 percent and permeabilities from 0.001 to 1,000 millidarcies in outcrop and core (North Aleutian COST No. 1 well), (2) fine-grained potential seals capable of supporting 250–2,500 foot hydrocarbon column heights, (3) numerous structures that represent potential traps and a Tertiary succession with significant stratigraphic trap potential, (4) organic-rich marine source rocks with total organic carbon contents as high as 5.28 weight percent in the Triassic Kamishak Formation (see chart below), the presence of numerous oil and gas seeps) and thick Tertiary/Cretaceous coals and carbonaceous shales, and (5) favorable thermal maturation indicators (R_o= 0.5–0.8 for the Miocene Bear Lake Formation) showing that potential reservoirs are in the "oil window." The oil and gas seeps consist of thermogenic gas at Port Moller hot springs and an oil seep southwest of Puale Bay flowing 0.5 barrels of 18 API gravity oil.

The onshore part of this region has a long history of petroleum exploration. More than 20 wells have been drilled on the Alaska Peninsula and most reported oil and gas shows (see figure above), but none has produced commercial quantities of petroleum. 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 trillion cubic feet of gas (U.S. Minerals Management Service report, Sherwood, 2000).

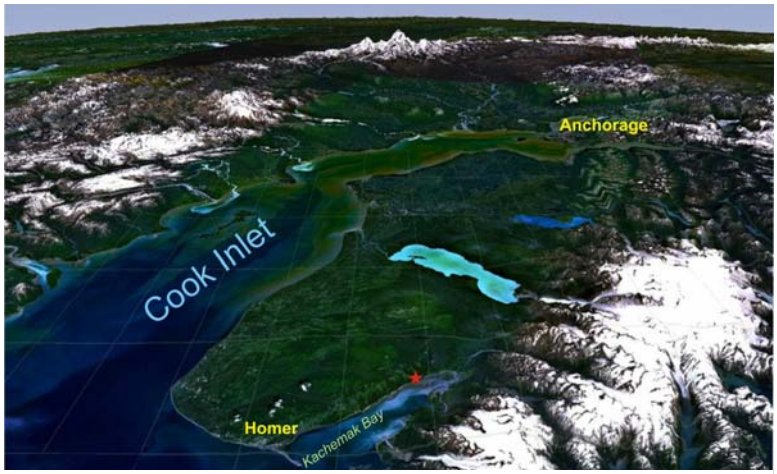


Our project data and publications continue to catalyze lease interest and new exploration, particularly by small independent companies. A state areawide oil and gas lease sale was held in 2007 and a second sale is scheduled for 2008 (see figure above). Rock samples will be archived for future use at 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) by the end of FY 2008.

Contact Rocky R. Reifenstuhl, 907-451-5026, rocky.reifenstuhl@alaska.gov

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.



Cook Inlet basin and location of coal seam on Kachemak Bay (red star), shown in photo below.

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 collect new coal quality data in the Cook Inlet basin that will be accompanied by accurate stratigraphic information for meaningful coal resource assessments. The Cook Inlet basin is an area of increasing oil and gas exploration; stratigraphic as well as coal quality data will benefit the exploration of energy resources in the region.

Coal seams in gradational zone between Tertiary-age Beluga and Sterling Formations, located near McNeil Creek on Kachemak Bay (see photo above).

During 2007, we evaluated a limited suite of Tertiary-age coal occurrences in the Cook Inlet region and collected coal samples for coal quality. Samples were analyzed for proximate, ultimate, and trace elements and a few samples were studied for high-pressure gas adsorption. Products for release in fall 2008 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.

Contact: Jim Clough, 907-451-5030;jim.clough@alaska.gov

ALASKA ENERGY INVENTORY: CATALOGING ALASKA'S RENEWABLE ENERGY RESOURCES

Alaska has considerable energy resources distributed throughout the state including conventional oil, gas, and coal, as well as unconventional coalbed and shalebed methane, gas hydrates, geothermal, wind, hydroelectric, and biomass (figure 1). While much of the known large oil and gas resources are concentrated in the North Slope and Cook Inlet regions, the other potential sources of energy are dispersed across a varied landscape from frozen tundra to coastal settings. Despite the presence of these potential energy sources, rural Alaska is mostly dependent on diesel fuel for both electrical power generation and space heating needs. At considerable cost, large quantities of diesel fuel are transported to more than 150 roadless communities by barge or airplane and stored in large bulk fuel tank farms for winter months when electricity and heat are at peak demands. Recent increases in the price of oil have severely impacted the cost of energy throughout Alaska; especially hard hit are rural communities and remote mines that are off the road system and isolated from integrated electrical power grids. Even though the state has significant conventional gas resources in restricted areas, few communities are located near enough to these resources to directly use natural gas to meet their energy needs.

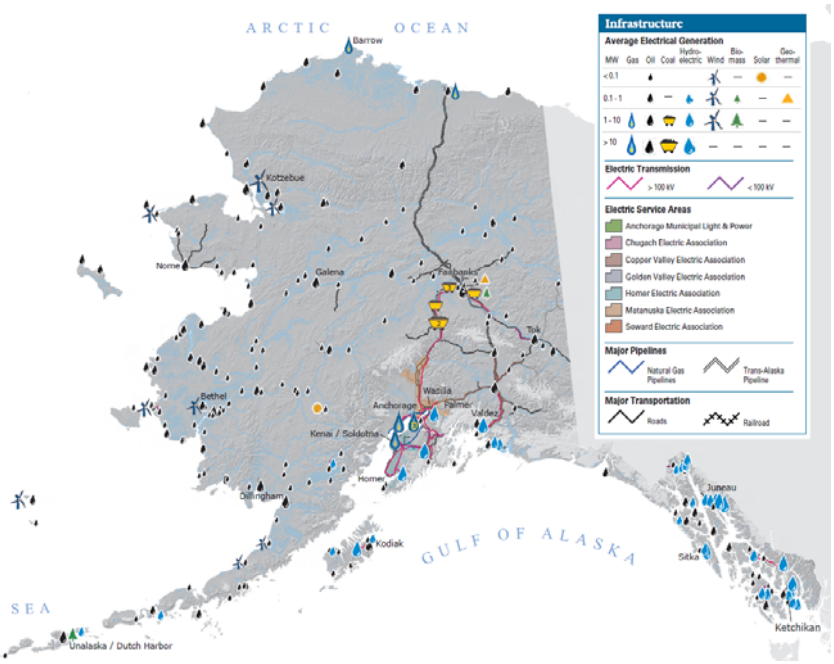


Figure 1. Alaska's energy resources infrastructure. Image courtesy of the Alaska Energy Authority.

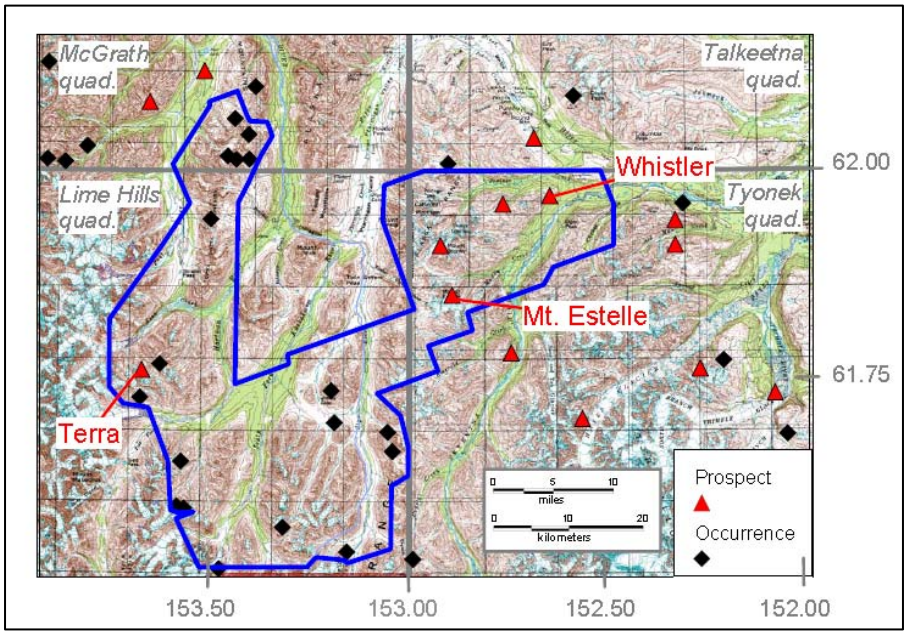
To address this problem, the Alaska Energy Inventory project will (1) inventory and compile all available Alaska energy resource data suitable for electrical power generation and space heating needs including natural gas, coal, coalbed and shalebed methane, gas hydrates, geothermal, wind, hydroelectric, and biomass, and (2) identify locations or regions where the most economic energy resource or combination of energy resources can be developed to meet local needs. These data will be accessible through a user-friendly web-based interactive map, based on the Alaska Department of Natural Resources, Land Records Information Section's (LRIS) Alaska Mapper, Google Earth, and Terrago Technologies' GeoPDF format. Displayed will be the location, type, and, where applicable, a risk-weighted quantity estimate of energy resources available in a given area or site.

Funded through a state Capital Improvements Project, the Division of Geological & Geophysical Surveys (DGGS), the Alaska Energy Authority (AEA), and the Division of Forestry (DOF) are working in concert to (1) notify and establish contacts with other agencies regarding the project's background and purpose, (2) design a web-based interface for distributing and displaying Alaska's energy resource data, (3) identify target end-users of the project's web site and data, (4) select key datasets to be used for testing purposes, and (5) determine the implications of providing data with quantitative attributes and the corresponding concerns of end-users potentially misusing the data. DGGS is also collaborating with LRIS and the Geographical Information Network of Alaska (GINA) at the University of Alaska Fairbanks to implement an interactive, web-based map interface allowing users to view, query, and download the available energy resource data. In addition, key datasets will be available for Google Earth and provided in the new, easy-to-use, georegistered, GeoPDF format. The latter formats accommodate users who wish to quickly view the data in already familiar software packages. A risk-weighted analysis of the energy resources inventory and an upcoming field program are scheduled to take place during FY09–FY10.

Contact: Kenneth Papp, 907-451-5039, ken.papp@alaska.gov

AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY: AIRBORNE GEOPHYSICAL SURVEY OF PARTS OF THE LIME HILLS AND TYONEK QUADRANGLES, SOUTHCENTRAL ALASKA

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, supported by state Capital Improvement Project funding, seeks to delineate mineral zones on Alaska state lands that: (1) have major economic value; (2) can be developed in the short term to provide high-quality jobs for Alaska; and (3) will provide economic diversification to help offset the decline 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 geologic maps; (3) 1:63,360-scale mineral occurrence maps; and (4) and various other geological, geochemical, and geophysical data compilations. Partly 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.

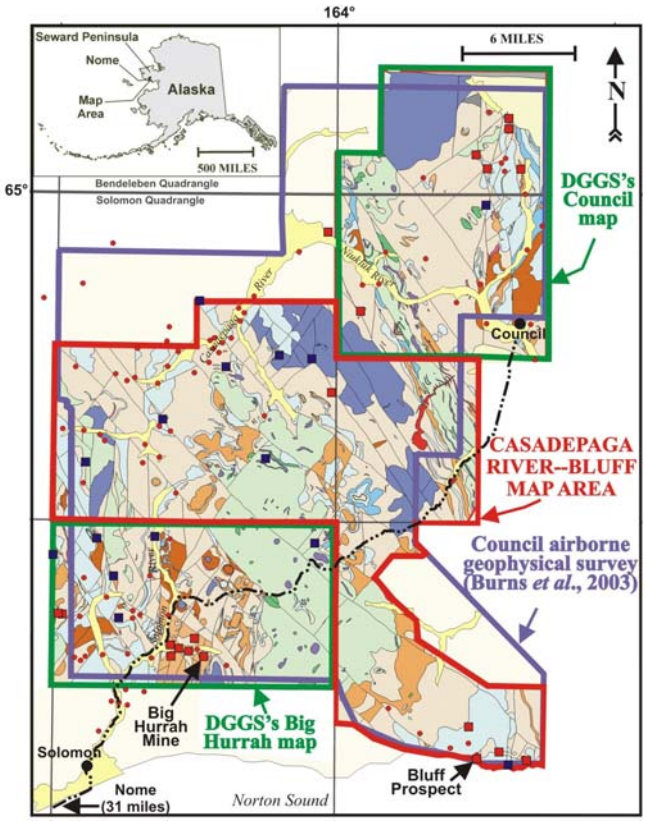


The DGGS AGGMI program is currently acquiring airborne-geophysical data for parts of the northeastern Lime Hills and northwestern Tyonek quadrangles. A contribution to the program by the mineral industry is allowing us to add about 190 square miles to our survey area. The area, all state-owned land, is about 120 miles northwest of Anchorage. The total area to be flown is about 700 square miles of prospective mineral terranes in the McGrath and Yentna mining districts. Most of the abundant prospects and occurrences throughout the area are considered polymetallic veins, copper–gold porphyries, or mixtures between those deposit types. Lead–zinc skarns, molybdenum-bearing quartz veins, and other deposits types are also thought to be present. Terra, Whistler, and Mount Estelle prospects in the survey area are currently being actively explored, as well as several other prospects in the area. Detailed geologic mapping is not available for the region. Airborne geophysical surveys and follow-up detailed geologic mapping will provide a way to map various rock units, especially distinguishing between granitic rocks and the various metamorphic rocks, and to delineate regional structures. By completing an integrated geophysical-geological mineral inventory study, new zones of mineralization may be identified; extrapolation of some of the information into the surrounding areas may be appropriate.

Geophysical maps and digital data will be released as DGGS Geophysical Reports in two batches in early winter and early summer 2008. DGGS believes that geophysical data leading to a better understanding of the geologic framework and potential ore deposits in these districts will stimulate increased mineral exploration investment in these belts of rocks and the surrounding areas. The geophysical and geological data that are produced from these studies will be used for decades.

Contact Laurel Burns, 907-451-5021, laurel.burns@alaska.gov

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, but gold production has declined in recent decades. To encourage renewed industry exploration for lode gold and base-metal deposits in this region, and to provide geologic data for land-use management, the Alaska Division of Geological & Geophysical Surveys (DGGS) in 2003 released an airborne-geophysical survey for the area outlined in purple (see figure). This survey was part of the Airborne Geophysical/ Geological Mineral Inventory (AGGMI) program, supported by state Capital Improvement Project (CIP) funds. In 2004, DGGS conducted 1:50,000-scale geologic mapping and geochemical sampling in the Big Hurrah and Council areas (green outline). 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 May 2008. A geochemical report for the 2006 map area was released in October 2007. This project is primarily supported by the CIP-funded 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.

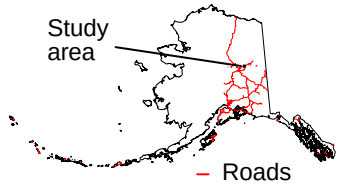
The Casadepaga River–Bluff area is underlain by Proterozoic to Lower Paleozoic metasedimentary and metaigneous rocks of the Nome Group, including the Solomon Schist, Mixed Unit, Casadepaga Schist, and undifferentiated marble. DGGS's recent detailed geologic mapping defines the internal metamorphic stratigraphy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

In the Casadepaga River–Bluff area, DGGS's geologic mapping and associated studies have documented the location, geochemistry, age, distribution, orientation, and regional structural controls on the area's gold-bearing quartz vein systems. To help predict where additional veins may be located, it is important to determine the timing of gold-vein formation relative to structural features, metamorphic events, and igneous intrusions. Our preliminary work indicates that Nome Group rocks underwent high-pressure blueschist-facies metamorphism ~200 million years ago (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 on the southern Seward Peninsula, as well as the more widely distributed, gold-bearing veins of possible orogenic or extensional origin. Ongoing 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.

Contact: Melanie B. Werdon, (907) 451-5082, melanie.werdon@alaska.gov

AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: GEOLOGIC MAPPING IN THE NORTHERN FAIRBANKS MINING DISTRICT, CIRCLE QUADRANGLE, NORTHEAST FAIRBANKS GEOPHYSICAL SURVEY TRACT

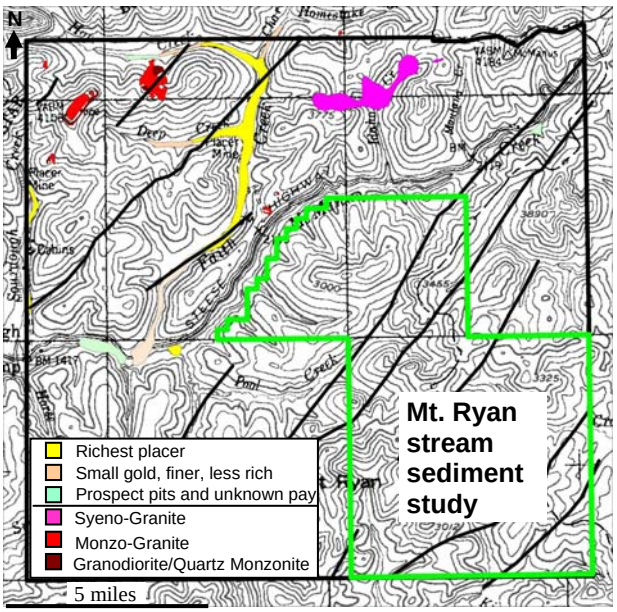
In summer 2007, the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted about 189 square miles of geologic mapping northeast of Fairbanks, covering the central portion of DGGS's 404-square-mile Northeast Fairbanks airborne magnetic and electromagnetic geophysical surveys released in January 2006. The mapping project is primarily funded by DGGS's Airborne Geophysical/Geological Mineral Inventory program, a special multi-year investment supported by State of Alaska Capital Improvement Project (CIP) funds to expand Alaska's geologic and mineral resources knowledge base, catalyze future private-sector mineral exploration and development, and guide state planning. Other funding sources include the federal STATEMAP program and the State's General Fund.



The Steese Highway bisects the study area from approximately highway miles 66 to 85. Good access from the highway, placer mining roads, and a few trails, in addition to nearby power from the high-voltage power lines of Fort Knox gold mine 25 miles to the southwest, would facilitate mineral development. The map area is within a northeast-oriented trend of plutonic-related gold mineralization between the central and southwestern Fairbanks and the Circle mining districts. The Fairbanks mining district has the largest historic gold production in Alaska, with slightly less than 12.3 million troy ounces of gold produced as of 2006. Three placer mines (two active) and one lode gold prospect occur within the map area. Placer gold is spatially associated with monzogranite and quartz monzonite plugs, dikes, and sills. The distribution of pay streaks in the placers and paucity of mineralization in the intrusions suggest that some of the gold may be structurally controlled. In 2007, DGGS identified arsenopyrite–pyrite–quartz veins and boxworks and semi-massive stibnite–quartz veins proximal to the intrusive rocks.

View of the Faith Creek gold placer, looking north.

In addition to geologic mapping, DGGS conducted a rock and stream sediment geochemical study to assist Alaska's Division of Mining, Land & Water in determining whether the proposed Mount Ryan Remote Recreational Cabin Sites Staking Area should be opened to settlement and closed to mineral exploration and development. Knowledge of the area's mineral potential is crucial to the decision on whether or not to retain the land for subsurface use. These geochemical data will be published in December 2007.



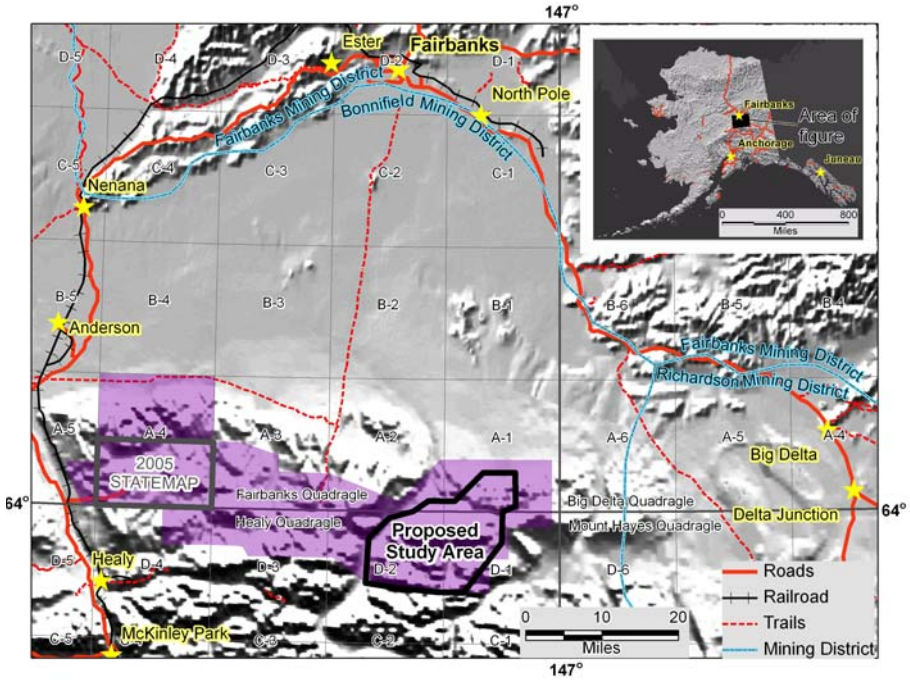
Study area outlined in black. Black lines are faults.

DGGS's geologic mapping, which incorporates interpretations of geophysical data, will provide: (1) a better understanding of the lithologic, metamorphic, and tectonic framework of Interior Alaska, (2) baseline geologic-materials and hazards data for future 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) geologic knowledge that will encourage mineral exploration investment in the northern section of the Fairbanks mining district. A series of 1:50,000-scale geologic maps and associated scientific studies for this project will be completed by fall 2008.

Contact: Jennifer E. Athey, 907-451-5028, jennifer.athey@alaska.gov

AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: GEOLOGIC MAPPING IN THE EASTERN BONNIFIELD GEOPHYSICAL TRACT

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



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.

The eastern Bonnifield map area is 60 miles south of Fairbanks in the northern foothills of the Alaska Range. The map area contains significant mineral occurrences, most notably the WTF and Dry Creek VMS prospects, which contain drill-inferred resources of Cu, Pb, Zn, Ag, and Au. Lithologic and structural relationships and interpretations depicted on existing, 50-year-old published geologic maps are not supported by recent investigations. Additionally, DGGS's preliminary interpretations of the Bonnifield airborne geophysical data indicate lineaments (potential faults) and other lithologic features that are not depicted on the existing maps.

The primary objective of the eastern Bonnifield project is to map the geology in sufficient detail to facilitate wise land-use decisions and to guide mineral industry exploration efforts. Geologic maps and data produced by this project will also serve as a framework for further scientific studies and increased regional understanding of this tectonically active area, which is about 25 miles north of the Denali Fault system. Should mineral development occur, surficial and engineering geologic data generated by this project will be useful for mine site and access planning. Surficial and bedrock map data are also necessary for the identification of potential construction-material sites, and assessing geologic hazard risks to nearby infrastructure and settlements.

Mineral companies are showing renewed interest in exploration for volcanogenic massive sulfide deposits; exploration activity in Alaska is at an all-time high. Because economic development could potentially come into conflict with other land uses, the availability of detailed geologic, resource, and hazard assessments is important for long-range planning. Providing a basic geologic framework and an inventory of potentially mineralized areas will help State and local planners balance the need for resource development versus other land management strategies.

Contact: Larry K Freeman, 907-451-5027, larry.freeman@alaska.gov

BEDROCK GEOLOGY AND MINERAL RESOURCES ALONG THE PROPOSED GAS PIPELINE CORRIDOR FROM DELTA JUNCTION TO THE CANADA 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 or Alaska Railroad extension is constructed along this route. Despite the corridor's strategic location, relatively little geologic and geotechnical work has been published along its length. This multiyear project, supported by state Capital Improvement Project (CIP) funds, will provide a framework of geologic data upon which engineering and design decisions may be evaluated for future development between Delta Junction and the Canadian border. DGGS benefits from recent airborne geophysical surveys, as well as modern satellite and aerial imagery, digital elevation modeling, and analytical techniques to facilitate more-detailed mapping than has been previously available.

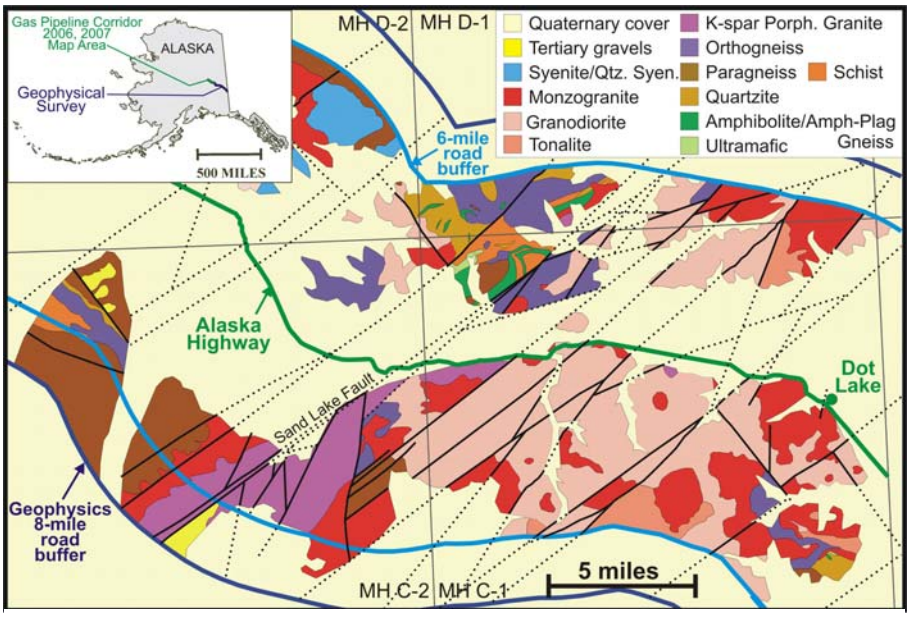


Figure 1. Preliminary generalized bedrock geologic map of 2006-2007 map area. Summer 2008 mapping will continue along the Alaska Highway corridor from Dot Lake to Tetlin Junction.

Collecting, interpreting, and publishing airborne geophysical data in 2006 completed 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 resources. DGGS conducted geologic field work between Delta Junction and Dot Lake during the summers of 2006 and 2007, mapping at a scale of 1:63,360. DGGS's bedrock mapping incorporates interpretations of airborne magnetic and resistivity data; it is particularly valuable for extrapolating geology in areas of extensive surficial cover or vegetation. Our geologic mapping defines at least two plutonic rock suites that intruded metasedimentary and metaplutonic rocks similar to those farther north in the Yukon–Tanana Uplands. One intrusive suite includes typical calc-alkaline monzogranite, granodiorite, and tonalite. The other ranges from syenite to monzogranite. Continuing analytical work will further establish the relationship between these rock types. Preliminary biotite and hornblende $^{40}Ar/^{39}Ar$ plateau ages on plutonic rocks range from about 93 to 103 million years. Additional age data and interpretation will provide a better understanding of the timing of intrusive events and possibly offer constraints on timing of tectonic activity. The broad range of topics covered by this project is contributing to our regional geologic understanding of this important transect through a major geologic and topographic break along the Tanana River valley.

DGGS is evaluating the mineral potential of bedrock units by sampling altered rocks and analyzing them to provide baseline data for mineral exploration companies. Major and minor oxide and trace-element geochemical analyses on representative plutonic and metamorphic samples will be published by January 2008. We anticipate publication of the bedrock geologic map for this segment in fall 2008. Funding for the Delta Junction to Dot Lake segment of mapping consists of remaining FY2005 supplemental funding and FY2007 CIP funding, augmented by federal STATEMAP funding. Continued bedrock mapping and mineral resource evaluation from Dot Lake to Tetlin Junction will be supported by FY2008 CIP funding.

Contact: Diana Solie, 907-451-5006, diana.solie@alaska.gov, or
Melanie Werdon, 907-451-5082, melanie.werdon@alaska.gov

FORTYMILE AREA AIRBORNE GEOPHYSICAL PROJECT, EAST-CENTRAL ALASKA

The U.S. Bureau of Land Management (BLM) and the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted an airborne geophysical survey for about 240 square miles of the western Fortymile mining district, east-central Alaska (figure 1). The survey was funded by the BLM through a cooperative agreement with DGGS in support of DGGS's statewide airborne geophysical survey program. The objective of the Fortymile survey is to expand the geophysical database available to government agencies and the public in the interest of evaluating the mineral potential of this area. This survey will contribute significant data on mineral-resource potential for BLM's upcoming land-use plan. These data will aid in providing timely information to policy makers, the resource industry, and the public regarding potential mineral deposits in the area.

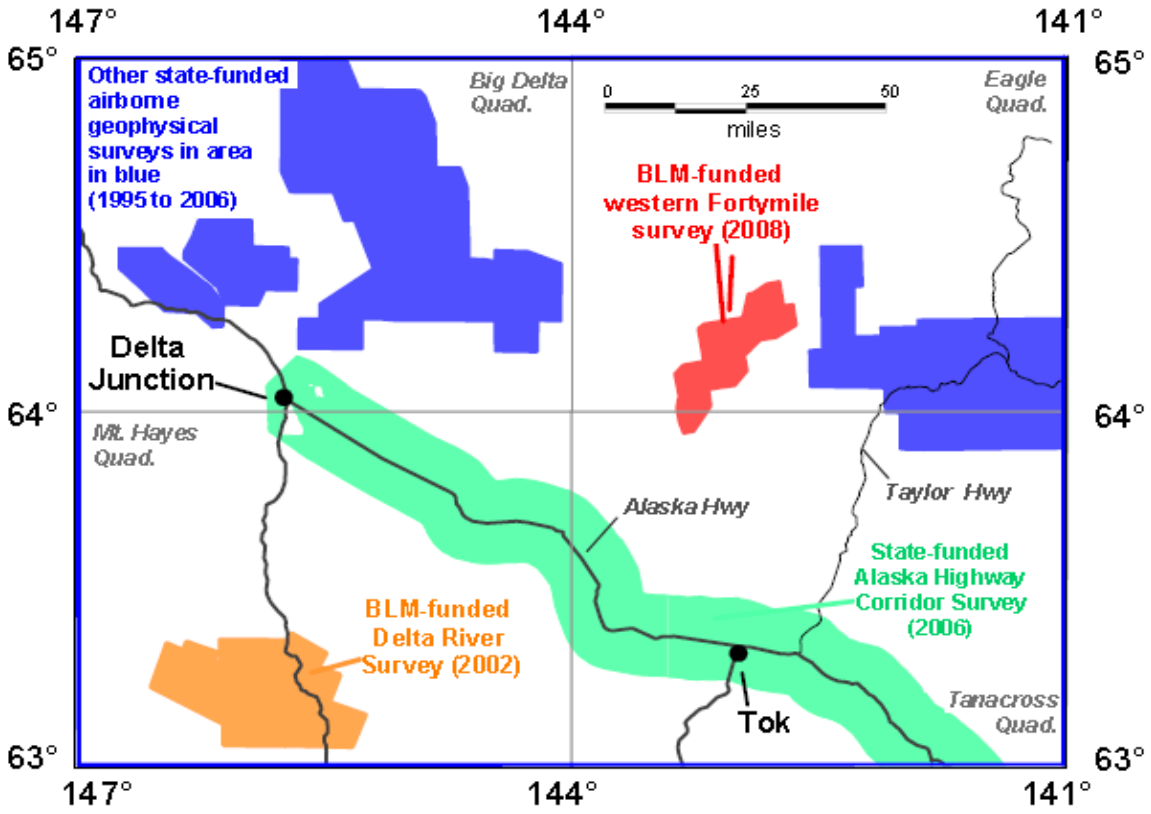


Figure 1. General location of the survey area with respect to major towns, roads, and previously surveyed areas.

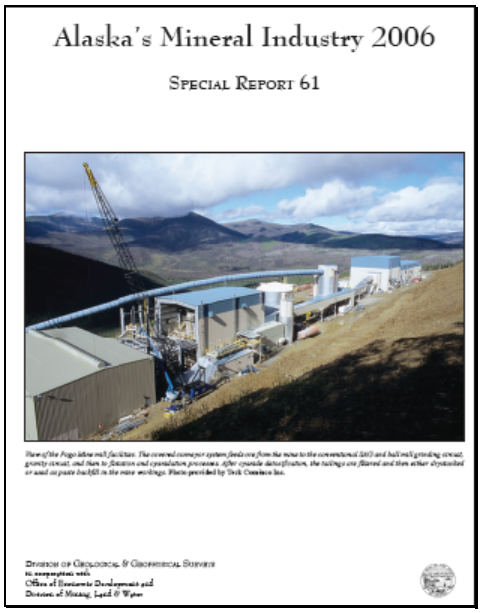
The western Fortymile survey tract contains at least ten known mineral occurrences. These occurrences are scattered throughout the tract and contain such commodities as lead, zinc, silver, copper, and gold. Most of the prospects, if not all, are related to igneous intrusions in the area. Major deposit types are thought to include copper skarns, lead–zinc skarns and replacement bodies, and intrusive-related gold prospects, among others.

This project is the eighth and possibly final cooperative BLM–DGGS airborne geophysical project since 1995. The role of DGGS in these BLM-funded projects is to contract and monitor geophysical data acquisition and processing, and to release the geophysical data to the public. Acquisition of aeromagnetic and electromagnetic data for the western Fortymile survey tract was completed by mid-October 2007 by Stevens Exploration Management Corp., which subcontracted Fugro Airborne Surveys. The maps and digital data will be released to the public in early 2008.

The BLM geophysical projects have been funded by the Minerals Branch of BLM, and because the branch was closed in 2007, additional joint airborne geophysical projects are not expected. The BLM airborne geophysical programs were similar to the geophysical portion of the Alaska Airborne Geophysical/Geological Mineral Inventory program funded by the State of Alaska, but tended to concentrate on Federal and Native lands instead of State and Native lands.

Contact Laurel E. Burns, 907-451-5021, laurel.burns@alaska.gov

ANNUAL ALASKA MINERAL INDUSTRY REPORT



Alaska Statute 41.08 charges the Division of Geological & Geophysical Surveys (DGGS) *"to determine the potential of Alaska land for production of metals, minerals, fuels, and geothermal resources; 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 Alaska's mineral industry, and fosters a better understanding of the significance of the mineral industry to Alaska's private sector and government.

The annual Alaska mineral industry report is a key source of information about exploration, development, and production of Alaska's mineral resources. Statewide and international circulation of the report and its findings at professional mineral industry conventions and trade shows, at 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 rely on the report as an essential tool in formulating public policy affecting resource and land management.

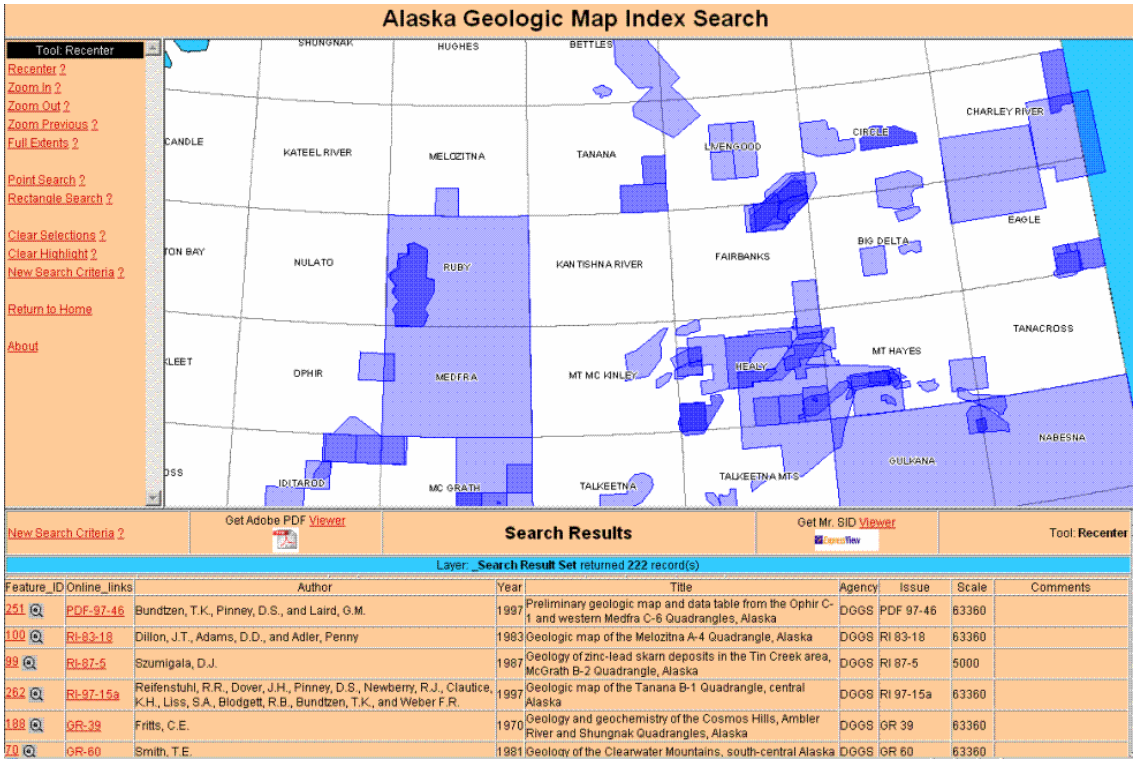
The 2006 Alaska mineral industry report released in November 2007 summarizes information provided through replies to questionnaires mailed by DGGS, phone interviews, press releases, and other information sources. The 2006 cumulative value of Alaska's mineral industry (calculated as the sum of exploration expense, development expense, and production value) was $3.533 billion, a new record value. This is the first year that the cumulative value topped $2 billion, and follows ten straight years during which Alaska's mineral industry exceeded $1 billion. Exploration expenditures for 2006 were $178.9 million, the highest expenditure total over 50 years of record keeping; development expenditures amounted to $495.7 million, the highest total since records were kept in 1981; and the value of mineral production was $2,858.2 million, also a new record and more than double last year's value. The Alaska mineral industry will likely post new records in 2007 due to continued high commodity prices.

The annual report has been published for 26 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 2007 Alaska mineral industry activities will be released by February 2008. The 2007 Alaska mineral industry report will be released by early November 2008.

Contact: David J. Szumigala, 907-451-5025, david.szumigala@alaska.gov

ALASKA GEOLOGICAL 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 a Web application that will portray the locations of geologic maps from all government agencies in a single, interactive, Internet-accessible location. The "Alaska Geology Map Index" site http://maps.akgeology.info/ was made accessible to the public in early 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 August, 2008. DNR's Land Records Information Section (LRIS) will then modify the interface for the "Alaska Geology Map Index" website to enable users to refine the searches. When that modification is completed, DGGS will add outlines for remaining geologic maps by DGGS, USGS, U.S. Bureau of Mines, and U.S. Bureau of Land Management and geophysical maps by DGGS and other agencies during FY09.



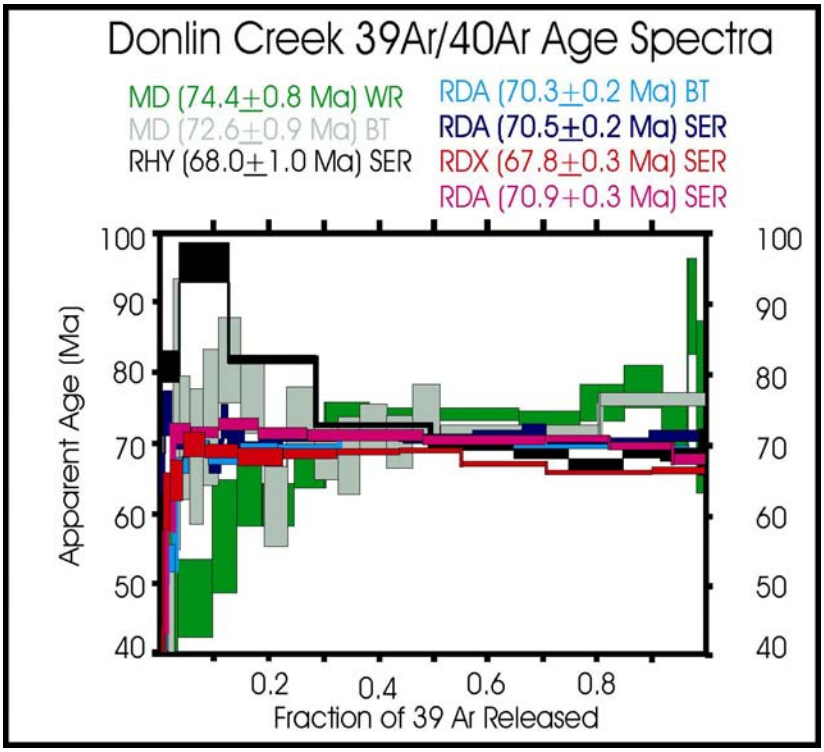
Feature_ID	Online_links	Author	Year	Title	Agency	Issue	Scale	Comments
251	PDF-97-46	Bundtzen, T.K., Pinney, D.S., and Laird, G.M.	1997	Preliminary geologic map and data table from the Ophir C-1 and western Medfra C-6 Quadrangles, Alaska	DGGS	PDF 97-46	63360	
100	RI-83-18	Dillon, J.T., Adams, D.D., and 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 map index of DGGS, USGS, U.S. Bureau of Land Management (BLM), and U.S. Bureau of Mines (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 federal Minerals Data and Information Rescue in Alaska (MDIRA) program. The primary objective of the MDIRA program is to ensure that all Alaska mineral data are preserved in a safe and readily accessible format for all potential users.

Besides allowing searching by rectangle or by point, 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 web-site (http://www.dggs.dnr.state.ak.us) will be provided when they have been included in 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 retrieved by the user through another associated Web page.

Contact: Laurel E. Burns, 907-451-5021, laurel.burns@alaska.gov

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 available 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 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, more than 4,925 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 website 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 2008. The completed database will reside in DGGS's Oracle database, which will serve as a repository for future radiometric data.

Contact: Melanie B. Werdon, (907) 451-5082, melanie.werdon@alaska.gov

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 and Information Rescue in Alaska (MDIRA) project. DGGS has maps, files, and unpublished reports from about 40 years of field work and office projects to be 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. Several UAF engineering students have been employed by UAF at various times during the past several years for this project; two DGGS staff and two UAF geological engineering students 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. data and other collections.

DGGS has boxes, file cabinets, and large flat-file drawers 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 legacy files 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 general information 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 via 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 more than 8,800 historic thin sections has also been completed. All minerals-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.

Contact: David J. Szumigala, 907-451-5025, david.szumigala@alaska.gov

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 past century, but placer production has been in decline in recent decades. In the interest of encouraging new opportunities for development in the Council area, the State of Alaska is updating its inventory of the geologic resources to guide planning activities and identify key features of potential interest for minerals and construction materials. In 2004, with federal STATEMAP support from the U.S. Geological Survey, the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted 1:50,000-scale geologic mapping in the Big Hurrah and Council areas (figure 1; other aspects of the project described separately). In 2006, we completed field work to extend this mapping into the Casadepaga River–Bluff area.

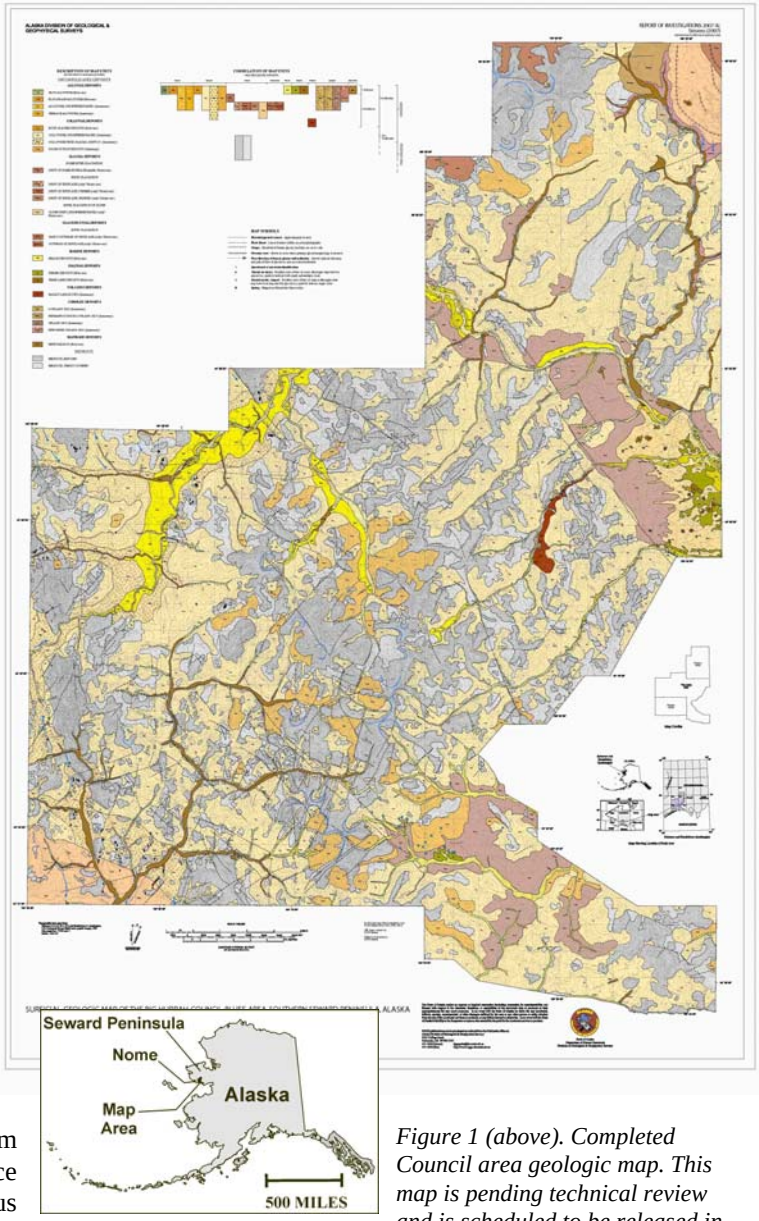


Figure 1 (above). Completed Council area geologic map. This map is pending technical review and is scheduled to be released in spring 2008.

DGGS's Engineering Geology section 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. Surficial 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 appears throughout the western part of the study area in the form of scattered erratic cobbles and boulders on slopes and ridges. Prominent gravel-topped terraces up to 16 meters thick are preserved along the Casadepaga River and may be related to higher sea level or damming by glacial ice. Carbonate-cemented, shell-bearing beach gravels perched 7 meters above modern sea level along the coast west of Bluff provide evidence of ancient higher sea levels around 118,000–125,000 years ago during the interglacial Pelukian transgression.

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 pending technical review and are scheduled to be completed and released in spring 2008. 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 website upon completion of the project.

Contact: DeAnne S.P. Stevens, 907-451-5014, deanne.stevens@alaska.gov

SURFICIAL GEOLOGY OF THE NORTHERN FAIRBANKS MINING DISTRICT, CIRCLE QUADRANGLE, NORTHEAST FAIRBANKS GEOPHYSICAL SURVEY TRACT

In the summer of 2007, the Division of Geological & Geophysical Surveys (DGGS) conducted about 189 square miles of geologic mapping northeast of Fairbanks, covering the central portion of DGGS's 404-square-mile Northeast Fairbanks airborne magnetic and electromagnetic geophysical survey area. The mapping project is primarily funded by DGGS's Airborne Geophysical/Geological Mineral Inventory program, a special multi-year capital-project 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. Other funding sources include the U.S. Geological Survey's STATEMAP program and the State's General Fund.

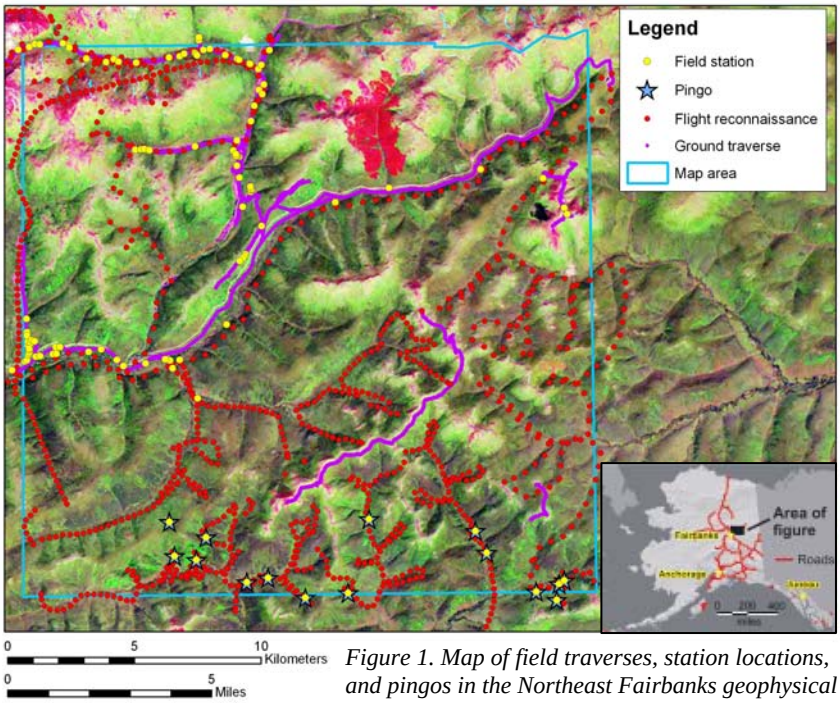


Figure 1. Map of field traverses, station locations, and pingos in the Northeast Fairbanks geophysical tract. Base map is Landsat satellite image.

The Engineering Geology section of DGGS is mapping the surficial geology of the area to understand the genesis of the landscape in which placer gold deposits have accumulated (fig. 1). Glacial deposits are prominent in the northwest portion of the field area, where large granite erratics can be traced many kilometers downvalley from sources in the high peaks of the Mt. Prindle area (fig. 2a). Extensive gravel-capped, high-level terraces are preserved along Chatanika River, and extend upvalley into the lower reaches of major tributary streams in the western portion of the field area. Thin lags of rounded fluvial cobbles are draped on discontinuous remnants of these high-level terraces as far as 10 kilometers upstream in Faith Creek (fig. 2b). Silt-dominated deposits characterized by numerous pingos predominate in the southern part of the study area (fig. 1).

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 2008 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 the Worldwide Web upon completion of the project. Past experience has shown that a thorough understanding of the geologic framework of an area acts as a catalyst for resource development and paves the way for future exploration. We anticipate a similar result in the Northeast Fairbanks geophysical tract.

Figure 2. Surficial deposits in the Northeast Fairbanks geophysical tract. A) 2-m granitic erratic in placer workings on Hope Creek. B) Rounded quartzite cobble and angular bedrock rubble on subtle bench above Faith Creek. Scattered rounded cobbles like this are found at elevations of almost 100 m above modern stream level and are remnants of ancient stream terraces.

Contact: De Anne S.P. Stevens, 907-451-5014, deanne.stevens@alaska.gov

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. The purpose of MapTEACH is to develop a field-geoscience outreach program for middle- and high-school students and teachers 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. Working directly with DGGS geologists, participants are taught 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. High school students from the Nenana Living Center use handheld GPS units to document the location of the Nenana cemetery during a MapTEACH field trip with local Elder Moses Paul. One of the reasons the cemetery was moved to the current location is because of a landslide at the original site.

The project is founded on the integration of three focus areas: Geoscience, geospatial technology, and local landscape knowledge. We are designing program materials 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 interact in field settings with Native Elders, traditions-based community leaders, and professional geologists from DGGS (figure 1).

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

Figure 2. Teachers on a Tanana River field trip during the 2007 teacher training course. Participants came from Anchorage, Fairbanks, Hooper Bay, Nikolai, Cantwell, Anderson, and Juneau.

MapTEACH held a successful pilot session in Nenana with high school students, predominantly Alaska Natives, during February–March 2007, and a teacher-training session in Fairbanks during July–August 2007 (figure 2). Selected students from a prior pilot at Effie Kokrine Charter School in Fairbanks presented their final projects at the annual meeting of the California Geographical Society in Borrego Springs, California, and a group of students from the Nenana pilot presented their final projects at the Alaska Surveying and Mapping Conference in Fairbanks.

DGGS was awarded supplemental NSF funding to meet immediate project goals to follow up with teachers and publish a fully edited and distribution-ready curriculum in early 2008. Upon completion of the current NSF-funded stage of the project, MapTEACH will be transferred to the University of Alaska Integrated Geography Program, which is embracing it as their "flagship K-12 outreach program." There are ample opportunities for possible continued participation by DGGS as MapTEACH grows.

Contact: De Anne S.P. Stevens, 907-451-5014, deanne.stevens@alaska.gov

ALASKA COASTAL MANAGEMENT PROGRAM: NATURAL HAZARDS

DGGS provides support to Alaska Coastal Management Program (ACMP) personnel and coastal district planners regarding natural hazard issues. DGGS responsibilities include: Reviewing natural hazard aspects of proposed coastal projects during the consistency review process; recommending state designation of hazard areas during consistency reviews when needed; 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.

The DGGS website provides access to a Natural Hazards Bibliographic Database for Alaskan Coastal Districts, including links to scanned DGGS and USGS publications containing information relevant to hazard identification. 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.

A lack of basic field data and baseline information on geologic hazards in Alaska makes it difficult for coastal districts and the State to implement the revised ACMP natural hazard standard (11 AAC 112.210). Coastal districts often do not have the scientific information needed to designate natural hazard areas in their district plans for the purpose of ensuring that coastal development adequately mitigates the risks of the hazards. During consistency review for a proposed project, the State can, under the standard, designate a natural hazard area so that hazards risks may be addressed in the review. DGGS assists DNR in development of the background information and formal designation of the hazard area. In late 2007, DGGS helped develop one of the first of these area designations in conjunction with consistency review of an erosion control project at Kivalina (see below).

Aerial photographs of Kivalina, Alaska, showing coastal changes between 1966 and 2000.

Contact: Rod Combellick, 907-451-5007, rod.combellick@alaska.gov

GEOLOGIC HAZARDS, SURFICIAL GEOLOGY, AND MATERIALS RESOURCES ALONG THE PROPOSED GAS PIPELINE CORRIDOR, 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 or Alaska Railroad extension is constructed along this route. Despite the corridor's strategic location, relatively little geologic and geotechnical work has been published along its length. This multi-year project, supported by state Capital Improvement Project (CIP) funds, will provide a framework of geologic data upon which engineering and design decisions may be evaluated for future development between Delta Junction and the Canadian border. DGGS benefits from recent airborne geophysical surveys, as well as modern satellite and aerial imagery, digital elevation modeling, and analytical techniques to provide more-detailed mapping than has been previously available.

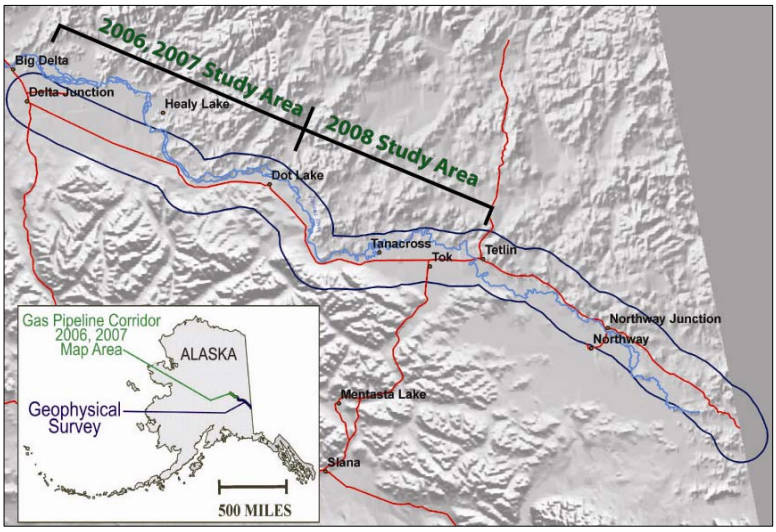


Figure 1. The proposed gas pipeline project follows a 12-mile-wide swath along the Alaska Highway. The FY08 field area will be between Dot Lake and Tetlin Junction.

The Denali Fault, which ruptured most recently in a November 2002, magnitude 7.9 earthquake, is only about 25 miles south of the project area. On the basis of airborne geophysics, we expect that major structural breaks in the rocks cross the corridor and pose potential risk to infrastructure. One goal of this project is to identify these faults in the field and, where possible, evaluate their potential for activity on the basis of observed geologic features. In 2007 DGGS dug and logged several trenches to determine whether recent surface deposits have been offset by fault movement. Our observations demonstrate fault offset within the last 10,000 years in at least three locations in and near the corridor. By geologic and engineering convention, faults showing evidence of offset during the past 10,000 years are considered active. Trenching will continue in the 2008 study area.

Figure 2. Billy Creek fault trench showing evidence for apparent high-angle faulting within the last 10,000 years.

We are also evaluating the potential for permafrost in the soil using 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 flooding.

DGGS completed 1:63,360-scale surficial-geologic mapping in 2007 from Delta Junction to Dot Lake. We anticipate publication of this surficial-geologic map in summer 2008. FY2008 CIP funding allows continuation of this project from Dot Lake to Tetlin Junction.

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 that describe the basic engineering properties to be expected from the surficial deposits and their potential as construction materials.

Contact: Diana Solie, 907-451-5006, diana.solie@alaska.gov

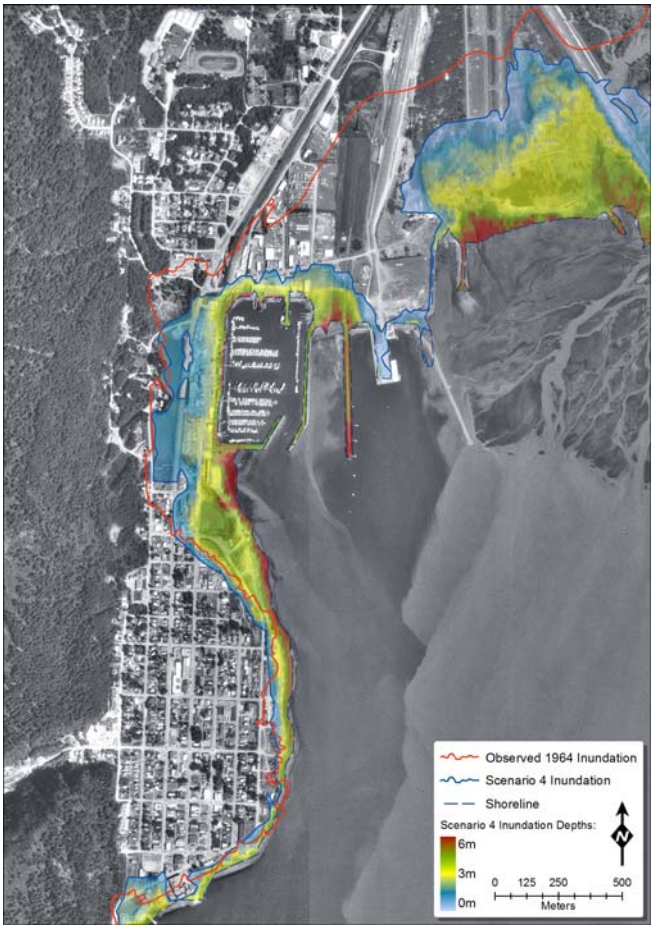
TSUNAMI INUNDATION MAPPING FOR ALASKA COASTAL COMMUNITIES

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 and UAGI develop 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 June 30, 2008. 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, 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, Seattle, Washington, and Hania, Greece, at the Tsunami Society symposium in Honolulu, Hawaii, at the International Union of Geodesy and Geophysics Symposium in Perugia, Italy, and at the American Geophysical Union annual meetings in 2003 through 2007. In addition, this project has been the subject of articles in *Geotimes* and *TsuInfo Alert Newsletter.*



Draft inundation map for a hypothetical submarine landslide-generated tsunami at Seward.

Contact: Rod Combellick, 907-451-5007, rod.combellick@alaska.gov

ALASKA VOLCANO OBSERVATORY: GeoDIVA DATABASE

GeoDIVA: Volcanology section staff designs, populates, and distributes 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 (those that have erupted in approximately the past 2 million years) 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 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.

Module	Status	Notes
Bibliography	Complete through 2006	Will be updated yearly to include new publications—fully searchable.
Basic volcano information	Complete	137 major and 197 minor volcanic features in Alaska: 54 historically active volcanoes (using newly refined definition)
Eruption history information	Complete through mid 2007	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. Images from previous years, as well as current photographs are being added.
Sample information	Structure complete—data loading in progress	Currently contains information for ~3,000 samples. Published sample information, as well as newly-collected samples are being added.
Geochemistry	Structure complete—data loading in progress	Geochemistry data loaded for more than 1,200 samples (~45,000 records). Currently adding analyses from published sources.
Petrology	Structure complete—data generation and loading in progress	Planned arc-wide thin section images and descriptions. ~50 Augustine thin sections with 1,000 point counts complete.
Hand sample storage	Structure complete	Sample cataloging in progress. Fairbanks storage 80% complete.
FieldDIVA	Beta phase	Mini-GeoDIVA for field use. (No field work done in summer 2007.)
GIS data	Needs analysis complete, hardware/software tools selected	Currently constructing database tables to hold metadata and testing hardware/software tools. See text for more information.
Geochronology	Planned for FY08	Arc-wide age dates and references, including radiocarbon dates.

Our current in-development module will archive and distribute AVO's geospatial data, including geologic maps, topographic bases, satellite data and other georeferenced vector and raster data. In 2007, we defined our users' needs and expectations, researched and tested available software and hardware solutions, and began data-table construction. This module has several planned steps: (1) internal organization, inventory, upload, storage, and retrieval of AVO GIS data; (2) dissemination of the data via the web—first to internal users and then to the public; (3) eventually, develop geospatial query capability (map interface) to both our internal and our public websites.

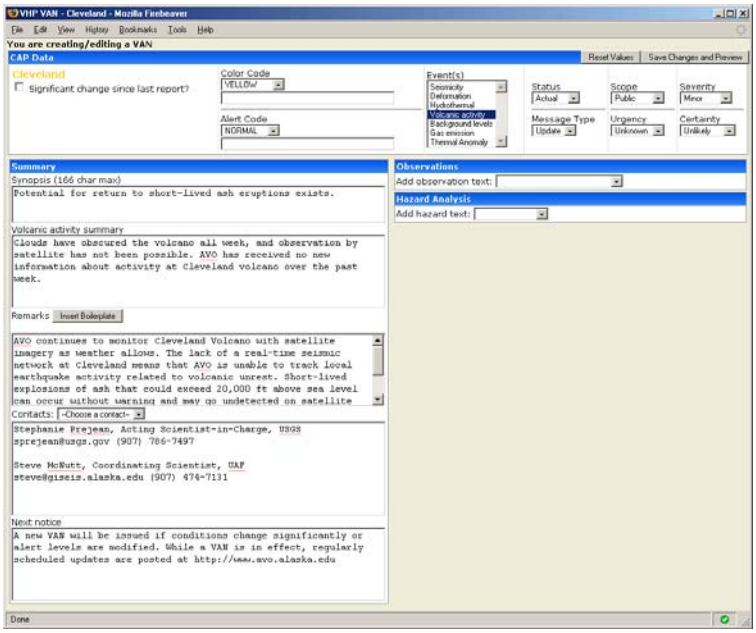
We have selected open-source software (MySQL, postgreSQL, postGIS, GeoServer, TileCache, and OpenLayers) which significantly reduces our costs (initial and maintenance), allows complete access to all of our member agencies, permits storage of proprietary and unpublished data, and allows us to utilize strategies and structures already developed by the DGGS database team.

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.

Cheryl Cameron, 907-451-5012, cheryl.cameron@alaska.gov

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. It is among the top ten USGS and USGS-affiliated websites 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 coding, graphics manipulation, and most of the design.



Web application for creating and releasing VAN and VONA statements to emergency-management agencies and others (see text). Data and information are input using this web-based form, collected in a database, and automatically parsed and formatted for distribution via email, FAX, internet, pager, telephone, RSS feed, etc.

In addition to serving as the primary source for detailed information on all volcanoes in Alaska, the website manages distribution of emergency-management communications such as status reports and information updates to appropriate and interested agencies, commercial groups, and interested citizens. During explosive eruptions, communication with commercial and government entities in the aviation sector is important.

As part of the National Volcano Early Warning System initiative, the national volcano-monitoring community has been working to standardize official information-release formats. Two new formatted updates have resulted: the VAN (Volcano Activity Notification), and VONA (Volcano Observatory Notice for Aviation). AVO is the test case for using these formats, and DGGS has created the database structure and web application to create these information statements. As the other U.S. volcano observatories adopt this standard for releasing information, DGGS will serve as the primary contact for installing the application and database subsystem, as well as future upgrades to the system.

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 website 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. DGGS continually refines and enhances the applications that AVO and other observatories use on a regular basis. We will focus on continual incremental improvements to the site, and serving new database modules as they become available.

Seth Snedigar, 907-451-5033, seth.snedigar@alaska.gov

ALASKA VOLCANO OBSERVATORY: Chiginagak Volcano
Volcanic Event Response, Geologic Mapping, and Hazard Assessment

Investigation of persistent environmental damage from the 2005 crater lake formation, lahar, acidic flood, and acidic aerosol emission. Mount Chiginagak is a hydrothermally active volcano on the Alaska Peninsula, approximately 170 kilometers (100 miles) south–southwest of King Salmon. Sometime between November 2004 and May 2005, a 400-meter-wide (1,312-foot-wide), 100-meter-deep (328-foot-deep) crater lake developed in the formerly snow- and-ice-filled crater of the volcano. In early May 2005, an estimated 3 million cubic meters (106 million cubic feet) 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 (17 miles) downstream, the acidic waters of the flood reached approximately 1.3 meters (4 feet) above current water levels and inundated an important salmon spawning drainage, acidifying Mother Goose Lake from surface to depth (pH of 2.90 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. As of August 2007, the persistently high 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, in cooperation with Northern Arizona University lake core specialists, cored the bottom sediments of Mother Goose Lake 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.

Top: The lake core team sets anchors at Mother Goose Lake in preparation for bottom sediment sampling. Mount Chiginagak, the source of the 2005 acidic flood, looms in the background. Bottom: Northern Arizona University professor Rod Parnell (left) and graduate student Chris Kassel (right) analyze Mother Goose Lake water samples for iron using a portable spectrophotometer. Photos by Kristi Wallace, USGS.

Geologic Mapping and Volcano Hazard Assessment. The DGGS-led geologic mapping and hazard assessment work that began in 2004 will be completed during the 2008 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 pace of completion of the mapping study has been slowed both by lean budget years and by the need to respond to the unanticipated flood and flowage event described here.

Products: A report describing the initial results and observations of the acid flood and acidic aerosol release has been submitted to a peer-reviewed journal, the *Journal of Volcanology and Geothermal Research;* additional publications in peer-reviewed scientific journals will follow, with timing of publication dependent on the outcome of pending analytical results. A geologic map and volcano hazard assessment are scheduled to be published by DGGS in 2008.

Janet Schaefer, 907-451-5005, janet.schaefer@alaska.gov

ALASKA VOLCANO OBSERVATORY: Fourpeaked Volcano Eruption Response and Geologic Investigations

2006 Eruption of Fourpeaked Volcano. On September 17, 2006, Fourpeaked volcano, located at the northeastern end of the Alaska Peninsula, produced a plume of steam, ash, and SO_2 ($+CO_2$) gas that rose to 20,000 feet (6,000 meters) above sea level (figure 1). The plume was observed by eyewitnesses and recorded by weather radar and SO_2-sensitive satellite imagery. Prior to this event, Fourpeaked was not known to have been active within the past 10,000 years.

Air and ground reconnaissance by DGGS and USGS geologists revealed a linear series of vents in the summit glacier, stretching about 0.6 mile (1 kilometer) down the north flank of the volcano. The geologic response, co-led by DGGS, documented that debris flows, extending many kilometers north from the summit ice cap, contained hydrothermally altered volcanic clasts that included kaolinite and pyrite in quartz, and native sulfur, mixed with ice and boulders up to 16 feet (5 meters) in diameter. Ash collected from the glacier surface contained crystal fragments, pyrite in quartz, and dense rock particles. Neither the ash nor the debris show evidence of fresh magma, and the pyrite in quartz and kaolinite suggest the clasts are wallrock fragments that had undergone low-temperature, acid alteration rather than pyrite precipitated by a sulfur-rich magmatic plume. By mid 2007, steam-vent activity had decreased, SO_2 levels by more than 90%, and seismic swarms were replaced by scattered earthquake activity. Steam plumes continue, but all have been far smaller than the plume that occurred at the onset of the eruption.

Geologic Field Response. The eruption response was co-led by DGGS volcanology staff and included field visits to sample and map the debris flow and ash deposits produced in the event, as well as field-checking surrounding areas for other young deposits from Fourpeaked volcano that could have been previously overlooked. No volcanic deposits of Holocene or younger age (past ~10,000 years) were identified.

Conclusions. The high SO_2 emissions indicate magmatic gas was released from Fourpeaked, suggesting magma at a relatively shallow depth. However, the lack of juvenile material, and of any erupted lava this year indicates that the source magma was unable to rise to the surface.

A. B.

C.

D.

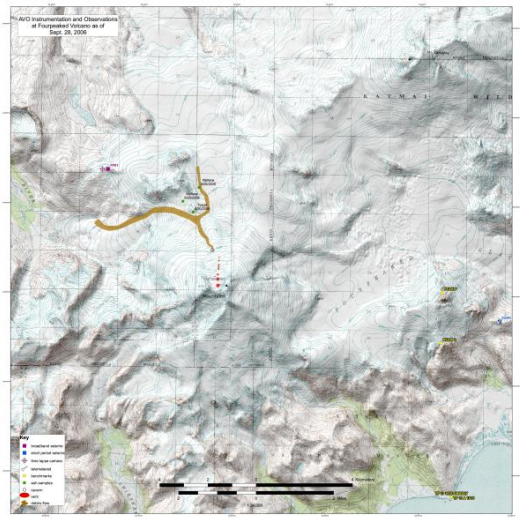


Figure 1. Fourpeaked volcano. A. Location map. B, C. Plumes rise from Fourpeaked volcano in September 2006. D. Topographic map showing craters (red) and debris flow paths (brown). Figure courtesy of K. Wallace, AVO-USGS.

Products: Results from volcano monitoring and field observations, including DGGS contributions, was presented as a poster by USGS–AVO colleagues at the American Geophysical Union conference in December 2007. An additional report in a peer-reviewed publication will follow.

Katharine Bull, 907-451-5055, katharine.bull@alaska.gov

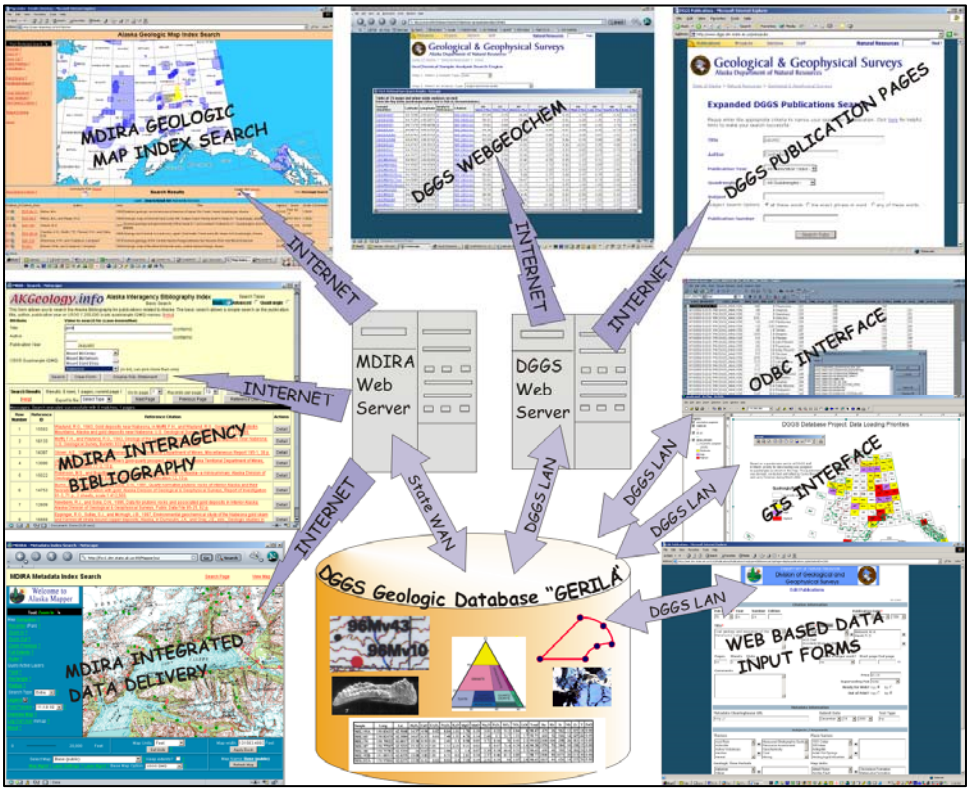
DIGITAL GEOLOGIC DATABASE PROJECT

In 2000, the Alaska Division of Geological & Geophysical Surveys (DGGS) initiated development of a geologic database system that provides the architecture for consistent data input and organization. The database system includes data identification and retrieval functions that guide and encourage users to access geologic data online. This project was initially part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program; ongoing data input, use, and maintenance of the database system are now part of DGGS's normal operations.

The Digital Geologic Database Project has three primary objectives. The first established a spatially referenced geologic database system in a secure, centralized information architecture with networked data access for new and legacy DGGS geologic data. The second objective created a functional online 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. The third objective integrated DGGS's minerals-related data with data from other agencies through the MDIRA website, http://akgeology.info.

During the first seven years, the project work group identified geologic data for inclusion in the database, established a secure and stable database structure, and started loading data into the database. As a result, the public can access DGGS and USGS reports and maps, and DGGS project digital data through a search page on the DGGS website http://www.dggs.dnr.state.ak.us/pubs and access DGGS geochemical data though a search engine http://www.dggs.dnr.state.ak.us/WebGeoChem. Users can search for DGGS reports and maps, along with geology and minerals reports from other agencies, through an integrated bibliography on the AKGeology.info website http://bib.akgeology.info.

During 2008, the project team will be supporting ongoing DGGS MDIRA projects by extending the DGGS database, and designing web-based search engines for the Alaska Geologic Map Index, and Geologic Materials Center. The team will also load geochronological and geochemical data, legacy data and map archive index, and geologic map index information into the database, and will work to integrate DGGS data with other datasets on the MDIRA website http://akgeology.info.



Contact: Larry Freeman, 907-451-5027, larry.freeman@alaska.gov

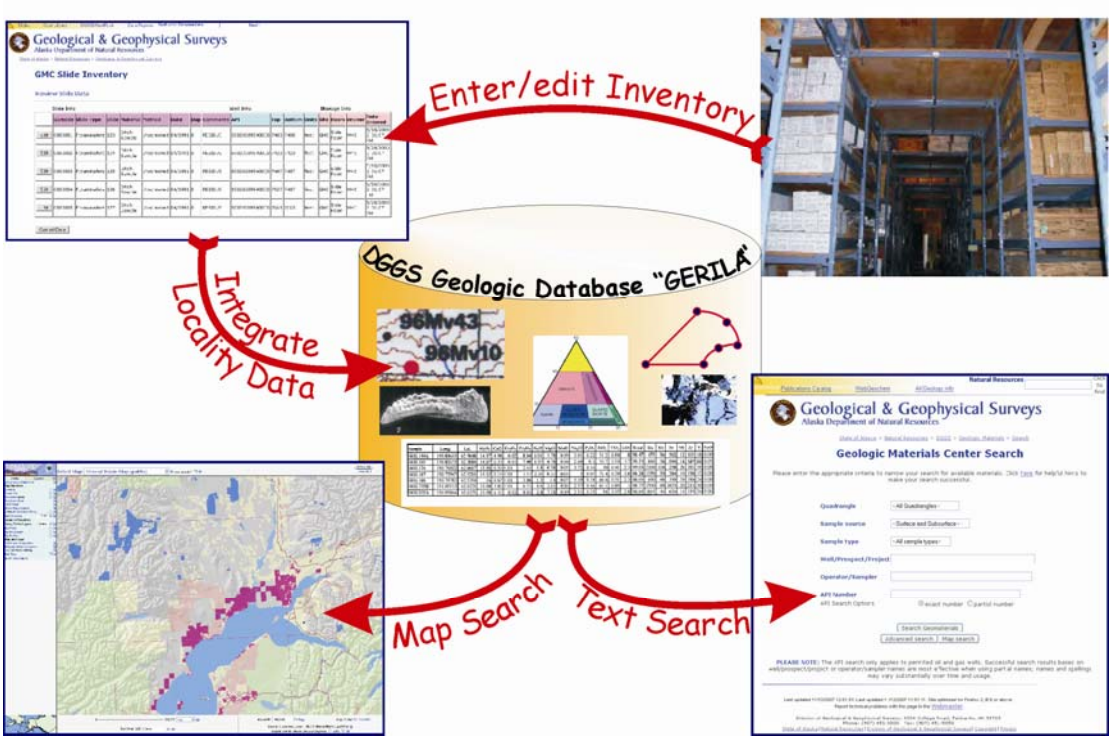
GEOLOGIC MATERIALS CENTER ONLINE SAMPLE CATALOG

The Alaska Geologic Materials Center (GMC) is the central repository in which geologic samples collected throughout Alaska are cataloged, stored, and studied. This archive facility holds geologic sample materials from a multitude of sources including government agencies, mineral companies, and oil and gas companies. For more details on the holdings at the GMC, please see the web page www.dggs.dnr.state.ak.us/?link=gmc_overview&menu_link=gmc. As part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) project, DGGS is overseeing the development of a new rock sample and hard rock drill core inventory system for the materials housed at the GMC.

The ultimate goal of the GMC on-line catalog component is to provide a secure, reliable catalog of the geologic materials held by the GMC and to provide public users with tools for searching for the appropriate materials and to assess their availability and condition prior to traveling to the GMC. The focus of the project is to provide a framework for a single digital index and catalog of DGGS and mineral industry cores and samples. While accomplishing that direct MDIRA goal, the project will integrate and upgrade the existing in-house digital catalog of oil and gas industry samples and the catalog of U.S. Bureau of Mines and U.S. Bureau of Land Management mineral and coal samples into the same database and online search engine.

The GMC inventory information will be entered and bulk uploaded to the DGGS Oracle database via a web-based application currently in development. This application will allow the integration of the geologic materials inventory with DGGS sample locality and analysis information, and allow the creation of a web-based search engine for public users to search for materials available at the GMC. Application development will be completed in cooperation with Land Records Information Section (LRIS) under the direction of DGGS database project staff.

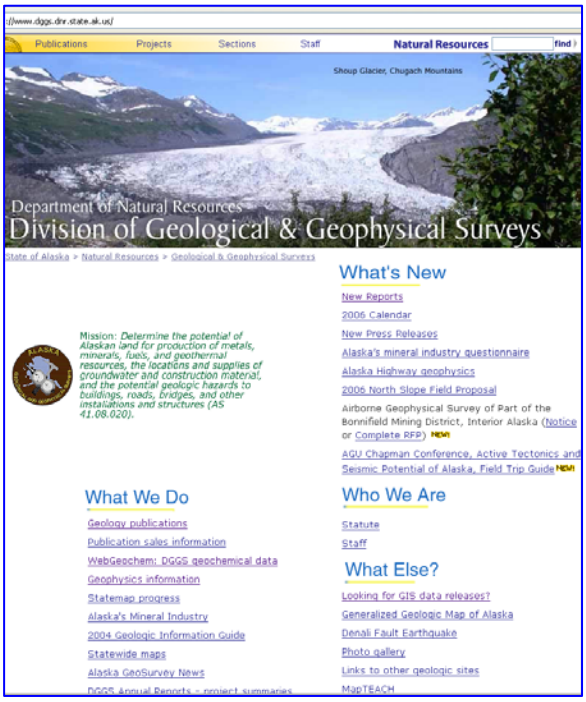
The project will use existing state DNR data and website infrastructure including the DGGS and Land Records Information Section (LRIS) databases and web servers. The existing technology uses Oracle Spatial databases, Apache web servers, and Tomcat application servers running on Sun hardware. Any map interface will use the LRIS Alaska Mapper framework for geographic display and query of the data. DGGS and LRIS already have established several similar applications within this system, and have the expertise to design, build, and maintain the GMC online catalog with no requirement to purchase or license additional technology.



Contact: Larry Freeman, 907-451-5027; larry.freeman@alaska.gov

DGGS Website

Since its inception in the late 1990s the DGGS website (http://www.dggs.dnr.state.ak.us/) 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, 9,000 oversize sheets and a growing assortment of GIS datasets.



Last year DGGS staff began researching and working to implement a code overhaul designed to bring our website into compliance with W3C (World Wide Web Consortium) web accessibility guidelines. During FY08 we have already completed significant work to modernize our code to comply with W3C recommendations. In working toward this goal DGGS determined that our site content had grown such that the existing tabular menu structure and HTML pages did not provide users with a clear navigation path among the various components of the site. To fulfill this need and provide a framework for future site expansion possibilities, we converted our default page file format from HTML to PHP and developed a dynamic, context-sensitive navigation menu.

In addition to building enhanced usability tools, we have worked to design a consistent and robust method of tracking site usage. Usage tracking plays an important role in site design and bandwidth decisions. Since our website was established in the late 1990s, DGGS has used several different usage tracking tools and methodologies. Rapid site expansion and the development of sophisticated online browsing tools have forced us to migrate from simple front page hit counters to programmatic analysis of our weblogs.

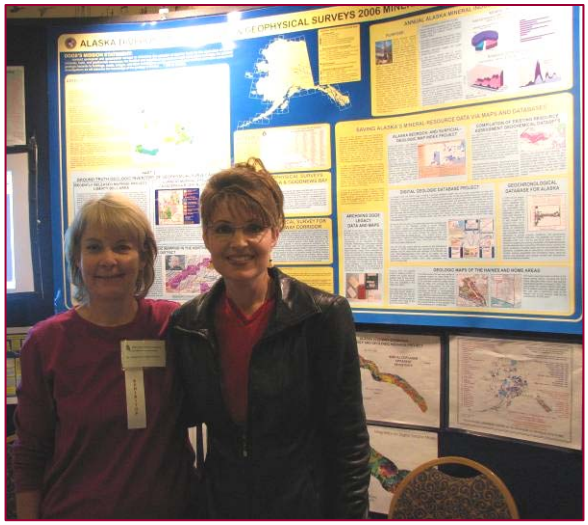
DGGS has been skeptical of the accuracy of the commercial website statistics analysis programs that we have used during the last several years. These programs were skewing the data by recording downloads of multipage .PDF files as multiple individual downloads and were unable to filter out automated search engine visits. To resolve the problem, our IT and web design staff have worked together to increase our web-log analysis accuracy by incorporating appropriate log filters into the configuration settings of our web statistics analysis software.

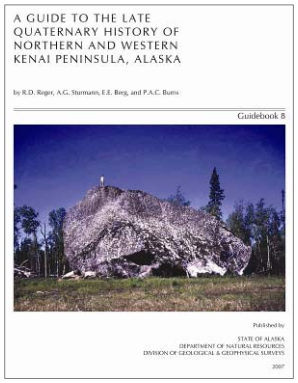
Contact Simone Montayne, Geologist, 907-451-5036;simone.montayne@alaska.gov

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 carry out 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 division staff, summarizing DGGS activities and products and communicating plans for its future projects.
- Publish two newsletter issues that communicate DGGS progress and announce the latest publications.
- Prepare displays and represent the division at geologic conferences and meetings by providing staff and assembling and transporting the display booth.
- Staff DGGS's information desk in Fairbanks, providing information in response to numerous inquiries about Alaska's geologic resources and hazards.
- Manage sales and distribution of DGGS's printed and online geologic reports, maps, and digital data.
- Review metadata for each project; file it in the appropriate digital repository. Assist other staff members as they prepare metadata for spatial data they want to distribute.
- Manage the DGGS reference library so that reports, maps, and other data are available and information is on hand that staff need for research when preparing geologic products.
- Maintain a complete collection of publications on Alaska by the U.S. Geological Survey, the former U.S. Bureau of Mines, the U.S. Bureau of Land Management; collect and maintain other Alaska-related publications as needed.
- Participate in school outreach activities such as helping prepare classroom presentations, judging science fair entries, or helping teachers by presenting earth science units.





The publications produced and distributed 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 2006;* airborne geophysical survey of part of the Bonnifield mining district; two new information circulars explaining how to use geologic maps and how geologic maps can be used to solve problems by understanding our world; *Geologic map of the Siksikpuk River area, Chandler Lake Quadrangle;* and other publications summarizing data collected by geologic staff during last summer's field work.

Publications are available in paper format (plotted as needed and sold for the cost of the plot) and as PDF documents and scanned compressed maps on the DGGS web page (no charge). A limited number of digital datasets are now available on the publications pages as additional products. Work will continue in FY2008 to increase the availability of digital datasets from which GIS maps are produced, so that customers can manipulate data as 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.

Contact Paula K. Davis, 907-451-5053, paula_davis@alaska.gov

ASSESSMENT OF ALASKA GEOLOGICAL & GEOPHYSICAL DATA COLLECTION AND PRESERVATION NEEDS

The Alaska Division of Geological & Geophysical Surveys (DGGS) has, as its statutory mission, the responsibility for collecting, archiving, managing, and disseminating geological and geophysical data on the subsurface energy resources, mineral resources, and geologic hazards of the state. During the last 10 years, through the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program, DGGS has greatly improved and cataloged the condition of its geological and geophysical data archive, upgraded its data management system, and has begun disseminating this data digitally through the internet. These improvements are especially pronounced for general geologic information and mineral resources data, but are lagging with respect to energy resource and geologic hazard data sets.

During the next year, DGGS will conduct an assessment of data preservation needs, including an evaluation of progress, data holdings, and gaps remaining from the MDIRA program, and will focus particularly on data and samples relating to energy resources and engineering geology that remain to be inventoried, cataloged, and made accessible. For energy-related data and samples, examples include: measured geologic sections, micro- and macro-paleontology, apatite fission track data, organic geochemistry, kerogen analyses, porosity and permeability data, coal proximate and ultimate analyses, peat analyses (TOC and ash), well e-logs, nonproprietary seismic and gravity data, geothermal data, and processed samples and resulting data reports at the GMC. For engineering-geologic data and samples, examples include: geotechnical boreholes, grain-size analyses, materials tests, permafrost depth and ice content, paleoseismic data, slope stability data, and volcano geology and hazards.

In conducting this assessment, DGGS will network with other state agencies that use and (or) archive related data, some of which is proprietary, including the Division of Oil & Gas (DOG), Division of Mining, Land & Water (DMLW), and the Alaska Oil & Gas Conservation Commission (AOGCC). DGGS will hold meetings with these state agencies, develop questionnaires for geologists in those agencies, and collate the information into a report. The report will list the volume of each type of data, the agency holding the data, current data formats, confidentiality vs. proprietary ownership, design and capacity of the storage system for holding existing and future data, and current public access and use.

The findings of DGGS's assessment will be reported to the U.S. Geological Survey (USGS) by completing their on-line Inventory of Geological and Geophysical Collections form, as well as a final technical report documenting and expanding the results of the inventory. This data-preservation assessment is funded by USGS grants, as part of the National Geological and Geophysical Data Preservation Program, authorized by the National Energy Policy Act of 2005.

Contact Larry Freeman, Geologist, 907-451-5027; larry.freeman@alaska.gov

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. The team consists of a Microcomputer/Network Specialist, a Microcomputer/Network Technician, and a GIS Manager.

The DGGS IT staff conducts projects that provide improved computer services to employees and streamlined Web access for external users. DGGS has made major improvements to the network in 2007 to improve that service. The installation and configuration of a LANdesk server has automated asset tracking and management. LANdesk also has streamlined the installation of software packages and updates, and allowed for remote desktop administration.

The topology of the networking infrastructure was redesigned from a ring-based system into a hypergraphic tree-based system. This rearrangement eliminated several single points of failure within the system and allowed for an increase in speed between servers and desktop machines.

The reconfiguration of our anti-virus servers has enabled seamless distribution of virus definition updates to every DGGS desktop and laptop computer.

The GIS/IT team is currently in the process of installing a multi-terabyte nearline storage system to complement the NEO 4000 tape backup system. The nearline storage system will provide the ability to quickly restore files and enable nightly backups of desktop machines.

As part of the statewide Voice over Internet Protocol (VoIP) migration, the bandwidth into and out of our local network is currently being upgraded from a 1.544MB to a 10MB connection. This change will provide more bandwidth to the general public viewing and downloading data from the DGGS website, as well as affording more increasingly needed bandwidth to the desktop users in the building.

Our database has been upgraded to Oracle 10g, offering greater performance, ease of administration, improved public access, and remote management. This upgrade also provided an opportunity to perform a maintenance upgrade of the operating system to Solaris 10.

The installation of a Mitsubishi uninterruptible power supply (UPS) required a major upgrade in the electrical infrastructure. Off-hours work, combined with significant planning and reconfiguration of the computer room, resulted in minimal downtime. The UPS now provides backup power for more than 3 hours to the entire computer room, including the web servers upon which our external users rely for accessing geological and geophysical data.

Geographic information system (GIS) users in the Division have benefited from the maintenance, upgrade, and support for ArcGIS licenses. The desktop GIS software, ArcGIS 9.1, implemented two years 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 and GIS data products for public release.

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

Contact Ken Woods, 907-451-5022, ken.woods@alaska.gov

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 collection, a little over 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 November 2007, the GMC had 228 visitations with another 1,130 contacts (by phone, mail, or e-mail) during FY08. To date in FY08, the GMC has also received 1,238 processed oil/gas petrographic, microfossil, or geochemical glass slides and eight technical data reports.

In FY07, there were 407 total visitations and another 2,332 contacts with the facility. The GMC also received a total of 2,882 processed slides and nine data reports.

To date in FY08, the GMC has received six pallets of rock samples representing surface samples, pulps (crushed rock samples), and mineral core from the Juneau office of the U.S. Bureau of Land Management and the "released" Alaska Oil and Gas Conservation Commission well samples. So far this fiscal year, the GMC received samples for one oil and gas well and received core for one nickel–copper–cobalt mineral hole.

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 FY08, no CONNEX containers have been added; no large rock donations are presently anticipated for the rest of FY08.

Contact: John Reeder, Geologic Materials Center, 907-696-0079, john.reeder@alaska.gov

PUBLICATIONS RELEASED IN 2007

ANNUAL REPORTS

AR 2006. Alaska Division of Geological & Geophysical Surveys Annual Report, by DGGS Staff, 2007, 64 p. Free

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GEOPHYSICAL MAPS & REPORTS

GPR 2007-1. Line, grid, and vector data, and plot files for the airborne geophysical survey of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 1 disk. 1 DVD. $15.

GPR 2007-1-1A. Total magnetic field of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. Topography included. $26.

GPR 2007-1-1B. Total magnetic field of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. Magnetic data contours included. $26.

GPR 2007-1-1C. First vertical derivative of the total magnetic field of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. Topography included. $26.

GPR 2007-1-2A. 56,000 Hz coplanar apparent resistivity of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. Topography included. $26.

GPR 2007-1-2B. 56,000 Hz coplanar apparent resistivity of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. 56,000 Hz resistivity data contours included. $26.

GPR 2007-1-3A. 7200 Hz coplanar apparent resistivity of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. Topography included. $26.

GPR 2007-1-3B. 7200 Hz coplanar apparent resistivity of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. 7200 Hz resistivity data contours included. $26.

GPR 2007-1-4A. 900 Hz coplanar apparent resistivity of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. Topography included. $26.

GPR 2007-1-4B. 900 Hz coplanar apparent resistivity of part of the Bonnifield mining district, Interior Alaska, by Burns, L.E., Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2007, 2 sheets, scale 1:63,360. 900 Hz resistivity data contours included. $26.

GUIDEBOOK

GB 8. A guide to the late Quaternary history of northern and western Kenai Peninsula, Alaska, by Richard D. Reger, Alfred G. Sturmann, Edward E. Berg, and Patricia A.C. Burns, 2008, 112 p., 6 sheets, scale 1:63,360. $25.

INFORMATION CIRCULARS

IC 54. Alaska's Mineral Industry 2006: A summary, by Szumigala, D.J., and Hughes, R.A., 2007, 20 p. Free.

IC 55. Geologic maps: solving problems by understanding our world, by Athey, J.E., 2007, 2 p. Free.

IC 56. Using geologic maps, by Athey, J.E., 2007, 2 p. Free.

NEWSLETTER (ALASKA GEOSURVEY NEWS)

NL 2007-1. Alaska GeoSurvey News, by DGGS Staff, 2007, 6 p. Free

PRELIMINARY INTERPRETIVE REPORTS

PIR 2007-1. Geologic map of the Siksikpuk River area, Chandler Lake Quadrangle, Alaska, by Peapples, P.R., Wallace, W.K., Wartes, M.A., Swenson, R.F., Mull, C.G., Dumoulin, J.A., Harris, E.E., Finzel, E.S., Reifenstuhl, R.R., and Loveland, A.M., 2007, 1 sheet, scale 1:63,360. $13.

PIR 2007-2. Brookian sequence stratigraphic correlations, Umiat Field to Milne Point Field, west-central North Slope, Alaska, by Decker, P.L., 2007, 19 p., 1 sheet. $15

RAW-DATA FILES

RDF 2007-1. Trace element geochemical data from reanalysis of stream-sediment samples collected in 1981 from the Fairbanks mining district, Alaska, by Jozwik, Diana, 2007, 170 p. $17.

RDF 2007-2. Data tables related to geology and gold mineralization in the Richardson district, east-central Alaska, by Graham, G.E., and Jozwik, Diana, 2007, 32 p. $3.

RDF 2007-3. Outcrop sample results from mercury injection capillary pressure analyses, Bristol Bay, Alaska Peninsula, by Loveland, A.M., Reifenstuhl, R.R., Gillis, R.J., and Decker, P.L., 2007, 11 p. $2.

RDF 2007-4. Major-oxide, minor-oxide, trace-element, geochemical, and non-carbonate carbon data from rocks collected in the Solomon and Nome quadrangles, Seward Peninsula, Alaska in 2006, by Werdon, M.B., Newberry, R.J., Szumigala, D.J., Freeman, L.K., and Athey, J.E., 2007, 49 p. $5.

RDF 2008-1. Major-oxide, minor-oxide, and trace-element geochemical data from rocks collected in the northern Fairbanks mining district, Circle Quadrangle, Alaska in 2007, by Athey, J.E., Freeman, L.K., Werdon, M.B., Szumigala, D.J., Lessard, R.R., Newberry, R.J., Hansen, S.E., and Jing, L., 2008, 41 p. $5.

REPORTS OF INVESTIGATONS

RI 2007-1. Sequence stratigraphy and geochemistry of the upper Lower through Upper Triassic of Northern Alaska: Implications for paleoredox history, source rock accumulation, and paleoceanography, by Kelly, L.N., Whalen, M.T., McRoberts, C.A., Hopkin, E., and Tomsich, C.S., 2007, 50 p. $5.

RI 2007-2. Petrographic study of 50 samples from the Tertiary sandstone of Cook Inlet, Alaska: potential tight gas reservoirs, by Hickey, J.J., Wilson, M.D., and Reifenstuhl, R.R., 2007, 64 p. $7.

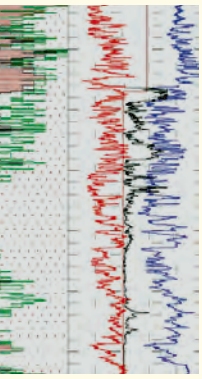
SPECIAL REPORTS

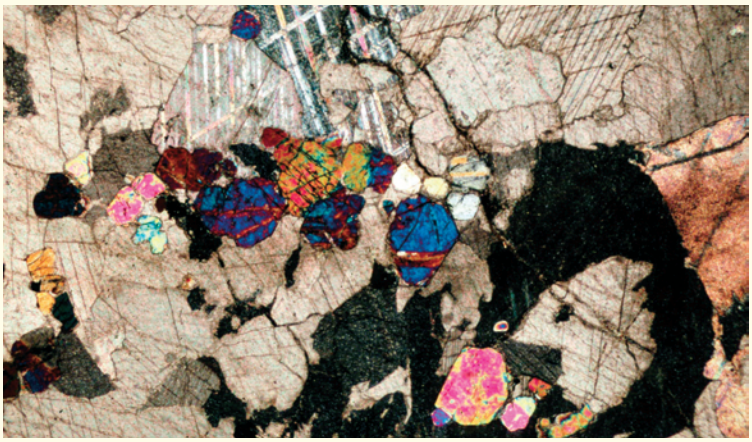
SR 61. Alaska's Mineral Industry 2006, by Szumigala, D.J., and Hughes, R.A., 2007, 83 p. Free

APPENDIX
Alaska’s Geologic Materials Center




Alaska Geologic Materials Center



Alaska Department of Natural Resources
Division of Geological & Geophysical Surveys

AGMC Alaska Geologic Materials Center

A vision for responsible stewardship of geologic samples and data in Alaska.

TODAY **TOMORROW**

"A geologist's ability to perform modern analyses on these unique samples is paramount for responsible development of the State's vast resources. It is critical that access to and protection of this valuable resource be improved and updated."

—Bob Swenson
Alaska State Geologist

"Drill core provides the most direct information on the third dimension and is an invaluable resource in interpreting geological history regardless of the application – mineral and energy resources development, construction, environmental or academic; like a great book, it should never be discarded."

—Rick Van Nieuwenhuyse
President and CEO
NovaGold Resources Inc.

An irreplaceable archive of Alaska's geology

The Alaska Geologic Materials Center is the state's principal archive of geologic samples collected by oil and gas exploration companies, mineral exploration companies, geotechnical companies and state and federal agencies.

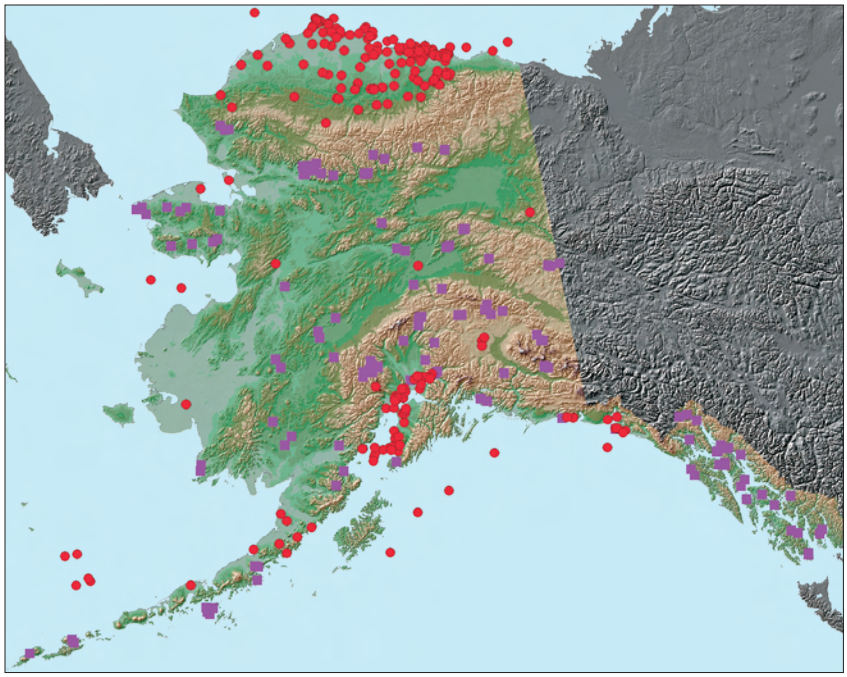
The collection includes unique core samples, surface samples, micropaleontology samples, well cuttings, and geochemical samples.

The AGMC occupies roughly 30,000 square feet of storage area in Eagle River, Alaska.

"The AGMC not only enables me to archive and retrieve samples and data, but its existence ensures that the samples collected by many of us in the industry will remain available in the future for other researchers and explorationists. With the rising cost of exploration, the value of the facility and its collection would be difficult to measure, but it is certain to increase."

—Jeff Foley
Senior Exploration Geologist
Calista Corporation

A century's worth of unique geologic samples from nearly every area of the state



Locations of geologic samples represented at the AGMC.
● = oil- and gas-related samples, ■ = minerals-related samples.

With specimens dating from the present day back to the early 1900s, the Alaska Geologic Materials Center contains

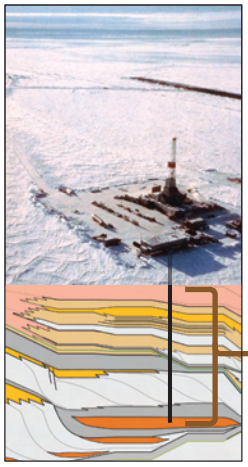
- about 12 million feet of exploration and production drilling, represented in rock core samples and drill cuttings,
- samples from more than 1,450 oil and gas exploratory and production wells from throughout the state,
- nearly a quarter million feet of diamond-drill core samples from over a thousand exploratory hard-rock mineral holes,
- collections donated from the U.S. Minerals Management Service (MMS), U.S. Geological Survey (USGS), U.S. Bureau of Mines, U.S. Bureau of Land Management (BLM), Alaska Oil and Gas Conservation Commission (AOGCC), Amoco, BP, Shell, Marathon, Phillips, Unocal, Kennecott, Aleut Corporation, and many others,
- more than 260,000 glass slides for microscopic analyses,
- more than 300 data reports on sample analyses.

"Core, slides, and rock donations by the many oil companies that have been bought up by others, or that have lost interest in the State, have been preserved at the Alaska Geologic Materials Center. Luckily, we can still view the materials due to the foresight of the State and the donating companies. This is an invaluable resource that needs to be preserved and made more accessible."

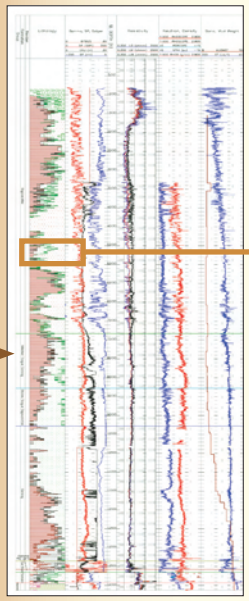
—David C. Shafer, Development Geologist Advisor
Chevron North America Exploration and Production

The exploration, sampling, and storage process

Rock samples from oil and gas exploration are obtained by drilling into the earth, often at very remote locations.

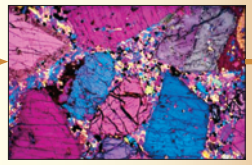


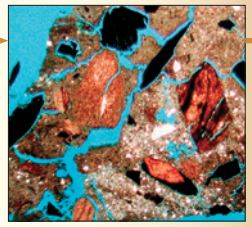
The well log shows properties of the rock from the surface down to the bottom of the drilled hole. AGMC samples are required to calibrate the log.



Drill core samples are labeled with the depth in feet (white lettering, top), and archived at the AGMC (bottom).

Photomicrographs from thin sections of the core samples allow detailed analysis of the rock.





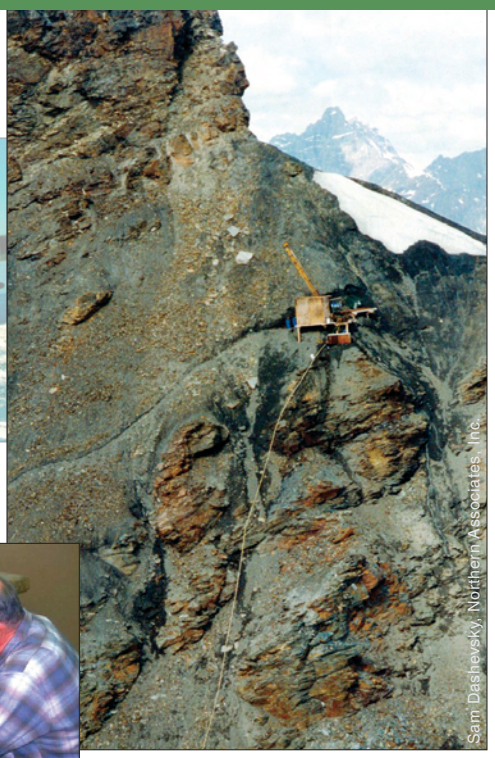
Ultimately, analysis based on AGMC archives and data leads to resource discovery and production.

EXPLORATION ANALYSIS PRODUCTION

"The Alaska Geologic Materials Center is an extremely valuable resource to the Alaska oil & gas industry. Results from studies on AGMC cores can strongly influence exploration decisions. However, the AGMC is grossly antiquated and this precludes efficient use of its resources. The AGMC absolutely needs to be upgraded, both in terms of its physical plant and its online database capabilities."

—Thomas Homza, Staff Geologist
Shell Exploration & Production Co.

Our vital role in future resource development



- Many successful prospects across the state were initially identified in the rock samples at AGMC.
- Each year, the AGMC's samples are inspected or analyzed by 400–500 clients from industry, government, and academia.
- Since 2005, about 80 percent of the AGMC's clientele has represented energy interests, while 20 percent has been concerned with mineral exploration and development.
- Modern sophisticated analysis of archived samples is widely recognized as a cost-effective alternative to the tremendous expense of core drilling and resampling in the field.
- One foot of core can provide critical information to an exploration/development company, potentially leading to discovery and ultimately to millions of dollars in lease, tax, and royalty revenue to both state and federal governments.

"The ability to catalog, inventory, recover and examine core and geologic data from past exploration projects in Alaska is of tremendous value to the minerals industry. Having improved access will advance the exploration-discovery process and decrease the time and expense required for the future development of new ore deposits."

—Jeffrey A. Pontius
President & CEO
International Tower Hill Mines Ltd.

Challenges facing the AGMC

The current AGMC facility lacks sufficient space and equipment for proper sample storage, processing, layout, and viewing.

- Available heated warehouse space has long been exceeded.
- Half of the collection is in 55 unheated, unlighted portable shipping containers, endangering the samples by exposing them to large changes in temperature and humidity.
- It is nearly impossible to perform routine core analysis on large-footage wells—the cores must be taken off-site, endangering the samples.
- The facility is unsecured, and has high fire and other risks.
- With the collection scattered among numerous buildings and shipping containers, access to data is poor.

"The AGMC's presentation doesn't befit its contents. Moreover, it speaks of lost opportunities to educate—not just geoscientists, but school kids, the general public, perhaps even tourists, about the abundant natural resources of Alaska."

—Denise M. Stone
Exploration Advisor
Benchmark Oil and Gas

Moving toward a better position on the storage spectrum

POOR ——— **EXCELLENT**

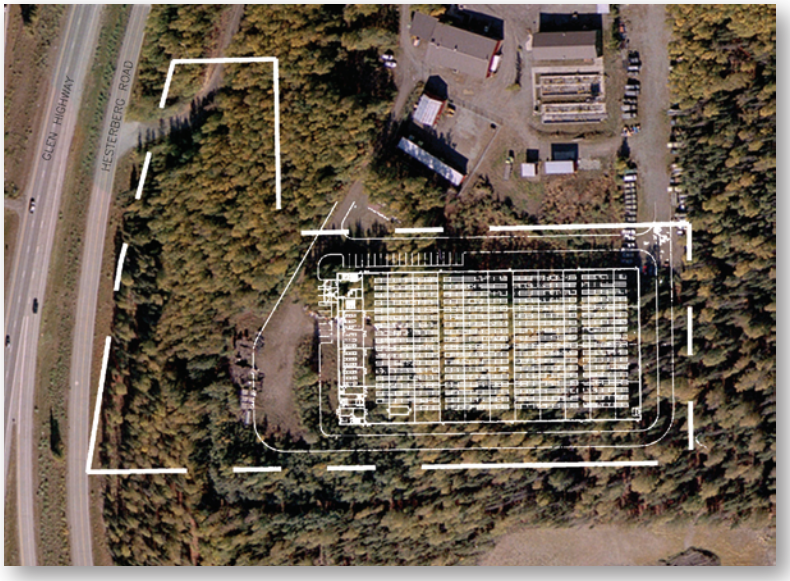
Foreign country
Unorganized and unmaintained, the valuable information once held by these core samples is lost.

Alaska
The current AGMC facility has limited workspace, is 150% over capacity, and is poorly designed for geologic sample storage.

U.S. and Canada
Modern facilities include Alberta Core Research Center (bottom), Oklahoma Geological Survey, Texas Bureau of Economic Geology (top), and U.S. Geological Survey Denver.

Taking steps to protect current and future collections

- In 2005, an ad hoc committee—with representatives from the energy and mining industries, the federal government, and the State of Alaska—developed criteria for a new, expanded and centralized Alaska Geologic Materials Center.
- In April of 2006, members of the committee met with architects, engineers, and a national expert in the design of geologic materials centers.
- The resulting design concept study has now been completed, including conceptual design of a 125,000 square foot facility that will accommodate growth well into the 21st century.
- 9.5 acres of state-owned property in Eagle River are available as a building site.
- Project is underway to link the AGMC sample database to the DGGS website for fast, online archive searches by explorers.



"…if a new repository is not developed soon, the State of Alaska, federal agencies, private industry, and the public will be at risk of losing irreplaceable scientific resources."

—2006 AGMC Concept Study

Alaska Geologic Materials Center

Alaska's archive of geologic materials in support of resource exploration, land-use management, and research

For more information, contact
Bob Swenson, State Geologist
Division of Geological & Geophysical Surveys
3354 College Road
Fairbanks, Alaska 99709
(907) 451-5001
robert.swenson@alaska.gov
www.dggs.dnr.state.ak.us