Alaska Division of Geological & Geophysical Surveys
Annual Report
2004

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

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Cover Photo: *DGGS geologist David Szumigala breaks glaucophane-bearing metabasite rocks of the Casadepaga Schist unit at the "Glaucophane Volcano" locality in the Solomon Quadrangle, Seward Peninsula. DGGS conducted 1:50,000-scale geologic mapping in two parts of the historic Council and Solomon placer gold mining districts in 2004 as part of the State-funded Airborne Geophysical/Geological Mineral Inventory Program and the federally funded STATEMAP Program. The field project was in an area for which DGGS released airborne-geophysical survey data in 2003. More than 1 million ounces of placer gold have been extracted from the Solomon–Council area of the Seward Peninsula during the past century. The purpose of DGGS's mapping is to provide geologic context for known lode gold and base-metal deposits and occurrences, and to evaluate the area's mineral resource potential. Photo by Melanie Werdon.*

State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
January 2005

State of Alaska
Frank H. Murkowski, Governor

Department of Natural Resources
Tom Irwin, Commissioner

Division of Geological & Geophysical Surveys
Rod Combellick, Acting Director

DGGS publications may be inspected at the following locations. Address mail orders to the Fairbanks office.

- Division of Geological & Geophysical Surveys
  ATTN: Geologic Communications
  3354 College Rd.
  Fairbanks, Alaska 99709-3707

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

- Alaska Resource Library
  and Information Services
  3211 Providence Dr.
  Anchorage, Alaska 99508

- Elmer E. Rasmuson Library
  University of Alaska Fairbanks
  Fairbanks, Alaska 99775-1005

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

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GOVERNOR'S FOREWORD

I firmly believe that the wise development of Alaska's natural resources is the key to a bright future for our state and vital for the security and economic health of our nation. Alaska has already provided enormous riches, and we know that there is much more left to be discovered. We are witnessing a major resurgence in mining, thanks to several exciting new discoveries, a more streamlined permitting process, and a sustained increase in metals prices. We are seeing an increase in oil and gas exploration, particularly by small companies and independents, as prices increase and the dream of finally getting our vast reserves of natural gas to market appears closer to reality. But Alaska finds itself engaged in fierce competition with other states and with foreign countries to attract exploration investment. My administration is doing everything it can to continue attracting companies that are committed to developing the state's natural resources in ways that are environmentally responsible and that provide Alaskans with reasonable economic returns.

One of the many factors that entice private companies to explore in Alaska is the availability of reliable, public information on the state's geology. This information provides the framework for private exploration and holds important clues to locating the areas most favorable for hosting oil and mineral resources. Data gathered in the field and published in peer-reviewed reports and maps by the Division of Geological & Geophysical Surveys help reduce private investment risk and provide the state with important information for managing the resources. DGGS's geological research on the North Slope and around Bristol Bay is helping to guide oil and gas exploration efforts there, as are their airborne geophysical and geological surveys for guiding mineral exploration throughout the state.

The geological processes responsible for Alaska's vast resources and scenic beauty also give rise to many of its natural hazards such as earthquakes and volcanoes. As recent tragic events in the Indian Ocean region testify, public understanding of these hazards is crucial for the safety of our citizens and the continued health of our economy. DGGS's research on geologic hazards provides much of the information needed to help reduce these risks and to plan for the major events that are inevitable in this geologically active state.

I am proud of the work performed by the Department of Natural Resources and its Division of Geological & Geophysical Surveys in promoting wise development of Alaska's oil and mineral riches. The inventory of Alaska's geological endowment is a sound investment in Alaska's future.

Governor Frank H. Murkowski

COMMISSIONER'S FOREWORD

The Department of Natural Resources' mission is to *develop, conserve, and enhance natural resources for present and future Alaskans*. Our Division of Geological & Geophysical Surveys (DGGS) plays a key role in this mission by collecting and publishing reliable earth-science information that supports resource exploration and sound land-use management. DGGS coordinates closely with other DNR divisions, particularly the Division of Oil & Gas and the Division of Mining, Land & Water, to prioritize these needs and to conduct joint field operations where appropriate. In addition to meeting the geoscience needs of DNR, all of DGGS's reports and maps are made available through its Web site to serve the multiple-use needs of other state agencies, industry, and the public.

I am committed to the principle that the management of Alaska's natural resources must be based on sound scientific information. DGGS provides the critical earth-science information to help us achieve this goal. You will find described in this annual report a comprehensive program for collecting and preserving geological and geophysical data to encourage exploration for energy and mineral resources in Alaska and to help mitigate the public-safety risks from geologic hazards. We as Alaskans can be proud to have one of the finest state geological surveys in the nation.

Thomas E. Irwin, Commissioner, Department of Natural Resources

DIRECTOR'S FOREWORD

Once again I feel privileged to have served another year as acting director for the fine group of professionals in the Alaska Division of Geological & Geophysical Surveys (DGGS). It is also a privilege to serve the Department of Natural Resources under the capable leadership of Commissioner Tom Irwin and Deputy Commissioners Marty Rutherford and Dick LeFebvre. The role of DGGS in DNR is to provide objective, peer-reviewed geological and geophysical information to help attract exploration investment, manage Alaska's nonrenewable resources, and mitigate the state's formidable geologic hazards. Only through the professionalism and integrity of our dedicated staff are we able to accomplish these goals and provide the public with reliable earth-science information in a timely manner.

Several personnel changes occurred at DGGS during 2004. We welcomed to the Energy Resources section newly hired geologists **Marwan Wartes** and **Emily Finzel**, who will help expand DGGS's oil and gas program, providing geologic information to attract exploration investment and manage the resources. **Gail Davidson** retired from her post as chief of the Geologic Communications section after a productive 25-year career with DGGS. **Paula Davis**, who has been with the division for almost 18 years in numerous capacities, very capably takes over as section chief. **Dawn Roberts**, who managed DGGS's public information desk and library for three years, moved to Seattle to pursue graduate study in museology at the University of Washington. **Sean Willison**, who will soon complete a bachelor's degree in Natural Resource Management at UAF, takes her place at the front desk. Sean is quickly learning the ropes as the public's primary point of contact with the division. **Bobby Kirchner**, who has maintained DGGS's computers for several years, accepted the position of Microcomputer/Network Specialist I, replacing **Kevin Secor** as network manager. I continue to be impressed with all of the staff at DGGS, who put in many extra hours because they care about the quality and timeliness of their work.

This annual report, which is required by statute, provides a summary of the DGGS program and its accomplishments during the previous fiscal year. You will find a section in which the project managers have provided detailed, one-page descriptions for each project that is currently underway during FY 2005. Further information on many projects is available through the DGGS Web site at **www.dggs.dnr.state.ak.us**. Please feel free to contact us directly to discuss any project or if you have questions on any aspect of Alaska geology. Contact information for the project managers is provided at the bottom of each project-briefing page.

We invite you to come visit DGGS at our still-new facility at 3354 College Road in Fairbanks. After moving to this location in late 2003, we finally feel settled and fully functional.

Rodney A. Combellick, Acting Director, Division of Geological &Geophysical Surveys

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Division of Geological & Geophysical Surveys
ANNUAL REPORT 2004

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 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

Eight 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 (Acting) 2003-Present

By statute the State Geologist also serves as the Director of the Division of Geological & Geophysical Surveys within 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 geological community and professional societies within Alaska. A department order in 2002 formalized a process whereby the Geologic Mapping Advisory Board oversees evaluation of candidates and provides a list to the Commissioner. The qualifications and responsibilities of the State Geologist and the mission of DGGS are defined by statute.

STATUTORY AUTHORITY

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

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

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

Sec. 41.08.030. Printing and distribution of reports. The state geologist shall print and publish an annual report and such other special and topical reports and maps as may be desirable for the benefit of the state, including the printing or reprinting of reports and maps made by other persons or agencies, where authorization to do so is obtained. Reports and maps may be sold and all money received from these sales shall be paid into the general fund. (§ I ch 93 SLA 1972)

LOCATION

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

Current DGGS staff totals 32 permanent full-time professional and support personnel, two non-permanent professional geologists, a Director, and twelve student interns hired through the State of Alaska internship program.

DGGS operates a Geologic Materials Center in Eagle River, Alaska, staffed by one professional geologist and one non-permanent geologist.

ORGANIZATION

DGGS is one of seven Divisions and four Offices in the Alaska Department of Natural Resources (fig. 1).

Division of Geological & Geophysical Surveys offices in Fairbanks

Geologic Materials Center in Eagle River

DIVISON OF GEOLOGICAL & GEOPHYSICAL SURVEYS

CURRENT ORGANIZATIONAL CHART

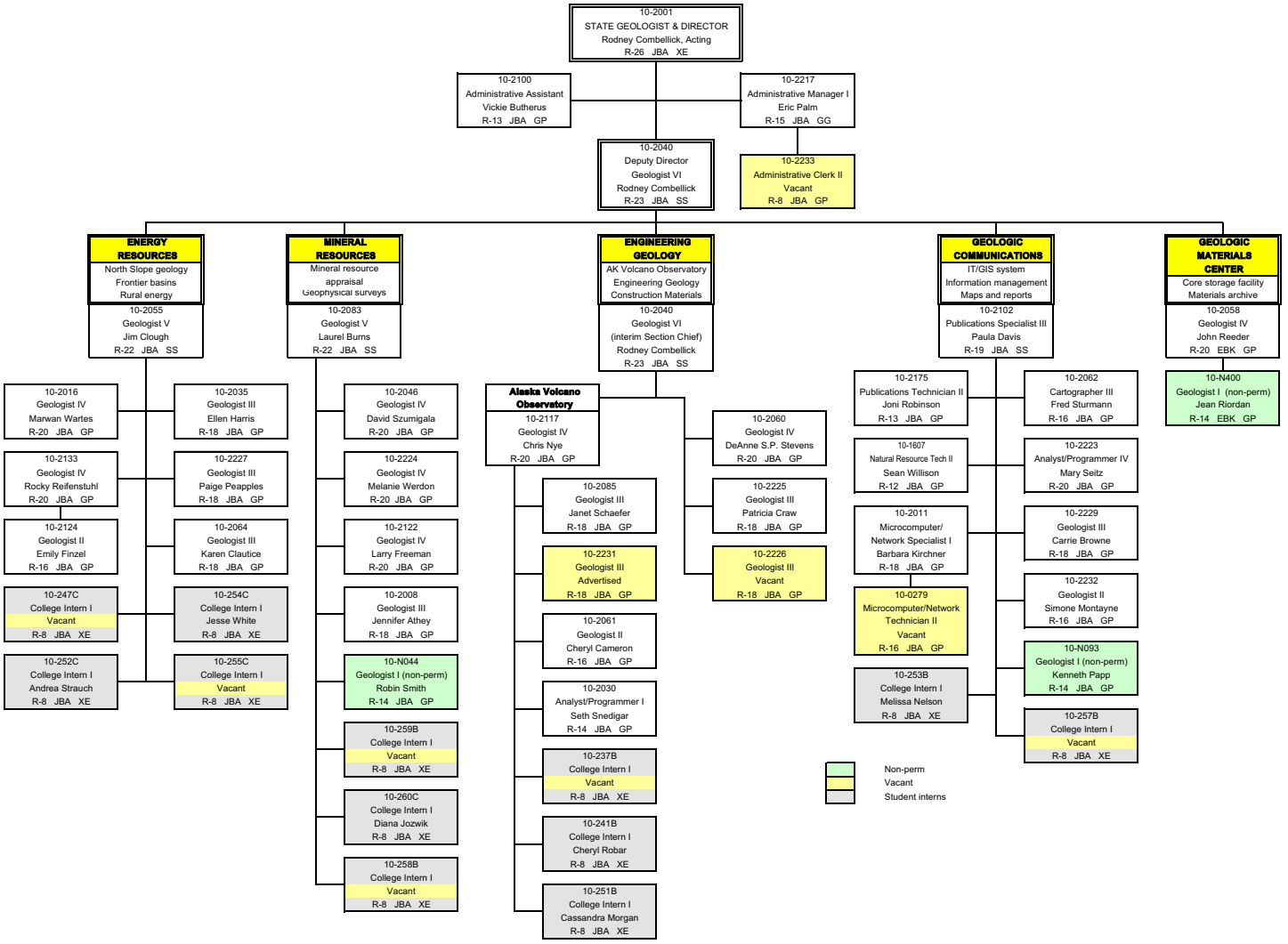
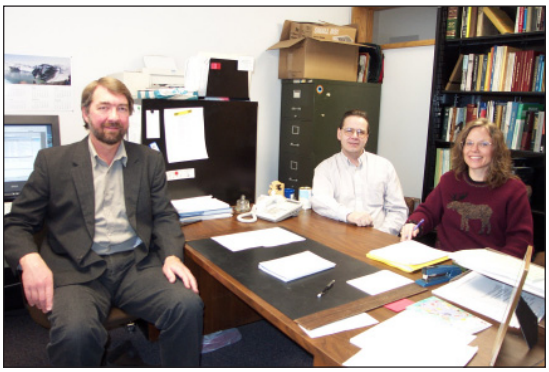


Figure 1. *Organizational chart for the Alaska Divison of Geological & Geophysical Surveys.*

Under the overall administration of the Director's Office, The Division of Geological & Geophysical Surveys is organized into four sections and the Geologic Materials Center:

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



L TO R: Rod Combellick, Eric Palm, Vickie Butherus.

The **Energy Resources Section** generates new information about the geologic framework of frontier areas that may host undiscovered oil, gas, or coal 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's scope of activities includes work that seeks to identify local sources of energy for rural Alaska villages and enterprises, and work that seeks to improve the success of state-revenue-generating commercial oil exploration and development.

L TO R: Jim Clough, Karen Clautice, Paige Peapples, Ellen Harris, Rocky Reifenstuhl. **INSET**: Emily Finzel, 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. The Mineral Resources Section seeks to improve the success of mineral discovery in Alaska so that new employment opportunities are created for Alaska's citizens.

BACK L TO R: Larry Freeman, Melanie Werdon, Dave Szumigala. **FRONT L TO R:** Jen Athey, Laurel Burns, Robin Smith.

Back L to R: Chris Nye, Janet Schaefer, Seth Snedigar. **Front L to R:** Patty Craw, Cheryl Cameron, De Anne Stevens.

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

Back L to R: Carrie Browne, Susan Seitz, Fred Sturmann, Bobby Kirchner, Joni Robinson, Sean Willison. **Front L to R:** Simone Montayne, Paula Davis.

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 DGGS geologic information. Increased utilization of computer technology is resulting in faster preparation of maps and reports and a wider awareness of Alaska geologic information available at DGGS. This section is coordinating the design of a computer-hosted database for the Division's digital and map-based geologic and geophysical data. The section responds each year to an estimated 2,500 public inquiries about geologic resources in Alaska, in addition to approximately 40,000 accesses of the Division's Web site (www.dggs.dnr.state.ak.us).

John Reeder, Jean Riordan

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

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' interaction with the Land Records Information Section in the DNR Support Services Division continues to increase as more of our geologic data are compiled and organized in digital format amenable to merging with other land information. The DGGS energy group works closely with geologic personnel in the Division of Oil and Gas (DOG) on issues related to rural energy sources and in providing geologic control for the subsurface oil-related geologic analyses conducted by DOG. DGGS supplies the Division of Forestry with information about the mineral resource potential within state forests. 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. DGGS works closely with Division of Homeland Security & Emergency Management in the Department of Military and Veterans Affairs to evaluate hazards, design scenarios for hazards events, and develop the State Hazard Mitigation Plan.

Funding to support work requested by other DNR agencies mostly has been drawn from our 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-inundataion maps for coastal communities. In Kodiak, Homer, and Seward, 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 or will soon be initiated 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 the Municipality of Anchorage in the development of earthquake site-response maps for the Anchorage area, and the Energy section is working closely with the communities of Fort Yukon, Chignik, and Wainwright to assess local potential for shallow coalbed methane as a potential energy source.

RELATIONSHIP WITH THE UNIVERSITY OF ALASKA

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

programs with the U.S. Minerals Management Service and National Aeronautics and Space Administration (NASA). In 2003, DGGS was successful in receiving its first-ever funding from the National Science Foundation through a highly competitive proposal process. DGGS receives some federal funds from matching grants for which we must compete nationally with other organizations on a yearly basis. In the past we have been successful in securing funds to support mineral inventory mapping, surficial and earthquake hazards-related mapping, volcanic-hazards evaluations and studies related to oil and gas potential. We are not, however, assured of yearly success for any of our federal grant proposals. These funds, therefore, sometimes complement but do not replace state General Fund money. Federal funding is pursued only for projects that are needed to meet the division's statutory mission.

Three ongoing cooperative programs with federal agencies have provided support for key elements of the DGGS mission in recent years. One is the Alaska Volcano Observatory (AVO), a partnership of USGS, DGGS, and the University of Alaska Fairbanks that was established in 1988. The USGS funds and administers the program for the purpose of providing a coordinated approach to mitigating volcano hazards to the public, the state infrastructure, and air commerce. A second long-standing cooperative federal program is the Statemap component of the National Cooperative Geologic Mapping Program, established by Congress in 1992 and also administered through 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 participates in numerous MDIRA projects, administered by either USGS or BLM 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 Alaskan public. A number of prominent leaders in the geologic community 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 need to be addressed by the state.
- To inquire into matters of community interest relating to Alaska geology.
- To provide a forum for collection and expression of opinions and recommendations relating to geologic investigation and mapping programs for Alaska.
- To make recommendations toward identifying Alaska's diverse resources and promoting an orderly and prudent inventory of those resources.
- To increase public awareness of the importance of geology to the state's economy and to the public's health and safety.
- To promote communication among the general public, other government agencies, private corporations, and other groups that have an interest in the geology and subsurface resources of Alaska.
- To facilitate cooperative agreements between DGGS and other agencies, professional organizations, and private enterprise to develop data repositories and enhance the state's resource inventory and engineering geology programs.
- To communicate with public officials as representatives of groups interested in the acquisition of Alaska geologic information.
- To enlist public and legislative support for statewide geologic resource inventories and engineering geology programs.

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

Members of the board are:

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

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

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

Paul Layer
University of Alaska Fairbanks Geology and Geophysics Department, 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, a position he held for 6 years.

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

Greg Beischer
Bristol Environmental & Engineering Services Corporation, a wholly owned subsidiary of Bristol Bay Native Corporation
Greg Beischer is a geologist and mining engineering technologist with 16 years of experience in the industry, specializing in exploration, development, and management of mineral resources.

FY 2004 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 FY 2004 the Division successfully pursued multiple funding avenues to finance geological and geophysical mineral inventory mapping, generate new geologic data to support North Slope and Bristol Bay energy exploration, perform rural energy geologic assessments, conduct earthquake hazard investigations, expand volcano monitoring and hazards studies in the Alaska Peninsula and Aleutian Islands, and streamline geologic data archival and dissemination.

MAJOR ACCOMPLISHMENTS IN FY 2004

Energy Resources

- Completed Year 1 of a two-year geologic mapping project in the Siksikpuk River area in the central Brooks Range foothills area of the North Slope. The new bedrock mapping is conducted in conjunction with ongoing petroleum-resource evaluations and will be released in 2006 for use by industry and government in lease sales on state and federal lands.
- Completed geologic field studies of reservoir quality in the central Brooks Range foothills and released a report (DGGS PIR 2004-5) summarizing three years of reservoir characterization studies. This work is supported by state and industry funds and is focused on evaluating the natural-gas potential of the foothills, which are estimated to contain many trillions of cubic feet of gas.
- Conducted field-based analysis of petroleum geology in the central North Slope, principally in the Chandler Lake quadrangle. A critical structural transect along Tiglukpuk Creek was completed, highlighting the style and geometry of folding and faulting in this petroleum province. A preliminary report on this transect will be released by the end of FY 2005.
- Convened a gathering of industry geologists and state oil and gas officials in Umiat to present recent technical results bearing on the petroleum geology of northern Alaska. Conducted a two day geology tour of North Slope field localities that illustrate structural and stratigraphic relationships that are key to oil and gas exploration.
- Received federal funding for a 3-year geologic evaluation of petroleum potential in the Bristol Bay region and completed the year 1 field program in 2004. This field work addressed the

source rock potential along the margins of the basin in the Alaska Peninsula region. The data were released in DGGS report RDF 2004-3.

- Initiated the Cook Inlet Tight Sands Project with support from the U.S. Department of Energy. Examined 50 core samples from the Alaska Geologic Materials Center to assess the natural-gas reservoir potential in parts of the Cook Inlet basin. Final DGGS Report of Investigations is scheduled for November 2005.
- Completed the permitting and field logistics planning for a 3-year U.S. Department of Energy-funded project to conduct slim-hole drilling at Fort Yukon to assess coalbed methane potential. Drilling at Fort Yukon was planned for the first quarter of FY05 and preliminary results on coalbed gas content and water quality will be released in the fourth quarter of FY05.
- Conducted new field examinations of coal outcrops in the Angoon and Kake areas of southeastern Alaska as years 1 and 2 of a three year project funded by the U.S. Geological Survey's National Coal Resource Data System program. This project will provide new information on the energy potential of a poorly understood area of southeastern Alaska. Reports on new analyses of coal samples collected during the field studies, along with a paleontologic study of Tertiary host rocks, will be released as a final report in first quarter of FY06.

Mineral Resources

- In collaboration with the Alaska Department of Commerce, Community and Economic Development, published the annual Mineral Industry Summary (Special Report 57), an objective, authoritative synopsis of statewide mining activity.
- Completed the ground-truth geologic mapping of the northern half of the Livengood mining district airborne-geophysical survey tract, including bedrock- and comprehensive-geologic maps and supporting geochemical and geochronologic data.
- Published the final version of the bedrock geologic map of the majority of the Salcha River—Pogo geophysical survey tract. This project includes the Pogo area and provides new interpretations to help the mining industry.
- Initiated the ground-truth bedrock- and surficial-geologic mapping project of about 250 sq miles of the Council mining district airborne-geophysical survey tract. These maps and data will be released to the public by end of FY05.
- Released 17 maps and 5 CD-ROMS containing updated geophysical maps and digital data for Fairbanks, Richardson, Circle, Valdez Creek, and Nyac mining districts (total of 1359 sq. miles), bringing the previously released data more in accord with present geophysical survey standards. Data for the Nome, Rampart-Manley, Chulitna, and Petersville geophysical projects will be updated in FY05.
- In collaboration with DNR's Land Records Information Section (LRIS), released a Web interface (http://maps.akgeology.info) to a geographical index of geologic maps produced by DGGS throughout its history, which will be expanded during FY05 and FY06 to include all published state and federal geologic maps for Alaska.
- Compiled mineral deposit data files for public access for the Tanana quadrangle (about 6,000 square miles) for inclusion in the USGS Alaska Mineral Resource Data Files web site.
- Completed the second and final year of geologic ground-truthing in the Council mining district, Seward Peninsula, in support of a NASA-funded project to use high-resolution remote-sensing data and field-geologic mapping to identify previously unrecognized deposits that may be favorable sources of placer minerals.

Engineering Geology & Construction Materials

- Awarded funding by the National Science Foundation (NSF) to develop the pilot program *Mapping Technology Experiences with Alaska's Cultural Heritage*, or MapTEACH, in collaboration with the University of Alaska Fairbanks and University of Wisconsin Madison. With the support of 10 partner organizations (including private sector, non-profit, and educational institutions), the 3-year MapTEACH project is developing a geoscience educational program for middle- and high-school students in Alaska emphasizing hands-on experience with spatial technology (GPS, GIS, and remote sensing imagery), in conjunction with traditional activities.
- Completed ground-truth surficial- and engineering-geologic field mapping in the Salcha River - Pogo mining district and Livengood airborne-geophysical survey area, and in the Kanayut River area, Brooks Range foothills as part of USGS-funded Statemap projects.
- Published 1:250,000-scale geologic strip maps for over 6,000 miles of transportation corridors considered for state selection. A total of 376 maps in 78 quadrangles includes geology, geologic hazards, geologic materials, and data quality for the 10-mile-wide corridors and are available via internet for printing and download.

- Participated in USGS- and Alyeska-supported studies of the 2002 Denali fault earthquake and hazard evaluations of Denali, Totschunda, Susitna Glacier faults. Two peer-reviewed papers on this work are in press.

Alaska Volcano Observatory

- Completed field studies of volcano hazards and volcano geology at Veniaminof and Okmok volcanoes.
- Provided helicopter and ship logistical coordination for Alaska Volcano Observatory (AVO) field operations, including a major expansion of AVO volcano monitoring capabilities on the Alaska Peninsula. Currently 27 of Alaska's historically active volcanoes are being seismically monitored, compared to four that were monitored in FY96.
- Coauthored volcanic hazard assessments and geologic maps of Great Sitkin and Kanaga Volcanoes as well as two scientific papers in international journals. Continued development of the Geologic Database of Information on Volcanoes in Alaska (GeoDIVA) and a whole-rock geochemical database, which has resulted in the single largest body of geochemical data on Alaska volcanoes.
- Continued maintenance and construction of the AVO internal and external World Wide Web sites, helping to improve public safety by providing timely and accurate information for AVO scientists, the general public, management agencies, the aviation industry, local communities, and others who may be impacted by the nearby or distant effects of volcanic eruptions. These pages have become instrumental in daily monitoring of volcanoes and are technologically at the cutting edge worldwide. Each month the AVO Web site is accessed about 10,000 times and about 45,000 pages are viewed.

Geologic Information Management and Delivery

- Produced 83 new geologic maps and 9 new reports for publication, including Alaska's Mineral Industry annual report for 2003 and two newsletter issues.
- Updated and reprinted the popular *Guide to Alaska Geologic and Mineral Information* (Information Circular 44) with funds provided by the Minerals Data & Information Rescue in Alaska (MDIRA) program. It will be distributed at no charge at libraries and public information centers and is available in digital form on the DGGS Web site.
- Sold 2,130 professional maps and reports, distributed approximately 225 free educational publications, and responded to about 1,000 significant geologic information requests.
- Expanded GERILA (Geologic & Earth Resources Information Library of Alaska) database into a multiple environment database and began populating it with datasets including geologic information and the DGGS publications index.
- With federal funding, completed the work to put the final group of DGGS publications online, achieving the objectives of the DGGS scanning project. Scanned all USGS Professional Papers and Bulletins on Alaskan geology to prepare to make them available on the DGGS Web site.
- Added maps to the Web-accessible Map Index application for all published geologic maps in Alaska.

Geologic Materials Center

- Hosted 427 visitations to the Alaska Geologic Materials Center in Eagle River by industry, government, and academic personnel to examine rock samples and processed materials. These visitations generated 1,242 new processed oil & gas related microscope slides and 7 hard-rock mineral and oil & gas technical data reports that are now available for public examination.
- Received, stored, and inventoried five 40 ft trailer loads of rock samples representing collections from BP Exploration (Alaska) for arctic Alaska, Union Oil Co. of California Amoco for Cook Inlet, CIRI hard-rock mineral core and oil/gas well-sample collections, Kinross Gold Corp. and Kennecott hard rock mineral core collections, a major part of the DGGS surface-rock collection, and the released Alaska Oil and Gas Conservation Commission and U. S. Minerals Management Service well samples. In total, rock samples for over 163 oil & gas wells, representing 1,073,907 ft of well samples, and 21 hard-rock mineral holes representing 6,294 ft of hole sample in 665 core boxes, were received during FY 2004.
- Received for storage the Anaconda geologic/technical map collection for Alaska that was donated to the University of Alaska Anchorage by Cook Inlet Region Inc. The Alaska GMC will house this map collection for the Alaska Resources Library and Information Services (ARLIS).
- Completed an inventory of the U. S. Geological Survey oil/gas well rock-sample collection at the GMC; this inventory has been added to the master GMC digital inventory database.

KEY ISSUES FOR FY 2005-2006

Escalating Cost of Field Operations

Rising costs of field operations, general fund budget reductions, and a tightening of federal funding sources because of Homeland Security issues decrease DGGS' ability to accomplish its mission. During the past 3 years, DGGS field operation costs have risen about 20 percent for geologic ground-truth geologic mapping and nearly 40 percent for airborne geophysical surveys. Much of DGGS's most valuable work for Alaska is done on the frontiers of our state. Our work provides the geologic framework that is used by the private sector to guide new energy and mineral 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 to logistical supply costs. Our remote field programs have always required fixed-wing and helicopter support for daily access. These costs are rising dramatically. For example, our field parties utilize up to 4 hours of helicopter flying time per day to deploy and recover team members. The cost of that daily flight time has escalated yearly: $2050 in 2000, $2680 in 2001, $2708 in 2002, and $3170 in 2003. With a level or declining budget, DGGS cannot meet this kind of cost escalation while maintaining current information quality and annual field area coverage.

Geologic Information Accessibility

DGGS products and services are specifically aimed at supporting statewide economic development and the mitigation of natural geologic hazards that are often at the heart of the issues faced by the above clients. DGGS faces increasing demand for: 1) more widespread and faster access to geologic data; 2) rapid delivery of special-purpose customized presentations of geologic data in response to unique critical needs; and 3) remote delivery of active digital files of the original underlying geologic, geochemical, and geophysical data used to produce our published products. The key to meeting these demands is the use of state-of-the-art computer technology. During FY01, DGGS secured Federal funding to convert all of its maps and reports to digital format. These maps and reports were made accessible on the Internet in FY02. Funded by Federal grants, we are implementing a Division-wide geologic database management system. This system will become part of a comprehensive Internet accessible State-Federal interagency geologic information system that will allow the public to download active digital data files of original DGGS numeric, text, and graphical geologic data via the Internet.

Another challenge has been the recovery of previously generated geologic data that has been all but lost over the years because of the lack of resources for effective and sustained data management. As part of the current geologic data management project, DGGS and cooperating federal agencies are developing an enterprise geologic information-management system and incorporating the system into their business practices. We view this effort as the last chance to recover and stabilize decades of Alaska geologic information that is important to the minerals, oil, and gas resource industries and would otherwise be forever lost. Preserving this information and making it available for present and future generations will require state commitment to its ongoing component of this system.

Commercial Energy

New oil and gas exploration in Alaska is increasingly being undertaken by smaller, independent petroleum companies that lack the depth and experience of the major oil companies. The independent companies rely heavily on publicly available geologic data on Alaska's sedimentary basins. In addition to providing this information, DGGS makes available the opportunity for these companies to sponsor and participate in field studies that provide a better understanding of the geologic framework of potential hydrocarbon sources in active and future lease areas. To this end, we actively seek both independent and major company partners in this program through frequent meetings with industry groups.

DGGS responds to many inquiries from companies seeking the geologic information that will assist their exploration efforts in Alaska. The challenge for DGGS is to meet the geologic needs of accelerated leasing and exploration licensing with limited staff and financial resources. We have redirected internal resources toward oil & gas geology to the extent possible and have been successful acquiring external funding from the federal government and industry. One way in which we have met these challenges with minimal increase in permanent state staff is to involve contract geologists, university faculty, student interns, industry partners, and occasional nonpermanent employees in multi-organization cooperative projects. A modest increase in the FY06 budget for this program will allow DGGS to provide the exploration-critical geologic data to meet the needs of the state's accelerated leasing schedule.

Rural Energy

The lack of developed sources of local energy in rural Alaska is a continuing problem that DGGS is addressing through its shallow gas program. First funded through a CIP appropriation in FY97, DGGS conducted an initial survey of the state to identify areas that have potential for supplying coalbed methane for local consumption. That work identified three high priority sites and a number of other sites of lower, but significant promise. Subsequent work has been largely funded by supplemental Federal grants. The work is now at a stage that test drilling is needed at three high-priority sites to determine whether coalbed methane gas is present in useful quantities in the subsurface. In 2003, DGGS secured Federal funds to obtain a light-weight slim-hole drill rig and to conduct a Federal and State cooperative exploratory drilling effort at Fort Yukon. The goal of the project is to evaluate the coal gas content beneath the community and confirm to seismic horizons tested in 2000. The use of the light weight drill rig has been successful, and additional federal funds are being sought to explore the other rural areas that have potential for shallow gas energy resources.

Major Pending Infrastructure Projects and Geologic Hazard Assessments

Alaska may be on the threshold of a major development cycle similar in scale to the construction of the trans-Alaska oil pipeline. There is increasing activity among industry and government to seek ways to expedite the construction of a delivery system to the Lower-48 for North Slope natural gas and possible extension of the Alaska Railroad to Canada. A fundamental and prudent first step in undertaking infrastructure development enterprises of this magnitude is a comprehensive, public geologic-resource evaluation and geologic-hazard assessment of the greater land corridors through which such construction must pass. Such assessments should be made prior to finalizing detailed alignments and prior to detailed geotechnical engineering assessments of those alignments and as a basis for evaluating permit applications.

By statute AS 41.08 DGGS is charged to determine the potential geologic hazards to buildings, roads, bridges, and other installations and structures as well as inventorying the state's geologic resources, but current funding is inadequate to fully meet this mandate. Prior knowledge of the kind and extent of geologic hazards affecting these projects is the first step in reducing future economic losses and casualties from the hazards. Such knowledge can be factored into design criteria to improve public safety, decrease long-term maintenance costs, and decrease the cost of reconstruction resulting from encountering unforeseen obstacles. Additionally, knowledge of geologic resources in the vicinity of the transportation corridors may improve their projected economic feasibility and identify sources of construction materials.

DGGS FY05 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 FY05 DGGS program is focused on projects designed to foster the creation of future Alaskan jobs and revenue, seek more economical energy sources for rural communities, and to mitigate adverse effects of geologic hazards. To maintain general prosperity, Alaska must encourage major capital investment for job creation in the state. In the near 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.

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 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 hazards. 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 exigencies 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 data or voucher samples existing in substandard storage sites or in a mode in which data may be subject to irretrievable loss or degradation, or may be unavailable to meet the needs of its intended users. A liaison committee comprising representatives from the Alaska Miners Association, Alaska Federation of Natives, University of Alaska, Alaska Department of Natural Resources, and independent mining industry consultants guides the implementation of the Alaska minerals data rescue efforts through a Federally funded program entitled *Minerals Data and Information Rescue in Alaska (MDIRA)*. Projects supported in whole or in part by this program are being undertaken by the Mineral Resources and Geologic Communications sections. In the FY05 Program Summaries that follow, MDIRA projects are indicated by an asterisk (*).

FY05 DIVISION EXPENSE BUDGET
(amounts in thousands of dollars)

Section	General Fund	CIP	Federal receipts	Interagency receipts	Program receipts	Total by section
Energy Resources	485.0	190.0	443.8[1]	0.0	165.0	1,283.8
Mineral Resources	300.0	200.0	612.0	0.0	0.0	1,112.0
Engineering Geology/AVO	175.0	0.0	1,387.9	37.0	0.0	1,599.9
Geologic Communications	335.0	0.0	710.9	10.0	25.0	1,080.9
Geologic Materials Center	50.0	0.0	76.5	200.0	0.0	326.5
Administrative Services	340.5	0.0	0.0	0.0	0.0	340.5
Total by funding source	**1,685.5**	**390.0**	**2,921.2**[1]	**557.0**	**190.0**	**5,743.7**

[1]*Includes $310.0K in federal funds received through Reimbursable Services Agreements with the University of Alaska Fairbanks*

PROGRAM SUMMARIES

STATE GEOLOGIST/DIRECTOR

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

OBJECTIVES

1. Provide executive leadership for the Geological Development Component and act as liaison between the Division and the DNR Commissioner's Office, other state agencies, legislature, and local, federal, and private entities.
2. Stimulate discovery and development of the geologic resources of the state through implementation of detailed geological and geophysical surveys.
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 Improvements budget, interagency programs, and federal initiatives.
- Inform Alaska state legislators, Governor's office, and Alaska federal delegation about the DGGS geologic program and its significance.
- Focus the Division's geologic expertise on addressing Alaska's highest priority needs for geologic information.

ENERGY RESOURCES

The Statewide Energy Resource Assessment program produces new geologic information about the state's oil, gas, and coal resources. With the current reduction in oil-generated revenue to the state's economy resulting from declining oil production, new significant hydrocarbon discoveries are needed to maintain or increase major revenue payments to the state. There is a continual need for acquisition of fundamental geologic data using modern concepts and techniques to enable industry to better focus its exploration in prospective areas beyond the core Prudhoe Bay area. Recent DGGS work in the central and western North Slope is stimulating industry interest in the west-central Brooks Range foothills. DGGS studies include acquiring new geologic data that assist exploration for new gas supplies for the proposed natural gas pipeline. Therefore, in FY05 this program continues to focus significant effort on frontier state lands in the central North Slope, within the southeastern corner of the National Petroleum Reserve—Alaska (NPRA), and on prospective state lands east of the Trans Alaska Pipeline.

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 are an immediate 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.

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

The Statewide Energy Resource Assessment program also is pursuing a solution for village and commercial enterprise energy needs in rural Alaska by drilling and testing shallow gas resources at an Interior Alaska community. The program is working to implement a comprehensive statewide coal resource data file and provide the energy component of an integrated DGGS geologic data management system.

The numerous elements of the Statewide Energy Resource Assessment program are financed from a mixture of funding sources: General Fund, 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 supports oil and gas industry exploration in the Bristol Bay Basin and Alaska Peninsula region.
3. Identify sources of energy in rural Alaska for the local generation of heat and power.
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.

FY05 ENERGY RESOURCES PROJECTS

Detailed project summaries for the following energy resources projects appear in the section *Project Summaries—FY05*:

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

1. Upon request, provide written evaluations of minable coal potential for lease areas in response to requests from Division of Mining, Land and Water Management.
2. 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 (estimated 80 responses).

MINERAL RESOURCES

The decline of oil-generated revenues suggests that Alaska must move decisively to strengthen a broader subsurface resource economic base. To achieve this goal, Alaska needs private-sector commitment of capital and talent in non oil-related as well as oil-related industries. The mineral industry, however, will not commit major company resources or succeed on an acceptable timeline without dramatic advances in understanding the geologic environments of the most prospective Alaska lands open to mineral and other geologic resource development.

Alaska has an accessible state land endowment of more than 100 million acres, much of it chosen from a 350-million-acre land pool because of perceived potential to host mineral wealth. Currently the overwhelming majority of these lands are not geologically or geophysically surveyed at the detailed level or with the focus needed to optimize mineral discovery and development. Recently, a DNR/DGGS program of integrated geological and geophysical mapping has been effective in attracting new private-sector mineral investment capital to Alaska. The purpose of the FY05 Statewide Mineral Resource Appraisal Project is to produce, on a prioritized schedule, the critical new geological surveys needed to sustain Alaska's mineral industry investments and provide management agencies with information needed to formulate rational management policy.

The Statewide Mineral Resource Appraisal project 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.

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

OBJECTIVES

1. Catalyze increased mineral resource exploration in three mining districts within the next three years.
2. Provide DNR, other state agencies, and the public with unbiased, authoritative information on the mineral resources of the state so that rational land policy and investment decisions can be made.
3. Provide an accurate current statistical and descriptive summary of the status of Alaska's mineral industry for calendar year 2004.

FY05 MINERAL RESOURCES PROJECTS

Detailed project summaries for the following Mineral Resources projects appear in the section *Project Summaries—FY05*:

* MDIRA-supported project (see p. 13)

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

1. 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.
2. 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.

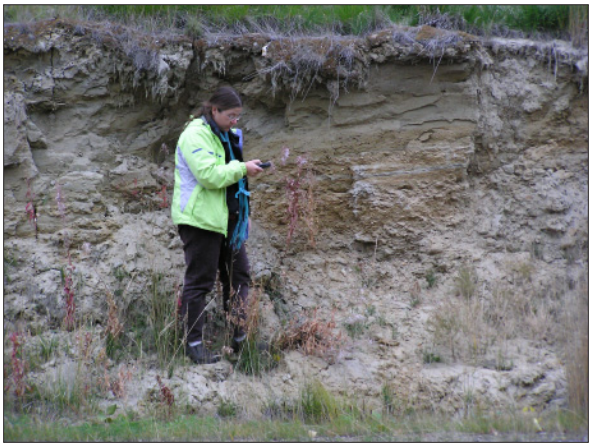
ENGINEERING GEOLOGY

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, and landslides help predict the likelihood of future major events, forecast the severity of hazards associated with them, and suggest alternatives to avoid or reduce the effect of these hazards. In addition to General Funds, several elements of the Statewide Engineering Geology Program are partially or largely financed from Federal Receipts.

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

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

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



OBJECTIVES

1. Help protect 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 participatation with Minerals Resources mapping teams.

FY05 ENGINEERING GEOLOGY PROJECTS

Detailed project summaries for the following Engineering Geology projects appear in the section *Project Summaries—FY05*:

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 (estimated 250-300 responses annually).
- As part of the Alaska Coastal Management Program, conduct reviews of Coastal Policy Questionnaires and consistency applications to determine compliance with the program's geophysical hazards standard (6 AAC 80.050).
- Conduct post-event hazard evaluations in response to unexpected major geologic events (e.g., earthquakes, volcanic eruptions, and landslides), providing timely information dispersal to the public via electronic as well as traditional methods, and providing event and continuing hazard information to appropriate emergency management agencies.

GEOLOGIC COMMUNICATIONS

The Geologic Communications Section staff edits, designs, publishes, and disseminates technical and summary reports and maps generated by the Division's technical projects about Alaska's geologic resources. The maps and reports released through this section are the state's primary vehicle for widely disseminating factual information and data relating to its subsurface mineral and energy wealth, its geologic construction materials, and its geologic hazards. These printed and/or digital-format documents focus attention on Alaska's most geologically prospective and useful lands and are the authoritative geologic basis for many of the state's resource-related land policy decisions. They also encourage geologic exploration investment leading to resource discoveries and subse-quent major capital investments. Timely availability of geologic information from DGGS is a significant factor in stimulating Alaska's economy and mitigating the adverse effects of geologic hazards. The geologic information desk staff provides information to the public on a wide range of topics including mineral and energy resources, prospecting, earthquakes, volcanoes, and permafrost, and assists customers in understanding geological and geophysical maps and data. Staff also manages sales of geologic reports, maps, and data and prepares displays and represents the division at geologic conferences and events.

The section produces an annual report summarizing division activities and accomplishments; publishes newsletters to communicate division progress and advertise recent publications; designs, edits, and produces technical and edu-cational 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 Web site <http://akgeology.info>. This project is led by a geologist from the Minerals Resources Section but is largely implemented by the Geologic Communications section.

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

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

OBJECTIVES

1. Disseminate new, accurate, unbiased, Division-generated data on the geology of Alaska to the public at large, to DNR policy and regulatory groups, and to all other interested parties within one year of its acqui-sition.

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.

FY05 GEOLOGIC COMMUNICATIONS PROJECTS

Detailed project summaries for the following Geologic Communications projects appear in the section *Project Summaries—FY05*:

*MDIRA-supported project (see p. 13)

GEOLOGIC MATERIALS CENTER

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

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

OBJECTIVES

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

A detailed project description for the Geologic Materials Center appears in the section *Project Summaries–FY05* (p. 61).

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; negotiating a contract for field helicopter services; administering and monitoring grants and contracts; tracking and reporting project expenditures to ensure cost containment within budget for all projects; mail/courier services; assistance in personnel matters; petty cash; and any other support necessary to further increased efficiency or savings in acquiring knowledge of the geology of Alaska.

OBJECTIVE

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

TASKS

- Monitor grants and contracts (Federal, Interagency, and Program Receipts) to ensure deliverables are produced on schedule and within budget; ensure expenses are properly billed against grants and contracts and receipts are collected promptly.
- Provide accurate, timely reporting of project expenditures and current balances; encourage prudent money management.
- Decrease the cost of transportation to the field by coordinating personnel travel and supply shipments; negotiate long-term helicopter contracts in cases where helicopters are necessary; coordinate Division vehicle use and decrease 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—FY04

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.

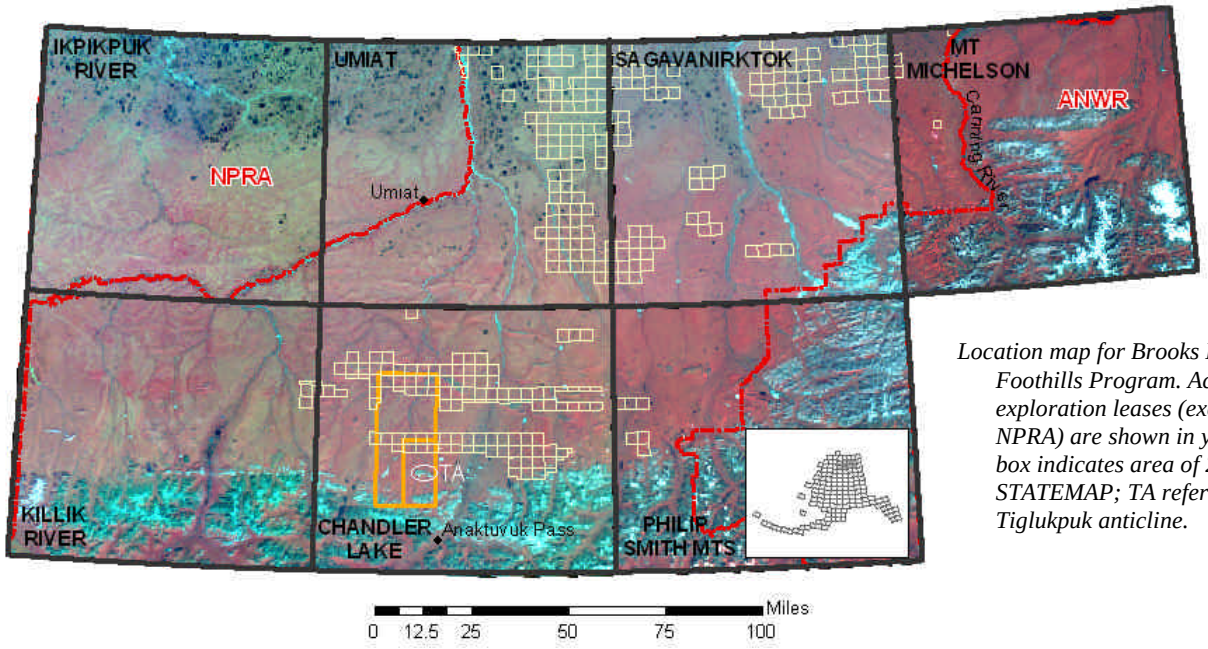
The overviews of the following 40 projects that are being pursued by DGGS in FY05 span the scope of our legislative mission statement. Each of these projects is making a positive difference for Alaska. Many are implemented through various cooperative agreements with other state and federal agencies, universities, in-house project teams, and contracts. We leverage state General Funds through these arrangements so that the Division's work provides the greatest possible benefit from the public's investment.

CONTENTS

*MDIRA-supported project (see p.13)

BROOKS RANGE FOOTHILLS 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 (see map). This program was developed in response to the need for high quality, publicly available geologic data to stimulate exploration for hydrocarbons in northern Alaska. 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, the United States Geological Survey, the University of Alaska, and others.



Location map for Brooks Range Foothills Program. Active exploration leases (excluding NPRA) are shown in yellow; gold box indicates area of 2004–2005 STATEMAP; TA refers to Tiglukpuk anticline.

During the 2004 field season, the program continued to focus on detailed stratigraphic studies of key reservoir and source rock intervals in the foothills of the central Brooks Range, south of the National Petroleum Reserve–Alaska (NPRA) (see map). Preliminary results from this work indicate the presence of a previously unrecognized succession of pre-Aptian (Early Cretaceous) rocks in this portion of the Colville Basin. The program also continued to analyze potential carbonate reservoirs within the Carboniferous Lisburne Group. Sulfurous springs emanating from these carbonates were discovered along the northern limb of the Tiglukpuk anticline (see map). The origin of gas vented at these seeps is unclear, but corroborates many other lines of evidence suggesting the foothills belt represents an active hydrocarbon habitat. In addition to stratigraphic studies, new emphasis was placed on constructing a detailed structural cross section through the foothills, documenting the geometry, structural style, and timing of deformation—all of which influenced hydrocarbon maturation and migration. Reconnaissance field work was also conducted in the Canning River area of the eastern North Slope during 2004 (see map). This study reflects a new direction for this program, moving northeast to assess the development of the Upper Jurassic–Lower Cretaceous Beaufortian sequence. Preliminary stratigraphic findings include the recognition of an anomalous Jurassic(?) succession beneath the regionally significant Lower Cretaceous unconformity (LCU). The presence of this previously unrecognized facies may suggest a more complicated pre-LCU paleogeography, perhaps controlled by Early Cretaceous normal faults.

Notable upcoming publications from this program: (1) a synthesis of nearly a decade of organic geochemical studies conducted by DGGS, (2) the final report on sequence stratigraphy and reservoir architecture of the Nanushuk and Torok Formations, and (3) a basin analysis of the Fortress Mountain Formation (all anticipated in spring FY05). Additional products will include reports summarizing measured stratigraphic sections, structural cross sections, paleontologic data, provenance studies, and reservoir quality analyses (released during winter and spring FY05).

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SIKSIKPUK RIVER STATEMAP PROJECT

DGGS proposed this geologic mapping project in the Siksikpuk River area of the Chandler Lake Quadrangle as part of the USGS-funded FY04 STATEMAP program. The mapping is the second year of field work for a previously proposed 2-year project. The area lies on the southern limit of Alaska's remote North Slope, long known for its petroleum potential. This portion of the northern Brooks Range foothills is thought to be strategic for natural gas in particular, and is currently under lease to both major and smaller independent petroleum exploration companies. New mapping in this area provides an opportunity to study, in outcrop, the stratigraphy and structural styles of the source and reservoir rocks that enrich the Colville basin to the north. The proposed mapping (see figure) will extend structural and stratigraphic models developed during previous mapping along the foothills to the west, providing baseline geologic data to the private and public entities that identify, develop, and manage resources that area.

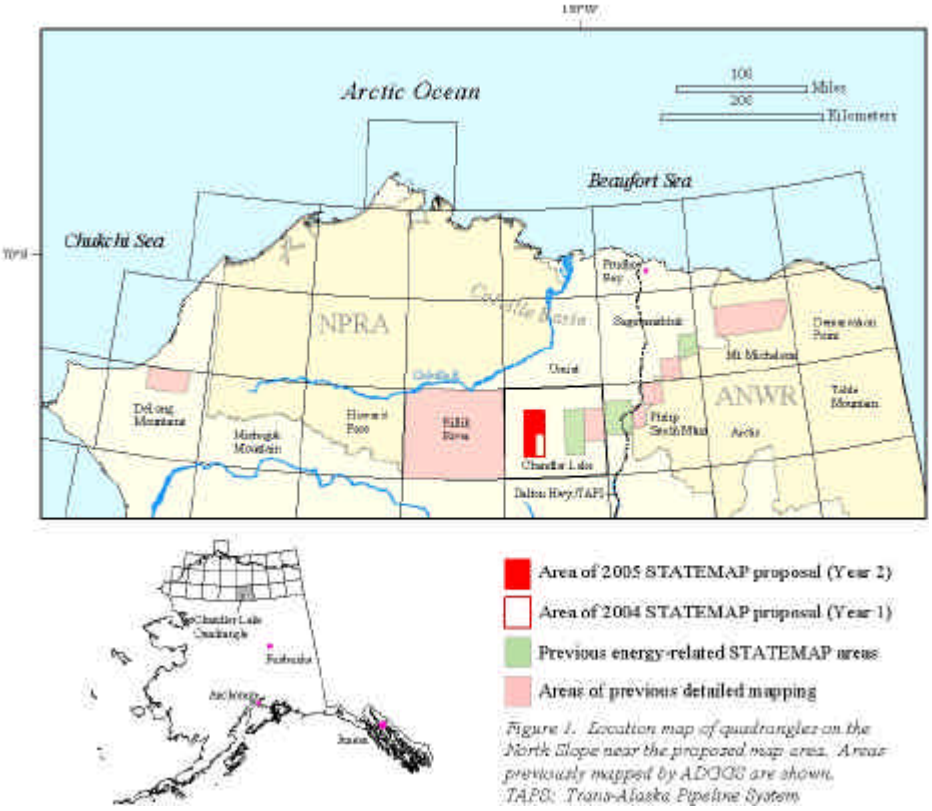

Figure 1. Location map of quadrangles on the North Slope near the proposed map area. Areas previously mapped by ADGGS are shown. TAPS: Trans-Alaska Pipeline System.

DGGS will augment this STATEMAP mapping project with detailed stratigraphic, sedimentologic, and structural studies. Our stratigraphic analyses include detailed observations of key formations from which we develop representative geologic models. Sedimentologic investigations include both hydrocarbon source and reservoir potential studies. Sampling and analyses will include geochemistry to identify source rock potential and to differentiate between similar lithologies. Paleontologic analyses will be performed to define and correlate units and to identify source potential. Isotopic age determinations may be used to date minerals where appropriate to model uplift histories. Thin section samples will also be collected for petrographic determination of lithology and microfacies to differentiate units, characterize porosity and permeability, and determine sediment transport pathways. Porosity and permeability testing of samples will also help define their reservoir potential. All of the above studies will contribute to interpretations of structural relationships and resource implications.

DGGS mapping and associated research in the map area support not only new foothills exploration by industry currently active on the North Slope, but also encourage smaller companies to enter the region as well. Products of this two-year project will include a published GIS-based comprehensive geologic map and reports of analytical results. Preliminary results and a draft geologic map will be released by DGGS at the end of the first year (mid 2005). The analytical data, geologic map, and interpretations will be published in final form at the end of the second project year.

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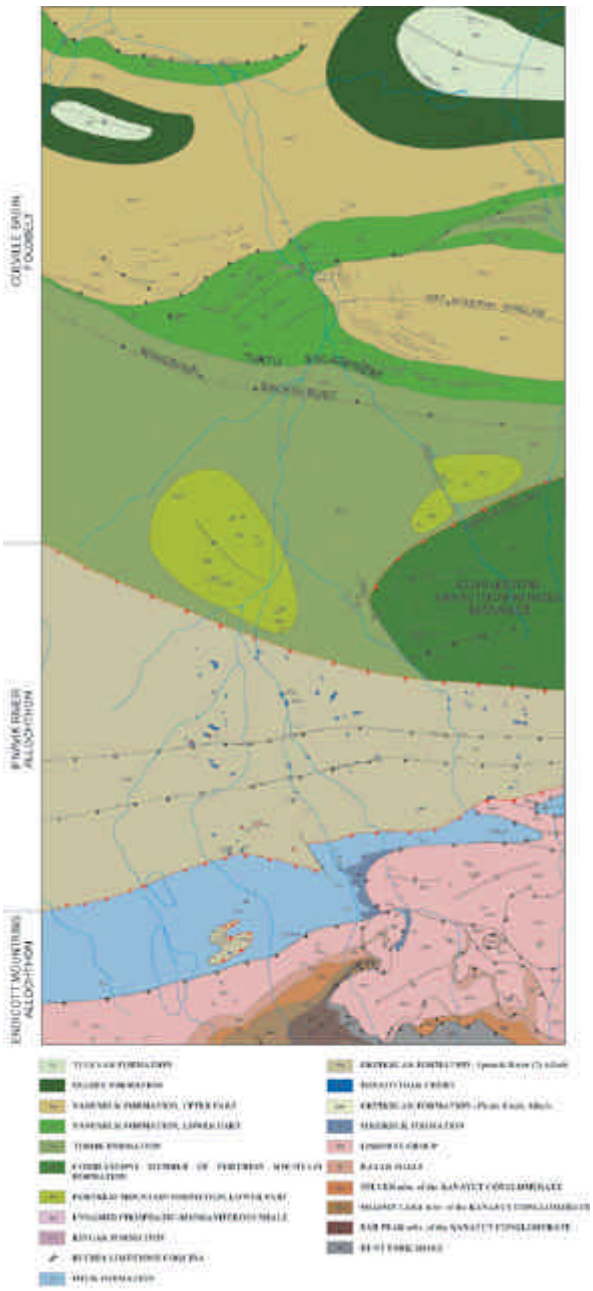
KANAYUT RIVER STATEMAP PROJECT

Geologic mapping in the Kanayut River area of the Chandler Lake Quadrangle is part of the National Cooperative Geologic Mapping Program, which partners with the U.S. Geological Survey and state geological surveys to prioritize the geologic mapping requirements of the nation, and to promote publication of geologic maps. The Kanayut River area was selected for detailed geologic mapping because it encompasses stratigraphic and structural elements important to understanding the geology and oil and gas potential of the central Brooks Range foothills belt and the adjacent North Slope. Surface geology mapped in the Kanayut River corridor can then be correlated to geology mapped elsewhere in Arctic Alaska and to subsurface stratigraphic units in the Prudhoe Bay–Kuparuk area, the Colville Delta, and to recent exploration wells drilled in northeastern NPRA. Recent oil discoveries in the northeastern NPRA and on adjoining State lands immediately to the east have generated strong interest in new exploration play concepts for Jurassic and Cretaceous strata in frontier areas of the North Slope. This interest is reflected in recent State and Federal lease sale results. In addition, the growing demand for natural gas has resulted in considerable interest in the Brooks Range foothills belt as a viable gas province. Many petroleum explorationists, particularly those in smaller companies that are newcomers to Alaska geology, rely on DGGS for continuity of mapping and stratigraphic studies to improve understanding of the geologic framework of the North Slope and advance their search for hydrocarbons.



During the summer of 2003 DGGS conducted geologic field mapping in the Chandler Lake C-2 and northern half of the B-2 quadrangles. Objectives included: (1) conducting stratigraphic studies of key map units including the Kanayut Conglomerate, Lisburne Group, Okpikruak Formation, Fortress Mountain Formation, and the Torok and Nanushuk formations to support map unit descriptions and facies interpretations; (2) evaluating the reservoir potential of selected map units; (3) correlating map units and structural interpretation of the Ellesmerian and Lower Brookian sequences to understand the structural transition from parautochthonous rocks of the northeastern Brooks Range to allochthonous rocks of the north-central Brooks Range and adjacent foothills belt and to constrain the timing of deformation; (4) sampling for organic geochemical analysis to evaluate hydrocarbon source rock potential in upper Triassic through Lower Cretaceous rocks; and (5) petrographic studies to differentiate units and define provenance for Lower Brookian rocks. Results from these studies have been compiled to produce preliminary maps at 1:63,360 scale: (1) A bedrock map with supporting text and diagrams; (2) A surficial geologic map; and (3) A construction material resources and geologic hazards map. In addition, numerous talks and poster sessions have been presented at professional meetings to disseminate the results of our studies.

These maps will advance DGGS's 1:63,360-scale geologic mapping westward along the Brooks Range mountain front and adjacent northern foothills. A final comprehensive geologic map, a surficial geologic map, and a construction material resources and geologic hazards map will be published spring 2005. All samples will be archived and available in a geographically referenced relational database.

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ALASKA NORTH SLOPE GAS HYDRATE ENERGY RESOURCE EVALUATION

Gas hydrates may become an important global source of clean burning natural gas. Gas hydrates are potentially a large untapped onshore energy resource that is thought to underlie a large area of the North Slope of Alaska within the hydrate pressure–temperature stability field (fig. 1A). While methane, propane, and other gases can be included in the hydrate structure, methane hydrates appear to be the most common in nature. To develop a complete regional understanding of this potential energy resource, DGGS, USGS, and BLM have entered into an Assistance Agreement to assess gas hydrate energy resource potential in northern Alaska. The primary objective of this project is 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. This project will actively collaborate with the BP-Alaska–U.S. Department of Energy (USDOE) methane hydrate research project, which is presently evaluating the energy resource potential of the known gas hydrate accumulations in and around the Prudhoe Bay oil field.

Gas hydrates are naturally occurring ice-like substances composed of water and gas, in which a solid water-lattice accommodates gas molecules in a cage-like structure. Gas hydrates are widespread in permafrost regions and beneath the sea in sediment of outer continental margins. The amount of methane sequestered in gas hydrates is probably enormous, but estimates of the amounts are highly speculative. The production history of the Russian Messoyakha gas hydrate field demonstrates that gas hydrates are an immediate source of natural gas that can be produced by conventional methods. The production potential of the Eileen or Tarn gas hydrate accumulations (fig. 1B) has not been adequately tested, but it is the present focus of two USDOE-led industry R&D gas hydrate research programs. Numerous technical challenges must be resolved before this potential resource can be considered an economically producible reserve.

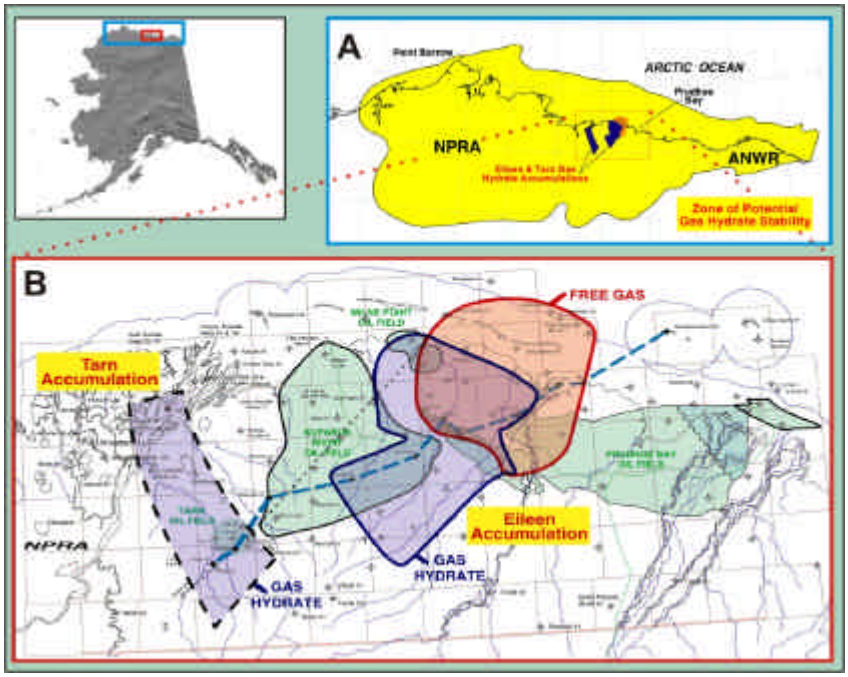

Figure 1. A. Stability field of North Slope gas hydrates.
B. Eileen and Tarn gas hydrate accumulations of the Prudhoe Bay area.

The BLM–USGS–DGGS Alaska gas hydrate assessment project is divided into three concurrent phases over 5 years. Phase I will study the known gas hydrate accumulations within and near existing development infrastructure of the Eileen and Tarn trends. Phase II will identify and characterize undiscovered gas hydrate accumulations in NPRA, ANWR, and the other relatively sparsely drilled areas between the Canning and Colville rivers. Phase III will develop a comprehensive assessment of the recoverable resource potential of gas hydrates and associated free-gas accumulations in northern Alaska.

DGGS and BLM are currently evaluating pingo growth along fault zones in the Eileen trend area as a tool for detecting subsurface gas hydrates seeps. A preliminary report detailing the presence and form of pingos along the subsurface fault zones in the Eileen area will be released in FY04. If successful, further work in FY05 will expand the pingo–fault study westward into NPRA, and field sampling of ice cores from pingos will be conducted to analyze for gas hydrate presence.

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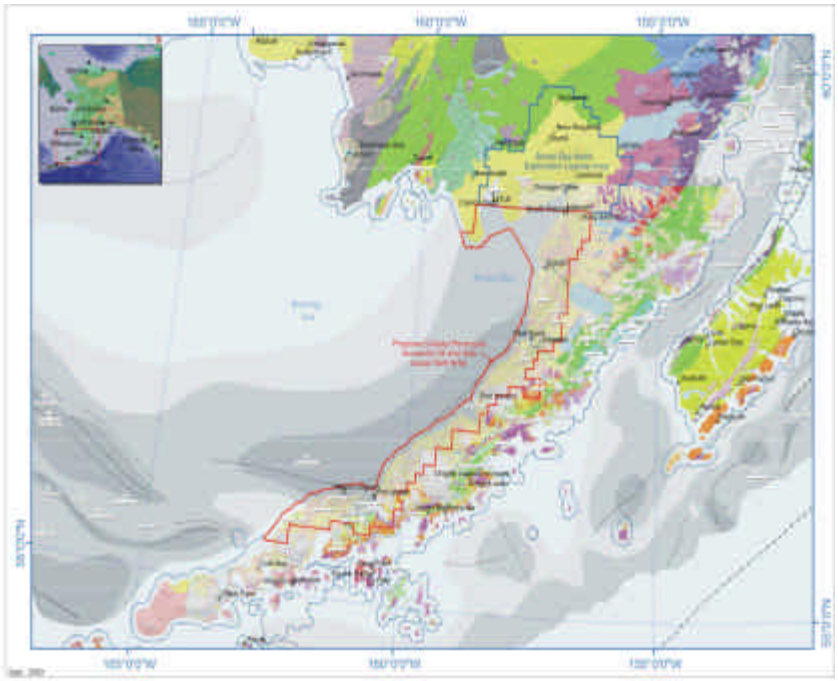
BRISTOL BAY, FRONTIER BASIN, ALASKA PENINSULA: HYDROCARBON RESOURCES, PETROLEUM RESERVOIR CHARACTERIZATION, AND SOURCE POTENTIAL

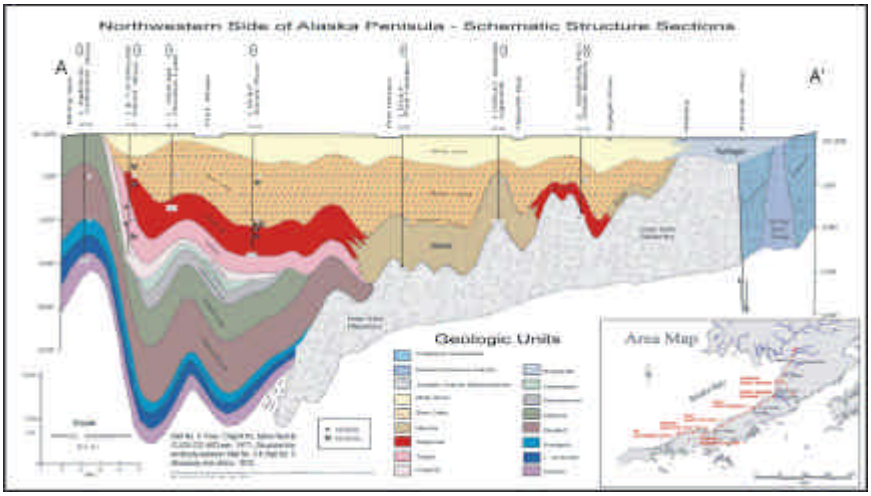
This program is a 3-year research effort funded by the U.S. Department of Energy's Alaska Energy Technology Development Laboratory, the Division of Geological & Geophysical Surveys (DGGS), the Division of Oil & Gas (DOG), Bristol Bay Native Corporation, and the U.S. Geological Survey (USGS). The project is a collaborative effort with geologists from Purdue University and University of Alaska Fairbanks. Our new field data will codify the fundamental reservoir characteristics of potential basin targets, place the reservoir data in a stratigraphic and sequence stratigraphic framework, and summarize the hydrocarbon potential of this frontier basin. All data will be published in peer-reviewed DGGS reports and accessible on our Web site. Project data and reports will catalyze future lease interest and new exploration, particularly by small, independent companies, in scheduled state oil and gas lease sales. All rock samples and data will be archived at the DGGS Geologic Materials Center, Eagle River.



New outcrop-based data addressing hydrocarbon resource estimates encompassing state-owned onshore and 3-mile-limit waters of Bristol Bay basin and Alaska Peninsula are 300 to 500 million barrels oil and 3 to 5 trillion cubic feet (TCF) gas. Unconventional gas resource evaluation awaits coal adsorption data.

Offshore federal water resource estimates are 230 million barrels of oil and natural gas liquids, and 6.8 TCF gas (mean values: U.S. Minerals Management Service report, Sherwood, 2000).

Oil seeps (one-half barrel of oil per day with an oil viscosity of API ~18) from the Jurassic Shelikof Formation. Triassic age, shallow-water limestone of the Kamishak Formation yields total organic carbon (TOC) to 2.4%, hydrogen index (HI) of 598 and 474, and oxygen index (OI) of 21 and 22. The Jurassic Naknek Formation sample yields 2.2% TOC, and locally includes tens of meters of oil-charged (dead or decomposed) delta-front sandstone. The main reservoir play is the 9,000-foot-thick, Miocene-age Bear Lake Formation. The Bear Lake yields porosity and permeability from 1 to 35% and 0.001 to 1,000 millidarcies based on samples from both outcrop and the North Aleutian COST #1 core. The COST well was drilled to 17,155 feet, all in Tertiary rock.



Measured sections (1,800 feet) of Bear Lake include >33 feet of coal, and sand/shale ratio of 50:1. Upper Cretaceous rocks also include thick coal. More than 20 wells have been drilled on the Alaska Peninsula; most reported oil and gas shows, but none has produced.

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RESERVOIR CHARACTERIZATION OF TIGHT SANDS, COOK INLET BASIN

Reservoir characterization is the detailed and complex process of identifying and quantifying properties that influence the distribution and migration of oil or gas within a reservoir. Studying the geologic details of tight sandstones that are potential reservoirs allows simulation of economic scenarios essential to reservoir development and production management. This project is a federally-funded, one-year joint grant with the University of Alaska Fairbanks and includes a coalbed methane water disposal study.

The Cook Inlet Basin (fig. 1) covers some 14,000 square miles and is locally filled with more than 25,000 feet of Tertiary non-marine sediments. The Cook Inlet project has investigated and summarized the reservoir characteristics of a representative collection (50) of Cook Inlet tight sandstone units. These include the Eocene West Foreland Formation, Oligocene Hemlock Formation, late Oligocene to middle Miocene Tyonek Formation, upper Miocene Beluga Formation, and Pliocene Sterling Formation. Oil production occurs from the Tyonek, Hemlock, and West Foreland formations.

Figure 1. Cook Inlet basin occupies the area bounded by faults.

Two types of gas occur in Cook Inlet: Associated and nonassociated. Associated gas occurs with oil reservoirs in the West Foreland, Hemlock, and lower Tyonek formations (fig. 2), has heavy hydrocarbon signature, and exhibits a carbon isotope ratio that links it with a Jurassic source. Nonassociated gas occurs in the upper Tyonek, Beluga, and lower Sterling formations from less than 7,500 feet. This gas is dry and has a carbon isotope ratio that indicates its source as coals in the Tyonek, Beluga, and Sterling formations. Both gas types occur in the Tyonek, Beluga, and lower Sterling formations. The current study will provide publicly available data about the reservoir quality of a representative suite of sandstones from the Tertiary age section.

Fifty samples have been collected from Cook Inlet drill core. These core samples have been analyzed for petrophysics, including porosity and permeability, grain density, grain volume, bulk volume, sample weight, and capacity for flow to nitrogen. Detailed petrography and point count (400 framework grains per thin section) will be completed on 25 thin sections. The specific clast composition of sandstone is fundamental to understanding its reservoir potential and for understanding sandstone provenance. Grain types, grain boundaries, grain interfaces, and cement types and timings are factors controlling reservoir characteristics, and critical to oil and gas assessments. Core information is placed in a regional framework by integrating generalized seismic-profile data at the Alaska Division of Oil and Gas. The DGGS final report has been peer-reviewed for publication in January 2005, and will be available from the DGGS Web site. All rock samples, locations and report will be archived at the DGGS Geologic Materials Center, Eagle River, Alaska.

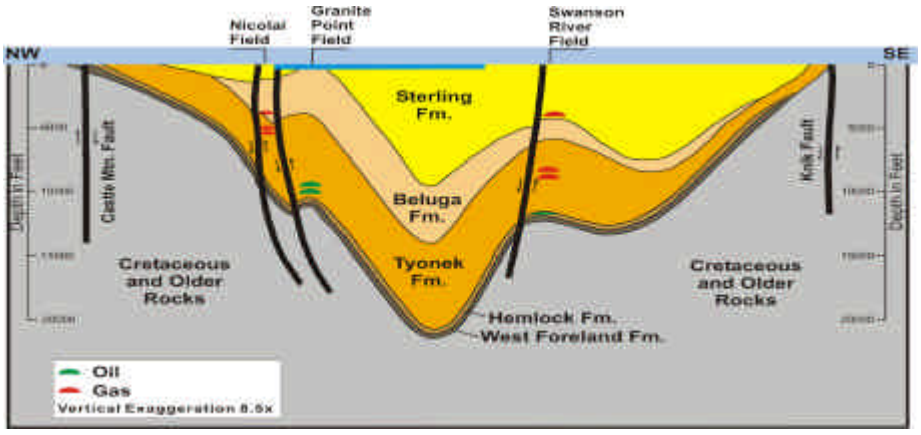

Figure 2. Diagrammatic geologic cross section of Cook Inlet basin.

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COALBED METHANE FOR RURAL ALASKA ENERGY

Coalbed gas is a low-cost clean-burning fuel that is comparable in heating value (~1,000 Btu/scf) to conventional natural gas. Coal seams underlie many rural Alaskan villages that currently depend on expensive diesel fuel for heating and electrical power generation. A cooperative effort between the Division of Geological & Geophysical Surveys (DGGS), U.S. Department of Energy Arctic Energy Office, U.S. Bureau of Land Management–Alaska, U.S. Geological Survey, Alaska Division of Geological & Geophysical Surveys, and the University of Alaska Fairbanks is evaluating the potential for local sources of coalbed methane to meet Alaska's rural energy needs in communities situated on or near coal basins. The presence and quantity of producible coalbed gas in these basins remains unknown and untested until test drilling can assess the quantity and quality of this resource. Coalbed methane can be locally produced and consumed using shallow well fields and short pipelines. This relatively inexpensive, clean coalbed methane could have considerable positive impact in villages that are now isolated from the power grid by reducing pollution problems from existing diesel generators, making a local gas production company possible, and allowing viable industrial development in areas that now use subsidized or imported energy.

The cooperative effort conducted shallow drilling operations to evaluate the gas content and hydrology of coal seams beneath Fort Yukon, Alaska, in late summer 2004. This project is intended to demonstrate the use of a light weight drill rig for exploration and development of natural gas from coal, and to assess the economic feasibility of extracting natural gas from coal in remote Alaskan villages using this technology. An additional side benefit of this project has been the use of the drilling mud, predominantly bentonite, as a sealant for an old landfill. This opportunity provides for proper disposal of this product and protects the water table and river from possible contaminants from the landfill. Drilling began on August 21, 2004; coring of the first coal began on August 26 at a depth of approximately 1,280 feet. Coal cores were collected for analysis of gas content and composition; water from the coal seam was sampled for chemical analysis. A second coal seam was successfully cored on September 1 at a depth of approximately 1,905 feet with the final hole depth of 2,287 feet reached on September 3. Core samples are being analyzed for methane content, formation transmissivity, and water quality. Preliminary results of the gas content analyses suggest that the gas saturation levels of the coals are in the 20 to 30 percent range on average, with a maximum of about 50 percent in one canister. Based on these preliminary test results, the low gas saturation levels would require pumping large volumes of water from the coal seams in order to produce gas. Preliminary water quality analyses indicate that the subsurface water is potable. Further results, including economic modeling of drilling costs in rural settings based on the Fort Yukon experience, will be released in the second quarter of 2005.

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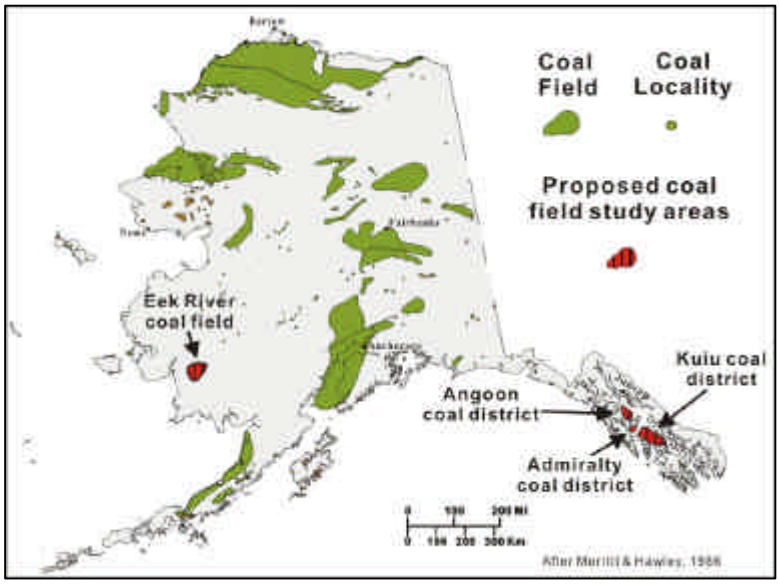
ALASKA COAL DATABASE
NATIONAL COAL RESOURCE DATABASE SYSTEM

The long-term goal of the Alaska Division of Geological & Geophysical Surveys' (DGGS) participation in the U.S. Geological Survey's (USGS) National Coal Resource Database System (NCRDS) cooperative program is to record all known coal resources in Alaska and archive them in a single, readily accessible database available at the USGS Web site: http://energy.er.usgs.gov/products/databases/USCoal/. Encoded and formatted data for northwestern, northern, interior, south-central Alaska, Alaska Peninsula, Nulato, and Kobuk coal fields of Alaska have been included previously in the Alaska portion of the NCRDS.



In the course of gathering information to expand the NCRDS database, which contains coal quality and stratigraphic data for Alaska, the need was recognized to collect new coal samples and current stratigraphic data. The most frequent problems encountered were lack of accurate outcrop and coal sample locations, suspect coal quality analyses, and insufficient stratigraphic control. The coal quality and stratigraphic context of coals in both southeastern Alaska and the Eek River area (see map, left) are poorly known. This NCRDS project will help alleviate the lack of data for these coal fields by providing significant new coal quality data and accurate stratigraphic information for meaningful coal resource assessment. Rural and roadless communities in both regions currently import costly diesel fuel to provide heating and electrical power generation, particularly Petersburg and Angoon (southeastern Alaska) and Kwethluk and Eek (southwestern Alaska). With the advent in the 1980s of coalbed methane as a major domestic energy source, nationwide assessments of coal basins for their coalbed gas potential are currently underway. Expanding our knowledge base of coal resources in southeastern and southwestern Alaska may well benefit rural communities by providing a local source of solid fuel or coalbed gas to meet energy needs. Additionally, local energy sources prevent potentially catastrophic fuel spills that may occur during the transportation and storage of liquid fuels.

During the 2003 and 2004 field seasons, DGGS and BLM personnel conducted field examinations of coal outcrops in the Kake and Angoon areas of southeastern Alaska. A paleontologic study of Tertiary flora was conducted to determine age and paleoenvironment of coal deposits. In 2005, coal deposits near Eek in southwestern Alaska will be sampled. Coal samples collected are submitted for proximate, ultimate, and trace-element analyses. Products from this project are (1) formatted coal resource data of new samples submitted to the USGS for inclusion into the Alaska coal database, and (2) a final report detailing coal resource data for each of the coal fields, to be released in September 2005.

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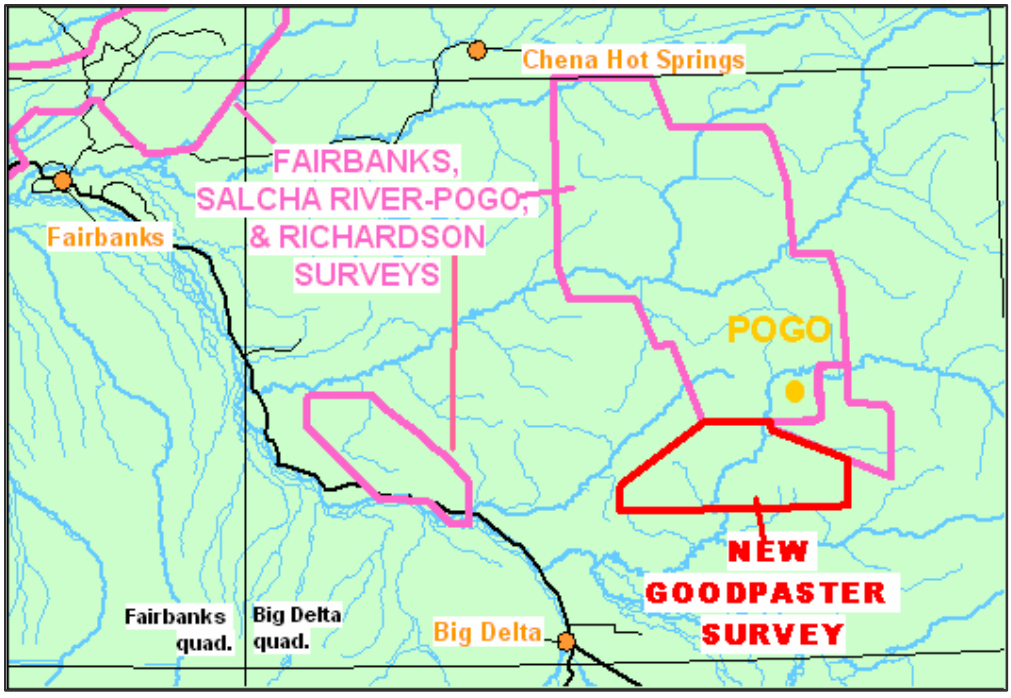
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: AIRBORNE GEOPHYSICAL SURVEY OF THE GOODPASTER AREA, INTERIOR ALASKA

The Airborne Geophysical/Geological Mineral Inventory project is a special multi-year investment to expand the knowledge base of Alaska's mineral resources and catalyze private-sector mineral development. The project seeks to delineate mineral zones on Alaska state lands that: (1) have major economic value; (2) can be developed in the short term to provide high-quality jobs for Alaska; and (3) will provide economic diversification to help offset the loss of Prudhoe Bay oil revenue. Candidate lands for this project are identified on the basis of existing geologic knowledge, land ownership, and responses to solicitations for nominations from Alaska's geologic community. Products resulting from these surveys generally include (1) 1:63,360-scale aeromagnetic and airborne-electromagnetic maps; (2) 1:63,360-scale bedrock and surficial geologic maps; (3) 1:63,360-scale mineral occurrence maps; and (4) and various other geological, geochemical, and geophysical data compilations.



For FY05, DGGS initiated an airborne geophysical survey near the Goodpaster River in the southcentral part of the Big Delta Quadrangle in Interior Alaska. The Goodpaster survey tract borders the previously flown Salcha River–Pogo geophysical survey tract and lies about 7 miles southwest of the Pogo gold deposit. Native gold at Pogo is hosted in three large, structurally controlled quartz bodies located near a Cretaceous granite. Currently the private sector is actively exploring for Pogo-style gold deposits throughout the Richardson to the Black Mountain area just east of the figure. The geology and potential for mineral lode deposits in the southern Big Delta Quadrangle is poorly known because of extensive vegetative cover and lack of detailed mapping. Airborne geophysical surveys will provide a way to map various lithologic units, especially distinguishing between granitic rocks and the various metamorphic units, and to delineate regional structures. By completing an integrated geophysical-geologic mineral inventory study, extensions or new zones of Pogo-style gold mineralization may be identified.

DGGS believes that geophysical data leading to a better understanding of the geologic framework hosting identified and potential ore deposits in these districts will stimulate increased mineral exploration investment within these belts of rocks and the surrounding areas. The geophysical and geological data that are produced from these studies are released to the public and will be used for decades. Data acquisition for the Goodpaster geophysical survey was completed by Stevens Exploration Management Corp. and their subcontractor Fugro Airborne Surveys in October 2004. Aeromagnetic and apparent resistivity maps will be produced in a variety of map formats and will be released in 2005. Digital data will also be made available at a very low price to the public and, when viewed with appropriate computer programs, allow the user to see many subtle trends in the data that will not be apparent on the paper maps.

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UPDATING OF SELECT AIRBORNE GEOPHYSICAL MAPS AND DIGITAL DATA FORMATS

The Airborne-Geophysical/Geological Mineral Inventory project is a special multi-year investment to expand the knowledge base of Alaska's mineral resources and catalyze private-sector mineral development. The project seeks to delineate mineral zones on Alaska state lands that: (1) have major economic value; (2) can be developed in the short term to provide high-quality jobs for Alaska; and (3) will provide economic diversification to help offset the loss of Prudhoe Bay oil revenue. Candidate lands for this project are identified on the basis of existing geologic knowledge, land ownership, and responses to solicitations for nominations from Alaska's geologic community. Products resulting from these surveys generally include (1) 1:63,360-scale aeromagnetic and airborne-electromagnetic maps; (2) 1:63,360-scale bedrock and surficial geologic maps; (3) 1:63,360-scale mineral occurrence maps; and (4) various other geological, geochemical, and geophysical data compilations.

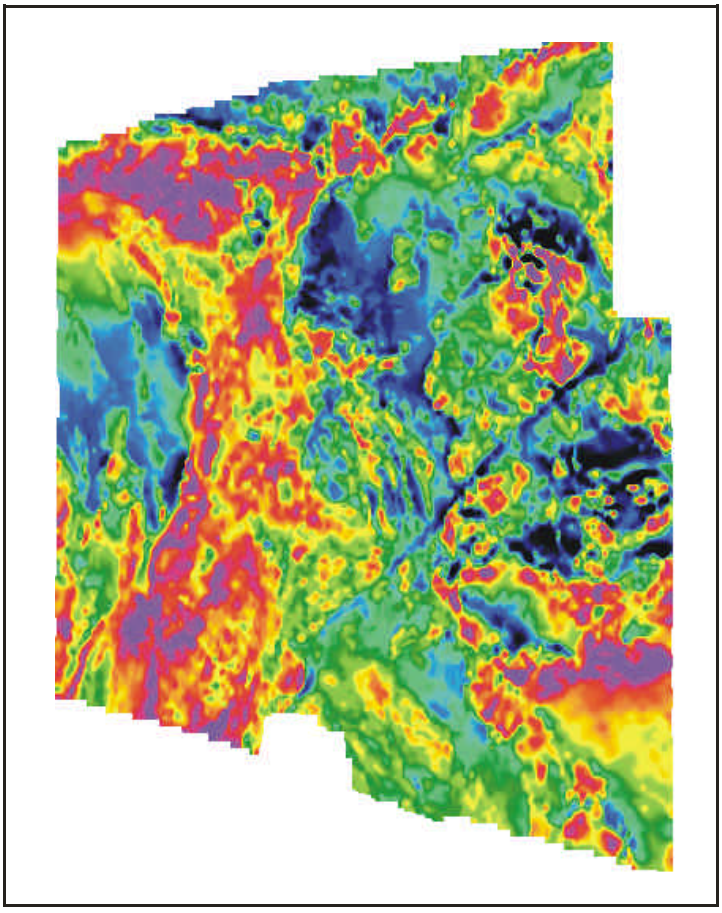

Figure 1: Aeromagnetic map of the Nome area.

The limited funding made available to DGGS in FY04 is being used to provide more information to the mining community for a minimum of nine airborne geophysical surveys that were flown previously. Data for the nine survey areas (Circle, Valdez Creek, Nyac, Nome, Fairbanks, Richardson, Chulitna, Petersville, and Rampart–Manley) were acquired between 1993 and 1997. The products DGGS requests when contracting for airborne geophysical data have evolved over the past 10 years to accommodate changing technology and archiving techniques. Our current standard contract deliverables include plot files and good quality topographic data combined with full-color image data that were not technologically feasible 10 years ago. The figure shown is an example of the geophysical data that will be combined in color with topography. Products will include numerous maps with topography, maps with data contours, plot files, and CD-ROMs of industry standard databases.

The geophysical data that are produced from these studies are released to the public and will be used for decades. The procedures being done on the older data will essentially revise presentation of the data to enable the user to more easily use the data and see more detailed information. Updated products for the Fairbanks, Richardson, Circle, Valdez Creek, and Nyac areas were released in FY04. Products for Nome, Rampart–Manley, Chulitna, and Petersville will be released as they become available during FY05.

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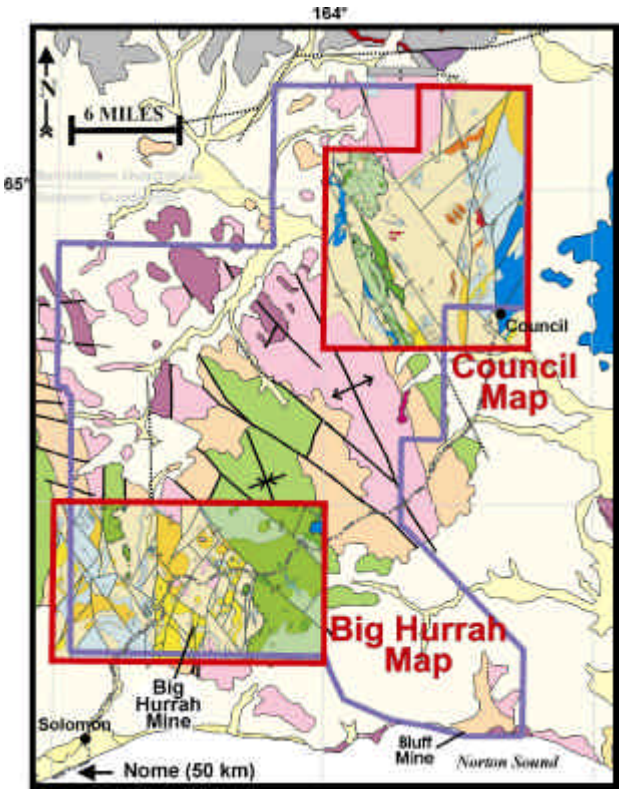
AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY PROGRAM: GEOLOGIC MAPPING IN THE COUNCIL GEOPHYSICAL SURVEY TRACT

More than 1 million ounces of placer gold have been extracted from the Solomon–Council area of the Seward Peninsula of Alaska since the turn of the century. In summer 2004, the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted 1:50,000-scale geologic mapping in two parts of the historic Council and Solomon placer gold mining districts (see figure). The purpose of DGGS's mapping is to provide geologic context for known lode gold and base-metal deposits and occurrences, and to evaluate the area's mineral resource potential. One map is centered around the Big Hurrah lode gold mine located ~13 km northeast of Solomon, and the second map is centered on Ophir Creek north of Council. The area outlined in blue is covered by an airborne geophysical survey released by DGGS in 2003 as part of the State-funded Airborne Geophysical/ Geological Mineral Inventory Program (see figure; Burns et al., 2003). The area is also the focus of an ongoing NASA-funded remote-sensing project (through DGGS) to evaluate the area's potential for undiscovered placer gold deposits.

The Solomon–Council region is underlain by Lower Paleozoic to Precambrian(?) metasedimentary and metaigneous rocks of the Nome Group, which has been regionally subdivided into the Solomon Schist, Mixed Unit, Casadepaga Schist, and Impure Marble (Till et al., 1986). Their ages and relative stratigraphic positions are uncertain. DGGS's mapping defines the internal metamorphic stratigraphy of these units, and evaluation of their protolith ages via conodont, Rb-Sr, and U-Pb (through the U.S. Geological Survey) analyses (in preparation) will help us determine their original stratigraphic positions. This information is needed for evaluating the depositional environment and economic potential of base-metal deposits, and to better understand the origin of the gold veins.



Detailed geologic mapping and sampling were also undertaken by DGGS to document the geochemistry, age, distribution, orientation, and regional structural controls on the area's low-sulfide, gold-bearing quartz vein systems. In particular, it is important to determine the timing of gold-vein formation relative to metamorphic and igneous events. Nome Group rocks have experienced blueschist-facies metamorphism and were later overprinted by a greenschist-facies event. Our preliminary interpretation of an $^{40}Ar/^{39}Ar$ spectrum from barroisite (NaCa amphibole) from the Casadepaga Schist indicates a minimum age for high-pressure metamorphism of ~150 to ~170 Ma. Rare, volumetrically minor, extension-related alkalic dikes of Early Cretaceous to Quarternary(?) age are scattered throughout the map areas, but are not spatially associated with gold-bearing quartz veins. Gold-bearing quartz + white mica ? plagioclase ? carbonate veins (so far) yield white mica $^{40}Ar/^{39}Ar$ plateau and integrated ages of 106 to 120 Ma. Some high-angle quartz veins peripheral to the Big Hurrah deposit are gold-bearing; they trend northwest and are sub-parallel to regional, northwest-trending, high-angle faults with significant vertical displacement. Gold-bearing quartz veins at Big Hurrah occur along both high- and low-angle faults, but their relationship to regional structures is poorly understood. Analysis of structural data will be undertaken to identify location controls for the gold vein systems. Ongoing Rb/Sr, $^{40}Ar/^{39}Ar$, petrographic, microprobe, conodont, and other studies by DGGS and University of Alaska personnel will soon provide additional insights into the region's geologic, metamorphic, and structural history, and its lode-gold and base-metal mineral potential.

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Till, A.B., Dumoulin, J.A., Gamble, B.M., Kaufman, D.S., and Carroll, P.I., 1986, Preliminary geologic map and fossil data, Solomon, Bendeleben, and southern Kotzebue quadrangles, Seward Peninsula, Alaska: U.S. Geological Survey Open-File Report 86-276, 71 p., 3 plates.

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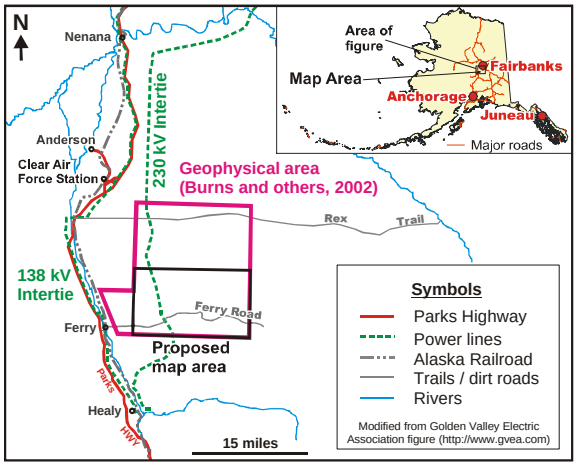
GEOLOGIC GROUND-TRUTH INVENTORY OF LIBERTY BELL GEOPHYSICAL SURVEY TRACT, INTERIOR ALASKA

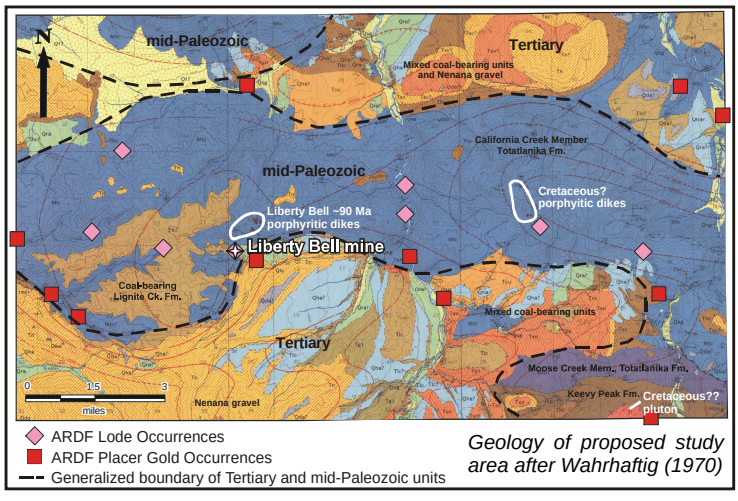
As part of the State-funded Airborne Geophysical/Geological Mineral Inventory Program, DGGS released airborne magnetic and electromagnetic geophysical maps for 276 square miles near Liberty Bell, western Bonnifield mining district, in March 2002. The airborne geophysical/geological mineral inventory program is a special multi-year investment by the State of Alaska to expand Alaska's geologic and mineral resources knowledge base, catalyze future private-sector mineral exploration and development, and guide state planning. DGGS plans to map about 130 square miles of the geophysical survey tract during the summer of 2005 as part of the federal STATEMAP program, with funding from state and federal sources.



The Bonnifield district is about 80 miles south of Fairbanks, Alaska, and extends across the north flank of the Alaska Range for approximately 40 miles. The western part of the district is highly accessible. The existing transportation corridor and nearby power would facilitate mineral development of this area. Approximately 80,000 ounces of placer gold have been mined from the region since 1903, with most production from the western part of the district. Eleven placer gold mines (1 active) and 8 metallic lode occurrences occur in the proposed map area (Alaska Resource Data Files [ARDF]). Several prospects with stibnite-rich quartz veins and a gold-bearing porphyry intrusion comprise most of the lode occurrences.

The Liberty Bell gold deposit is the major lode prospect in the mining district. Mineral exploration work by industry at Liberty Bell since 1973 includes more than 11,000 feet of diamond core drilling, with considerable trenching, geologic mapping, geophysical surveys, and several thousand feet of reverse-circulation drilling. The Liberty Bell property has an announced potential of 250,000 ounces of gold, with inferred resources of 1,240,000 tons at an average grade of 0.1 ounces of gold per ton at the Mine Zone (ARDF). Principal ore minerals at Liberty Bell are arsenopyrite, pyrite, and pyrrhotite, with chalcopyrite and bismuthinite. Gold mineralization is associated with sulfide- and sulfosalt-rich lenses, veins, and low-angle shear zones in phyllitic rocks adjacent to a porphyry intrusion. Six types of hydrothermal alteration have been differentiated at the Liberty Bell property, with a quartz–sericite–clay assemblage being most widespread (Yesilyurt, 1996). The hydrothermal alteration age is about 92 Ma, based on two K-Ar radiometric determinations on hydrothermal biotite and sericite.

Bedrock at the Liberty Bell mine is dominated by weakly metamorphosed volcaniclastic-sedimentary rocks of the California Creek Member of the Totatlanika Schist (Late Devonian–Early Mississippian age) (Yesilyurt, 1996; Dusel-Bacon and others, 2004). Mesozoic(?) mafic dikes, Late Cretaceous felsic porphyry dikes and plugs, and metamorphosed mid-Paleozoic rocks occur throughout the proposed map area. Tertiary continental clastic rocks of the coal-bearing Usibelli Group and Nenana Gravel discontinuously overlie these older rocks in angular unconformity. A complex system of dormant and active faults displaces this geologic section.



Geology of proposed study area after Wahrhaftig (1970)

Metal anomalies throughout the district point to multiple mineralization sources and deposit types. Massive sulfide mineralization hosted by the mid-Paleozoic Totatlanika and Keevy Peak schist formations may extend into the map area. Additional plutonic-related gold-rich deposits similar to mineralization at Liberty Bell likely occur in the map area.

DGGS believes that new geologic mapping with interpretation of geophysical data will lead to: (1) a better understanding of the tectonic framework of the northern Alaska Range foothills, which is demonstrated by recent earthquakes to be a hazard to important Alaskan infrastructure, and (2) increased mineral exploration investment within this belt of rocks in the western Bonnifield district. This project's products will be a series of geologic maps at 1:63,360 scale, and reports containing geological, geochemical, and geophysical data compilations. Geologic maps will be completed by June 2006.

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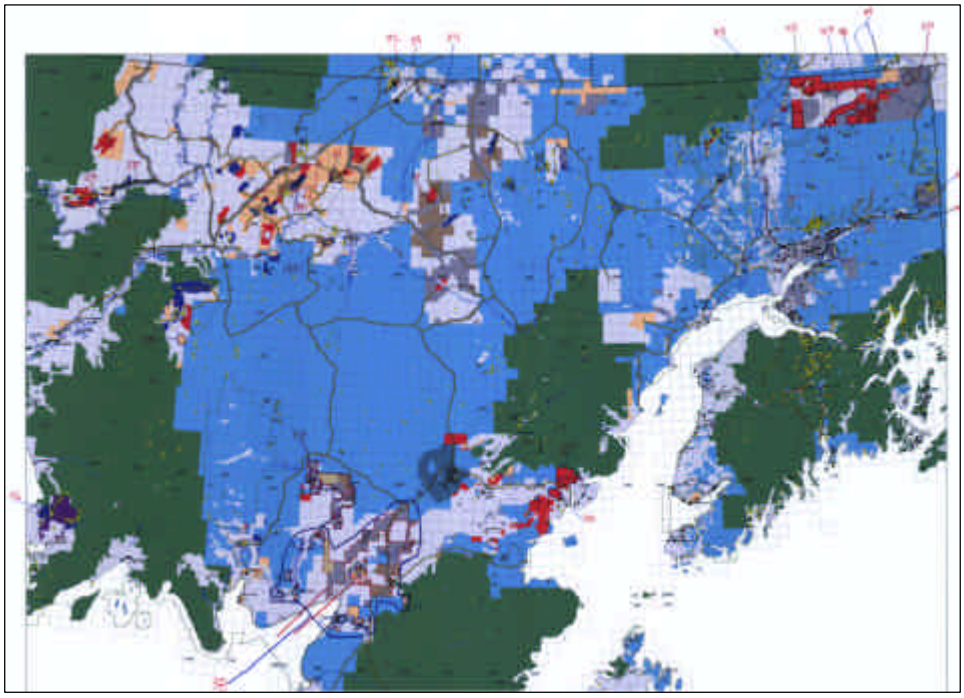
ALASKA LAND SELECTION PRIORITIZATION (BLM 2009 PROJECT)

The Alaska Statehood Act (PL 85-508) guaranteed the State of Alaska a land entitlement of 104.6 million acres. The deadline for completing state selections was January 3, 1994. State selected lands were prioritized for ownership (Ownership Priority List—OPL) and a process was established for managing conveyance from the U.S. Bureau of Land Management (BLM).

The BLM 2009 Project will review the current OPL and revise it as needed to submit a final OPL for State-selected land to the BLM by mid 2005. The project is prompted by legislation introduced by U.S. Senator Murkowski, co-sponsored by U.S. Senator Stevens, as the Alaska Land Transfer Acceleration Act (S.1466). The Act aims to speed conveyance of state and Native corporation land conveyances, and includes a proposed $9.5 million increase in funding for surveying and land conveyance efforts in the BLM budget. The bill's goal is to complete conveyance of the remaining 89 million acres of state and Native land conveyances prior to 2009, the 50th anniversary of Alaska's Statehood.

The state has about 14.5 million acres of General Grant entitlement remaining as of October 2004. Lands identified as moderate–high to high priority (priority groups 1, 2, and 3) by DNR agencies for mineral potential, oil and gas, surface resources, or access corridors combine for about 20.1 million acres, approximately equal to the amount of remaining entitlement plus 25 percent. Selected lands ranked lower than group 3 may not become state owned. Regional Native corporations also selected much of the state's high priority mineral lands and these dual selections need to be quantified.



DGGS's part of the project is divided into two phases. Phase 1 was intended to be a quick and generalized review by state agencies in which areas deserving a shift in priority were identified. Phase 1 was completed on November 22, 2004. The upcoming Phase 2 will concentrate on detailed analysis and discussion of areas identified in Phase 1. The Phase 2 deadline is March 25, 2005. DGGS has built a GIS database to review and analyze geologic and mineral deposit information for this project. Database information includes vector data and scanned PDFs of state selected lands and mineral priority groups 1–3, current federal and state mining claim locations, results from earlier DGGS probabilistic modeling using the DGGS mineral endowment model known as ROCKVAL for 36 land tracts across the state, locations of geochemical samples collected by DGGS during Land Selection, more than 6,500 ARDF mineral occurrence sites categorized by mineral deposit model, outlines of DGGS geophysical survey tracts, and selected topographic maps. Digital geologic maps will be included for Phase 2 work.

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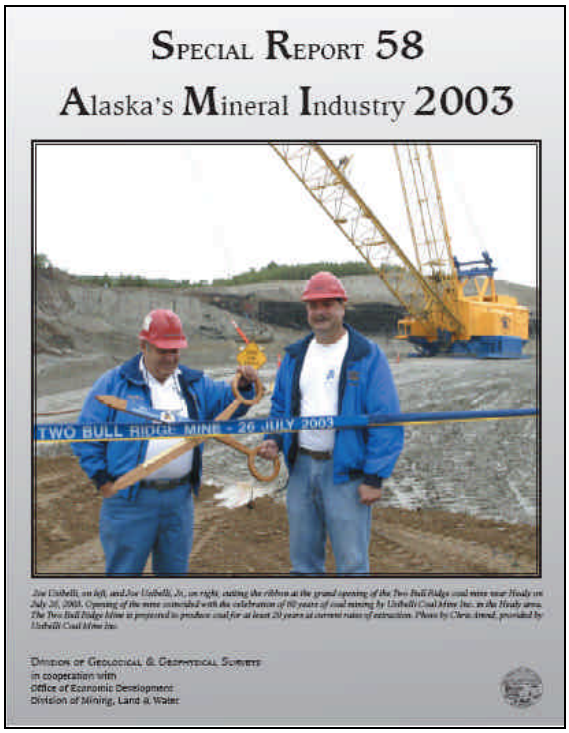
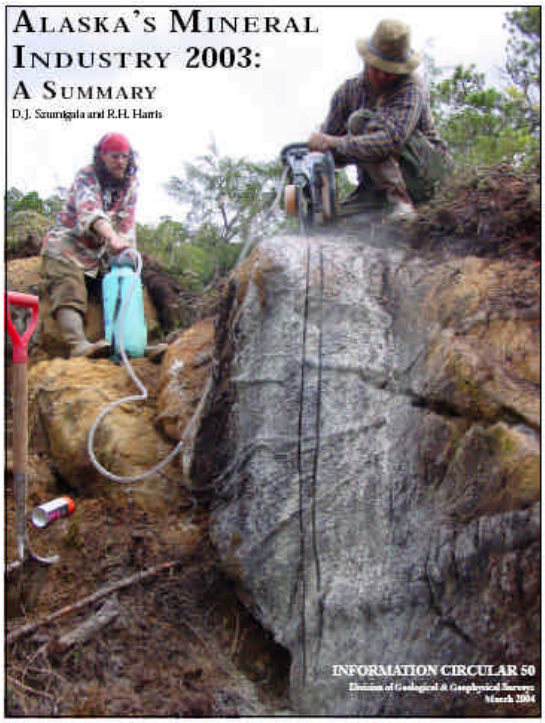
ANNUAL ALASKA MINERAL INDUSTRY REPORT





Alaska Statute 41.08 charges the Division of Geological & Geophysical Surveys *"to determine the potential of Alaska land for production of metals, minerals, fuels, and geothermal resources; the location and supplies of groundwater and construction materials; the potential geologic hazards to buildings, roads, bridges, and other installations and structures; and shall conduct such other surveys and investigations as will advance knowledge of the geology of Alaska."* To meet part of this goal, we gather, verify, collate, and supply statistics and summary observations about Alaska's mineral industry in a timely manner and release this information 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 in terms of the health of the state's mineral industry, and fosters a better understanding of the significance of the mineral industry to Alaska's private sector and government.

The annual Alaska mineral industry report is a key source of information about Alaska's mineral resource exploration and development. Statewide and international circulation of the annual mineral industry report and its findings at professional mineral industry conventions and trade shows, 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 the Alaska mineral industry. The report serves as a barometer for the mineral industry's status in any given year and provides unbiased, authoritative information. Government personnel formulating public policy affecting resource and land management rely on the report as an essential asset.

The 2003 Alaska mineral industry report released in November 2004 summarized information provided through replies to questionnaires mailed by DGGS, phone interviews, press releases, and other information sources. The annual report has been published for 23 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 (Commerce), with help from the Division of Mining, Land & Water (DMLW) in DNR. A summary of the 2004 Alaska mineral industry activities will be released by February 2005. The 2004 Alaska mineral industry report will be released by early November 2005.

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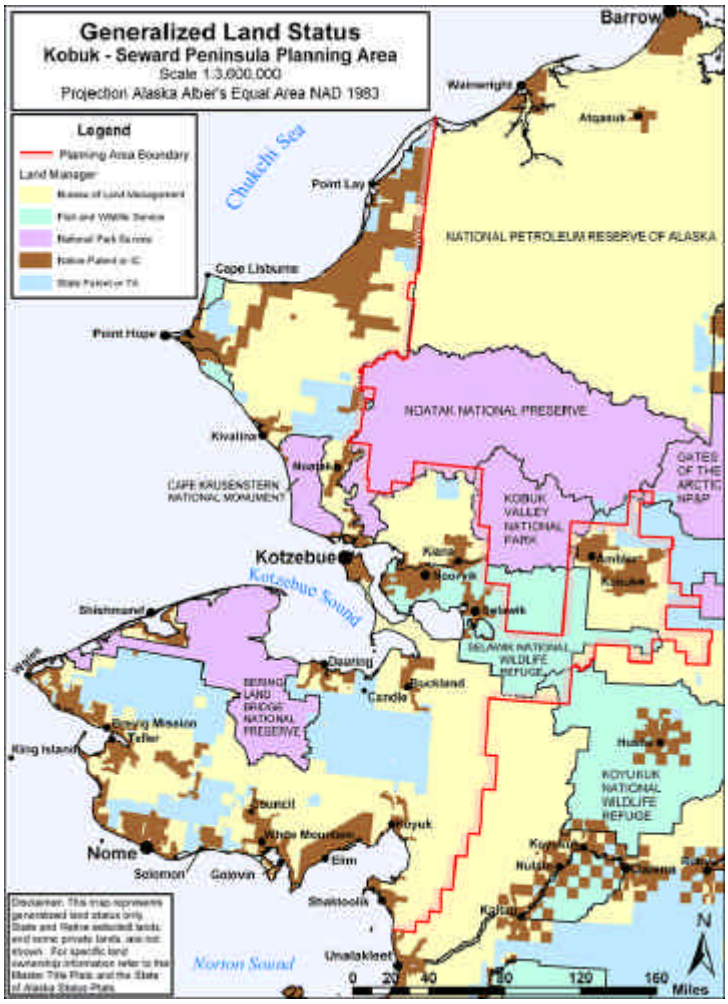
KOBUK–SEWARD PENINSULA PLANNING AREA MINERAL POTENTIAL ASSESSMENT REPORT

The U.S. Bureau of Land Management (BLM) requires a Mineral Potential Assessment Report be prepared to help evaluate the occurrence of mineral resources within the Kobuk–Seward Peninsula (KSP) planning area (boundary outlined in red in the figure) located in northwestern Alaska. This report will provide decision makers and stakeholders, including the general public, a better understanding of mineral resources in the area, and the importance of those mineral resources in the context of future land-use allocations. The purpose of the report is to assess the mineral-resource occurrence and development potential of the area defined for the Resource Management Plan and provide a GIS package that includes an up-to-date compilation of all existing mineral occurrence data that is accessible to the public.



In fall 2004 BLM contracted the Alaska Division of Geological & Geophysical Surveys (DGGS) to provide geologic input, which will be included as part of their Mineral Assessment Report for the KSP Planning Area report.

First, DGGS will provide GIS datasets and figures showing the location of published geologic maps (at various scales) that fall within, or overlap with, the KSP planning area. These map locations are a derivative product of the work being done for the MDIRA-funded Map Index project. A reference list for these maps will be provided, and coded to the corresponding map-outline polygon.

Second, DGGS will compile a list of publications that include all relevant information on the geology, mineral occurrences, and mines for the KSP planning area. Both published and unpublished reports will be included, and DGGS will provide BLM with a digital and paper copy of the bibliography.

Third, DGGS will update the merged Alaska Resource Data Files (ARDF) and Alaska Mineral Information System (AMIS) mineral occurrence dataset with any additional mineral occurrences that have been discovered since these datasets were created. DGGS will provide BLM with digital files containing the new mineral occurrence information for the KSP planning area. Data fields will include occurrence name, latitude and longitude (to four decimal places), brief prospect description, and interpreted Cox and Singer (1986) mineral deposit model. BLM will then incorporate the DGGS-created dataset into their AMIS database.

Finally, within the KSP planning area, DGGS will define geologically permissible regions for the occurrence of mineral deposits. These regions will correspond to the Cox and Singer (1986) set of mineral deposit models, but other models may be included if a more recent model has been developed, or if appropriate models are not available in Cox and Singer (1986). DGGS will review, and incorporate where appropriate, U.S. Geological Survey mineral-assessment and DGGS land-selection studies. DGGS will provide BLM with a digital copy of polygons that outline “permissible regions for mineral occurrences” that are attributed with their assigned Cox & Singer (1986) or other appropriate model number. Final products are due to the BLM by April 30, 2005, for incorporation into BLM’s Mineral Potential Assessment Report.

REFERENCES CITED

Cox, D.P., and Singer, D.A., eds., 1986, Mineral deposit models: U.S. Geological Survey Bulletin 1693, 379 p.

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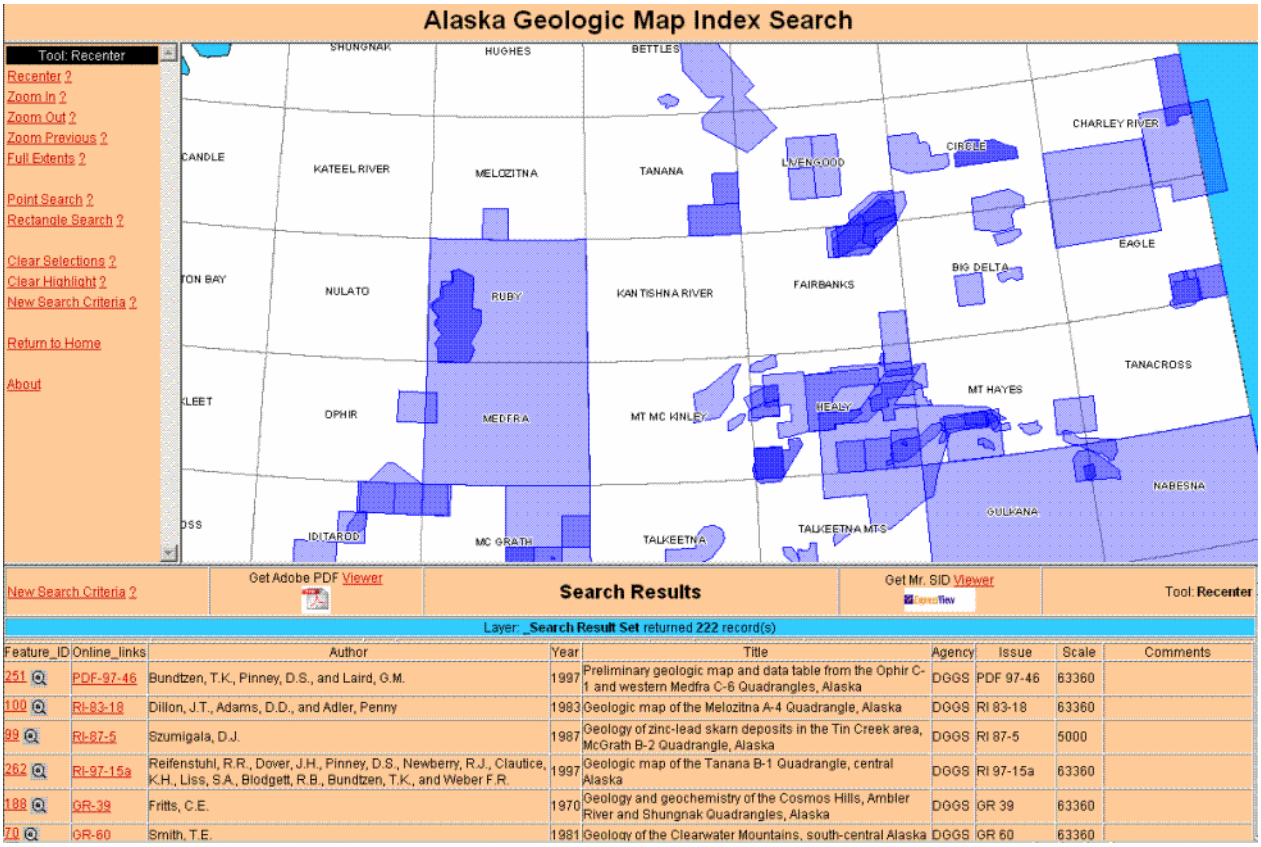
COMPILATION OF ALASKA BEDROCK, SURFICIAL, AND GEOPHYSICAL MAP INDEX PROJECT

The Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS) and Land Records Information Section (LRIS) released the first version of an application that portrays 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 about 500 more geologic maps, most of them produced by the U.S. Geological Survey, and outlines of geophysical surveys published by government agencies will be added by DGGS during FY05 and FY06.



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 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.

Improvements to the first version of the Web interface will be made by LRIS during FY05 and FY06. Currently, besides allowing searching by rectangle or by point, the interface shown above provides links to scanned reports and maps for each DGGS citation. Subsets of map outlines based on map categories, such as bedrock, surficial, "resources-metals, lode," and "hazards, permafrost" may also be produced by the user through another associated Web page.

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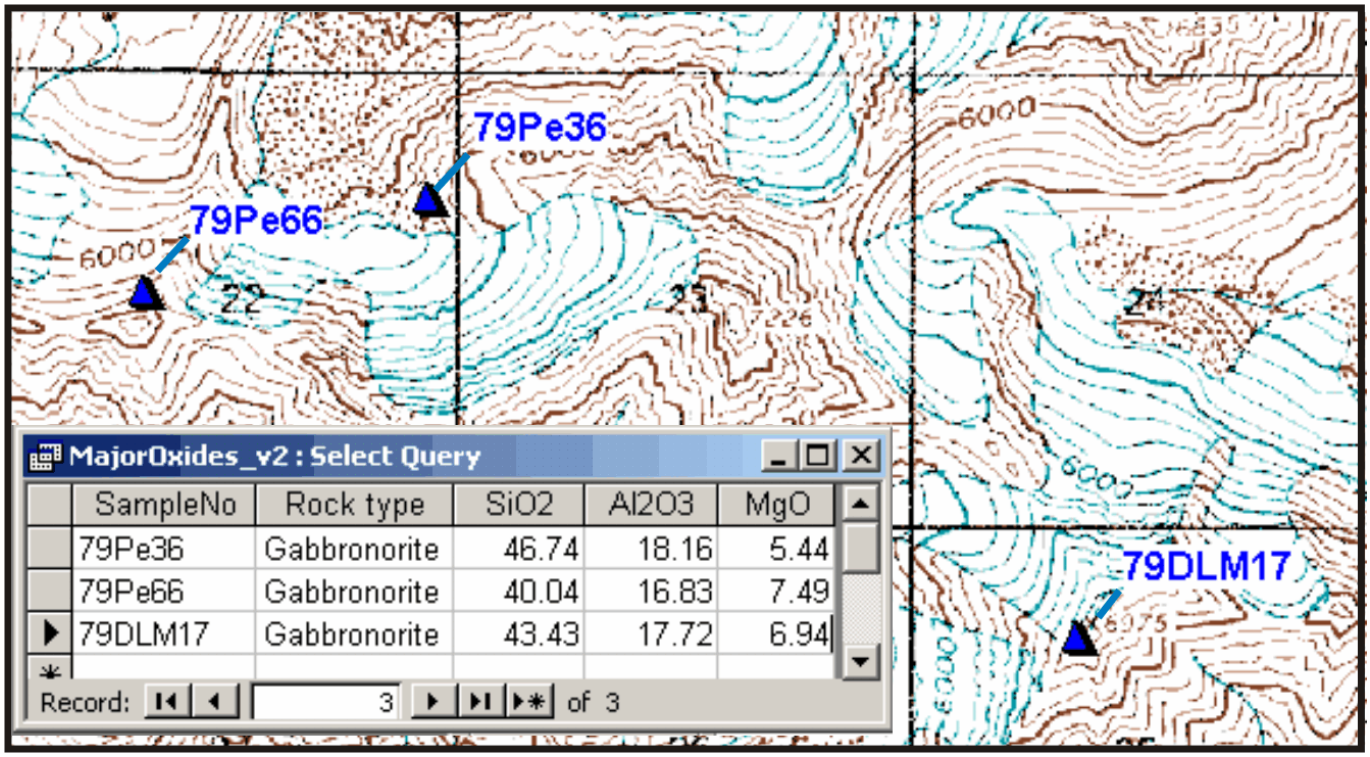
COMPILATION OF ALASKA STATE AGENCY LITHOCHEMICAL DATA

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



The objective of the Alaska State Agency Lithochemical Data Project is to make DGGS lithochemical data accessible via the MDIRA program's Web site <AKgeology.info>. Then the data will be incorporated into the DGGS division-wide database. As part of the MDIRA project, during the past 4 years Federal agencies have made a concerted effort to systematically organize their electronic geochemical-data files. That effort is nearly complete for much of the Federal quantitative geochemical data. DGGS possesses a significant amount of Alaska mineral-related geochemical data that has not yet been gathered into organized data sets. Some of the data have not been published; other sets are not in digital format and are in danger of being lost. The vast majority of the data have not been digitally linked with geographic locations.

DGGS is assembling the various at-risk lithochemical data that have been generated by DGGS or, in some cases, by the University of Alaska, organizing these data into rational datasets and linking them with georeferenced locations. The DGGS system will be designed and implemented in a manner compatible with U.S. Geological Survey PLUTO and RASS datasets and will provide the data for the MDIRA database and Web site. This project works in conjunction with USGS counterparts and the DGGS MDIRA database project. Geochemical data and latitude and longitude sample locations are being compiled in a Microsoft Access database.

We estimate this project will recover 1,200 sets (one sample equals one set) of major oxide analyses, 500 sets of minor element analyses, 3,000 rock trace element data sets, and 500 to 600 mineral compositions data sets. An additional 1,000 major oxide or trace-element datasets from unpublished Master's of Science thesis research done at UAF also will be included. Data will be included for the areas of Haines, Lime Peak, Chugach, Fairbanks, Talkeetna Mountains, Interior Alaska, Valdez Creek mining district, and southwestern Alaska, as well as others. The project is scheduled for completion by June 30, 2006.

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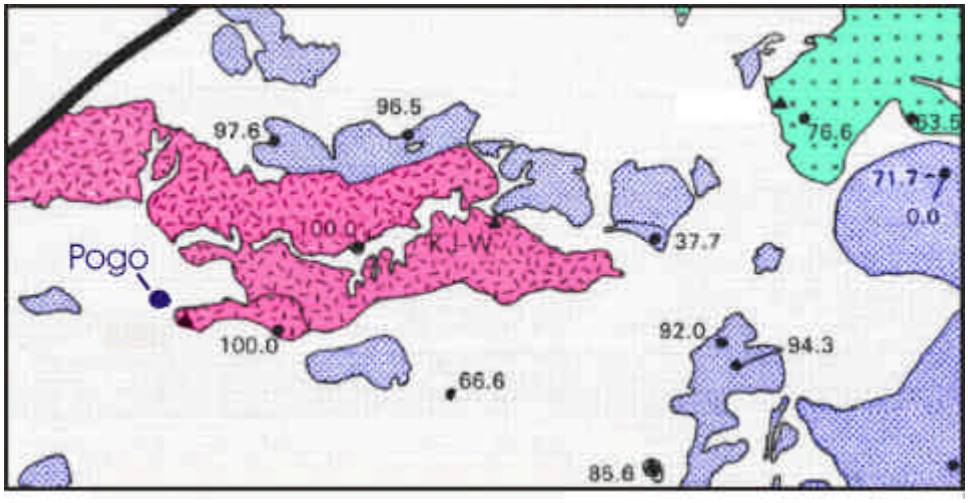
COMPILATION OF EXISTING RESOURCE ASSESSMENT GEOCHEMICAL DATASETS

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

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



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

The datasets will be released via the DGGS and MDIRA Web sites (<www.dggs.dnr.state.ak.us> and <www.akgeology.info>, respectively). The project should be completed by June 30, 2006.

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

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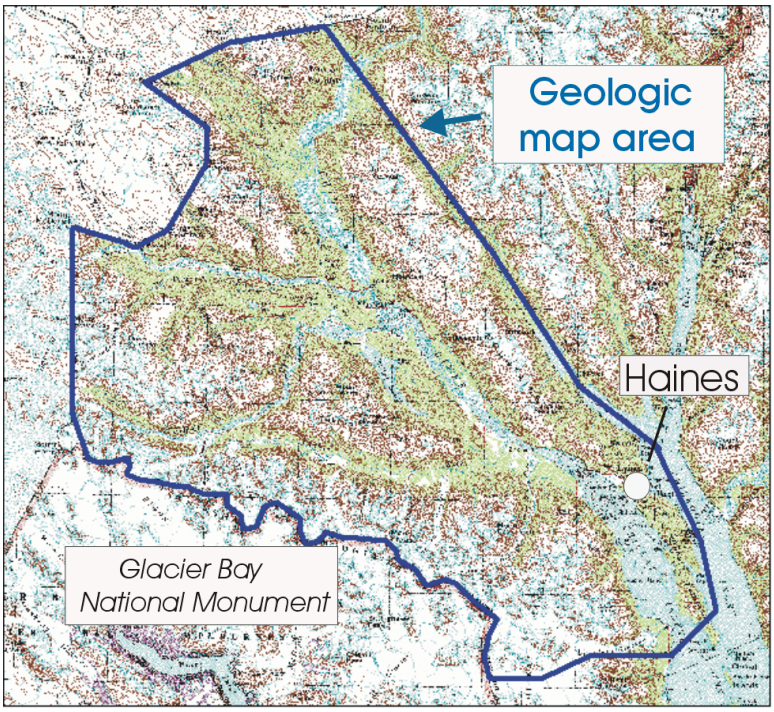
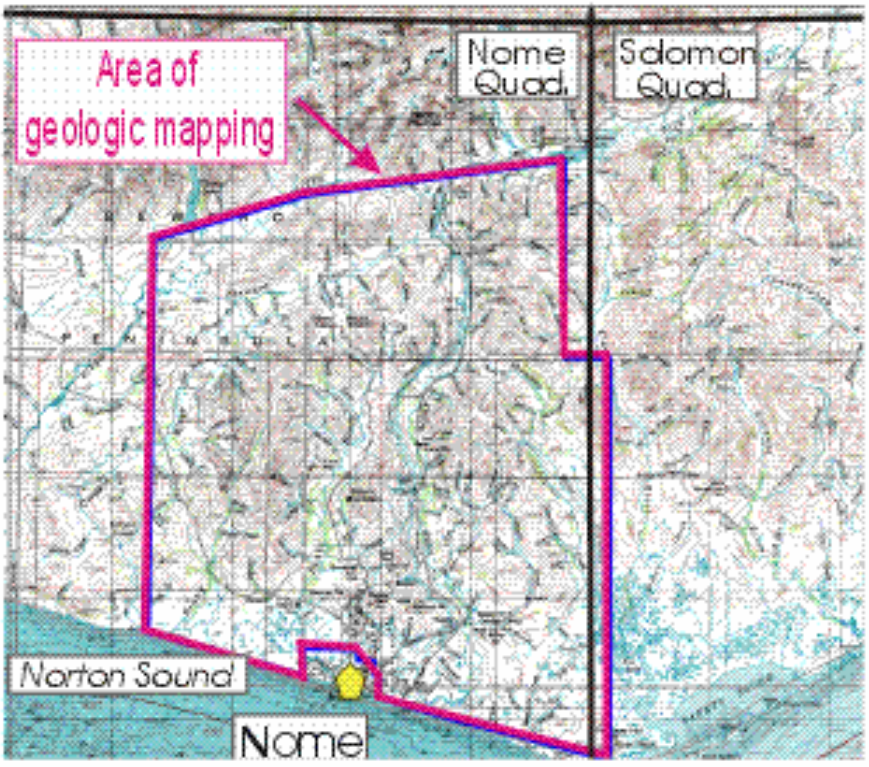
GEOLOGIC MAPS OF THE HAINES AND NOME AREAS

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



The Haines map covers the entire Porcupine mining district. This bedrock and surficial geologic map has been reviewed and edited as a Professional Report. The map unifies five geologic maps previously published in reconnaissance form for a 900-square-mile area. The authors of the five geologic maps used different nomenclature and mapping styles. The map to be published contains the synthesis of terminology and map units that were worked out by the original authors. The second sheet of the Haines map contains sample locations, radiometric ages, and geochemical data. Production of the Haines map was interrupted near completion. This area is a major section of southeastern Alaska that has no existing coherent geologic map. This project will complete the digitizing of the geologic map and cross-sections and publish the map both in hardcopy form and on the DGGS Web site. The Haines map project began in fall of 2004 and is scheduled to be finished by end of August 2005.



The Nome map covers a portion of the Nome mining district. An initial year's worth of geologic mapping was released for part of the area, but compiling the mapping of a second summer of geologic work was delayed due to other State priorities. This project will compile the field data and publish the geologic map. The Nome map project began in fall 2004 and is scheduled to be finished by end of August 2005.

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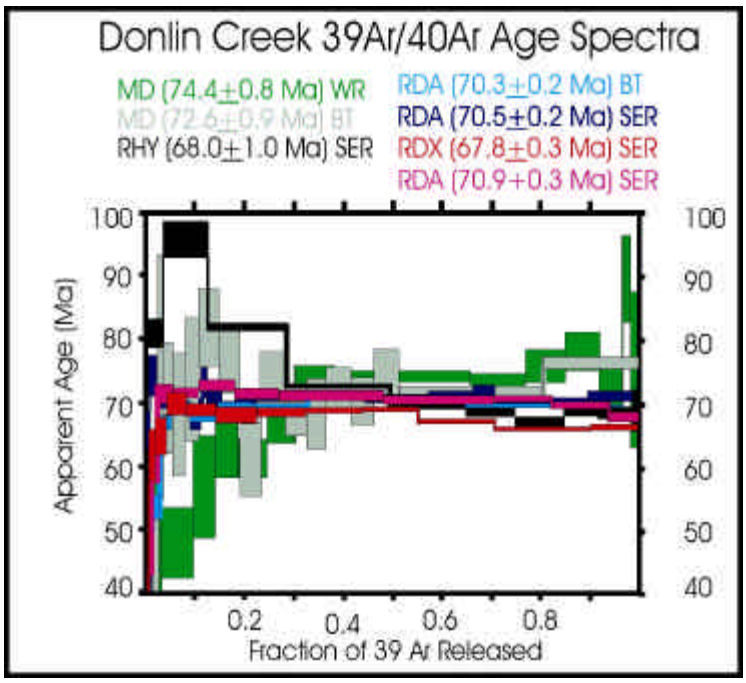
GEOCHRONOLOGIC DATABASE FOR ALASKA

In Spring 2005 the Alaska Division of Geological & Geophysical Surveys (DGGS) will begin work on the geochronologic database for Alaska. The geochronologic database will contain age data and associated information for all available radiometric dates for rocks and minerals in Alaska. The objective of this project is to expand the most-current existing compilations of radiometric data and to make this age information widely accessible to private industry, academia, and government. This project is part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program. The primary objective of the MDIRA program is to ensure that all Alaska mineral 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 is being used as a starting point for the structure of the geochronologic database. Additional fields will be 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. The initial source of age data will be the previous compilations by Wilson and others (1990; 1999). Additional radiometric dates will be compiled from both published and unpublished sources, starting in August 2005. In addition to updating the existing compilations, this database project will add 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, will be used to search for additional sources of data.

This geochronologic database will provide a centralized, up-to-date, digital source of radiometric dates. 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. The final stage of the geochronology project will be to make this database accessible via DGGS's Web site and through a link on the Interagency Minerals Coordinating Group website. Bibliographic citations for DGGS and U.S. Geological Survey publications will be linked to digital or PDF files of the appropriate publication. The geochronologic database project is scheduled to be completed in 2 years. The completed database will reside in DGGS's Oracle database, which will serve as a repository for future radiometric data.

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

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

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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. It is estimated that DGGS project files for about 40 years' worth of field work/ projects will be available for inclusion in 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 will have principal investigators who will manage different aspects of the project. It is anticipated that two UAF undergraduate engineering students will be employed by UAF for this project. Methodology of the project will be similar to that used for the successful MDIRA-sponsored Alaska Mineral Information Data Index (AKMIDI) Project, which inventoried the Anaconda Minerals and other data collections.

DGGS has boxes and file cabinets full of project maps, files, field notes, and associated data accumulated during the last 40 years. While some retiring geologists have left organized collections of project files and field notes and maps, many retired leaving their project files unorganized. Lack of time and funding for DGGS has precluded addressing this problem and prevented including much of this legacy project information in current projects. This indexing project will enable DGGS to organize, inventory, and store legacy documents to make them accessible to DGGS scientists and the public.

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

Indexed project and working file data and materials will be 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 Geologic Materials Center.

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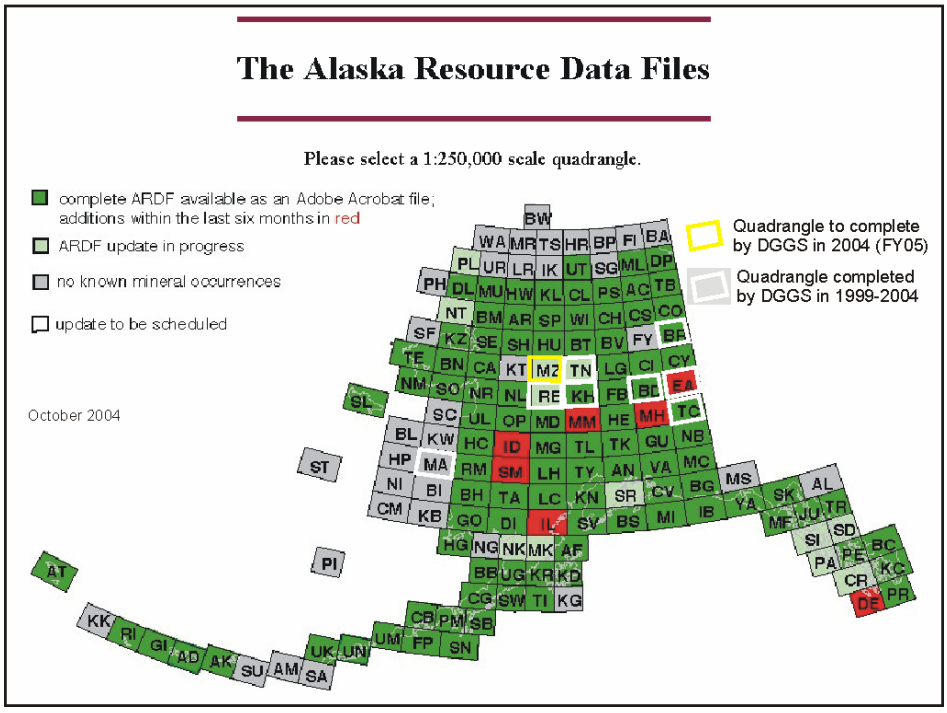
ALASKA RESOURCE DATA FILE PROJECT
(ALASKA MINERAL DEPOSIT DATABASE)



DGGS has been compiling information on mineral deposits, prospects, and occurrences under a cooperative agreement with the U.S. Geological Survey (USGS) as part of the Federal *Minerals Data and Information Rescue in Alaska (MDIRA)* program. The primary objective of the Data and Information Rescue project is to ensure that all Alaska mineral data are preserved in a safe and readily accessible format for all potential users. Information on mineral resources is important for encouraging private investment in minerals exploration and for management policy decisions in both the public and private sectors. Higher quality, accessible data leads to better economic, legislative, and environmental decisions. One component of this program is a digital (electronic) database of mineral deposits of Alaska known as the *Alaska Resource Data Files (ARDF)*. These files are the first comprehensive update of Alaska's mineral deposit database in a quarter century.

Descriptions of mines, prospects, and mineral occurrences in the Alaska Resource Data Files (ARDF) are compiled for individual USGS 1:250,000-scale quadrangles in Alaska (see map) as USGS Open-File Reports and are available for downloading from the USGS (http://ardf.wr.usgs.gov/). Descriptions in the ARDF database are derived from published literature, state mining claim files, state land status information, personal interviews, and unpublished reports and data from various sources including DGGS, the U.S. Bureau of Land Management, the USGS, Alaska Native corporations, and the mineral industry. Records in the database are generally for metallic mineral commodities only but occasionally may include certain high-value industrial minerals such as barite and rare-earth elements. Common industrial minerals such as sand and gravel, crushed stone, and limestone, and energy minerals such as peat, coal, oil, and gas are not included in this database. As of November 2004, 6,100 records (1,659 placer, 4,441 lode) were included in this database for 108 of 155 Alaska quadrangles.

DGGS will complete nine quadrangle mineral deposit record-sets that meet peer review and USGS ARDF review criteria. DGGS minerals section staff have already completed ARDF files for eight of the nine quadrangles; these include the Big Delta, Black River, Tanacross, Kantishna River, Charley River, Eagle, Tanana, and Ruby quadrangles. A literature review by DGGS for mineral deposits in the Marshall Quadrangle did not find any known mineral occurrences. In FY05, final review comments will be addressed for the Melozitna Quadrangle, and will conclude our part of this phase of the ARDF project.

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SURFICIAL GEOLOGY IN THE COUNCIL GEOPHYSICAL SURVEY TRACT, SEWARD PENINSULA

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 century. In summer 2004, the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted geologic mapping in two parts of the historic Council and Solomon mining districts to provide geologic context for known gold and base-metal deposits and occurrences, and to evaluate the area's mineral resource potential. One map is centered around the Big Hurrah lode gold mine located ~13 km northeast of Solomon, and the second map is centered on Ophir Creek north of Council. The area is also the focus of an ongoing NASA-funded remote-sensing project to evaluate the area's potential for undiscovered placer gold deposits.

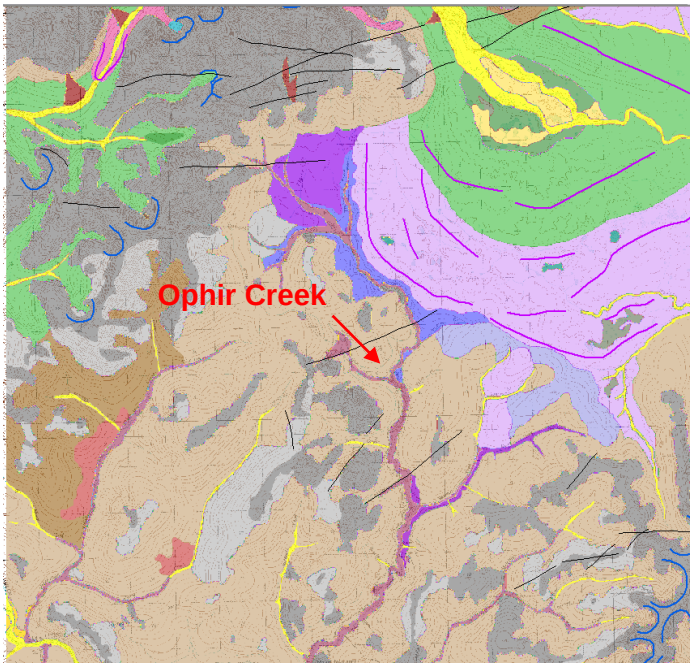

Figure 1. Preliminary surficial-geologic map of part of the Council area illustrating the influence of glaciation on placer development. Successively older glacial deposits are shown in pink, green and purple. Glaciers originating in the Bendeleben Mountains to the north probably diverted auriferous Ophir Creek from its ancestral eastward direction of flow to its modern southward course.

In order to explore new opportunities for development in the area, it is critical that the State have an up-to-date inventory of the geologic resources of the area to guide planning activities and identify key features of potential interest. The Engineering Geology section of DGGS is mapping the surficial deposits of the area to understand the genesis of the landscape in which the placer gold deposits are found (fig. 1), to assess the cover deposits and other rock units for their potential as construction materials in the event of further economic development or infrastructure needs in the region, and to identify possible geologic hazards that could pose a danger to human life and property should there be such increased development in the district. Quaternary deposits in the map areas are primarily colluvial and glacial in origin, and the great age of many of the glacial deposits combined with extensive reworking and slope movement resulting from extreme periglacial conditions has made mapping a challenge (fig. 2).

Anticipated products of this project are geologic-framework maps at 1:63,360 scale describing the surficial geology of the area. Maps of the two areas are scheduled to be completed and released in the spring 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 will ultimately be made available in a geographically referenced relational database. We will serve this 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 development and paves the way for future exploration. We anticipate a similar result in the Council geophysical survey tract area.

Figure 2. Rounded, dark-colored cobble of Casadepaga metabasite resting on light gray marble bedrock. Such glacial erratics are the only physical remnants of glaciation in many parts of the Solomon mining district.

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CREATING LOCAL EMPLOYMENT OPPORTUNITIES IN THE RURAL NATIVE COMMUNITIES OF NORTHWESTERN ALASKA

Historically, small-scale placer-gold mines have been highly successful as a means of generating income in rural areas. Between 1992 and 2001, however, 780 of a total 1,251 placer mining jobs had been lost statewide. In an effort to help facilitate the economic viability of rural communities through increased placer mining opportunities, DGGS is engaged in the wrap-up phase of a 2-year NASA-funded project to apply remote sensing imagery, high-resolution Digital Elevation Models (DEMs), and high-altitude color-infrared photography in conjunction with knowledge of geomorphology, surficial deposits, and bedrock geology, to evaluate the placer gold potential of part of the Council placer mining district on the Seward Peninsula, northwestern Alaska.

The project is being implemented in two phases: Phase I, regional evaluation using lower-resolution data; and Phase II, detailed evaluation using higher-resolution data. Additionally, high-altitude color-infrared aerial photographs are being used to cross-check satellite imagery classifications, produce traditional photointerpreted geologic maps, and generate geographically corrected orthophoto base maps (fig. 1) that will be useful for many other applications in the Council area. Combining spectral, geologic, and topographic data at many scales to generate virtual 3-D landscape models shows great potential as a powerful analytical tool, as well as being an instantly intuitive means of portraying the data relationships to the general public (fig. 2).

Figure 1. Planimetrically correct orthophoto base map generated from digital, color-infrared aerial photographs.

The final products from this project will consist of detailed geologic maps of unconsolidated Quaternary deposits, appropriate cross-sections, and three-dimensional landform models. The maps and models will display the spatial relationships between deposits that are fundamental to understanding the Quaternary geologic history of the mining district and to identifying the most probable location and extent of currently undiscovered placer gold-bearing paleochannels. All map products will be produced in conformance with NGDC standards and will be in ESRI ArcGIS format.

DGGS is also presenting educational workshops in Nome to teach interested members of the communities impacted by this research how to understand, interpret, and apply the products being generated by the study. The new remote-sensing technologies will be extremely useful in future geologic investigations, but they are best used in conjunction with traditional air-photo-based methods, not instead of them. Ground truthing is a critical issue, and the new technologies require high-end computers and expensive software in order to be utilized effectively. DGGS remains committed to using these tools to better serve the needs of communities throughout Alaska.

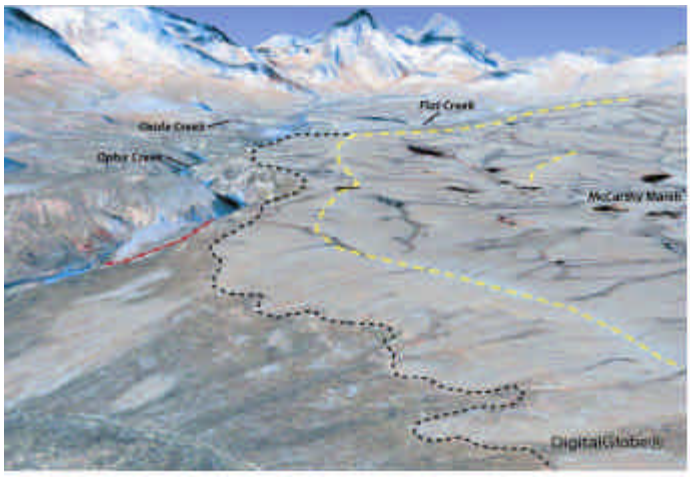

Figure 2. Virtual three-dimensional landscape model of upper Ophir Creek, Council mining district, generated by draping QuickBird multispectral imagery over inSAR-derived DEM with 3X vertical exaggeration.

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SURFICIAL AND ENGINEERING GEOLOGIC MAPPING

The DGGS Engineering Geology section is currently wrapping up three projects supported in part by the U.S. Geological Survey (USGS) STATEMAP program: Mapping of the Salcha River–Pogo and Livengood areas for projects led by the DGGS Minerals Section; and mapping of the Kanayut River area for a project led by the DGGS Energy Section. The surficial- and engineering-geologic map suites for each project describe properties and extent of surficial deposits, geologic materials, and geologic hazards. Publication of these map suites is scheduled for spring 2005.

The 1:63,360-scale surficial, engineering, and comprehensive maps for the Salcha River–Pogo area encompass the Big Delta C-3, the SW ¼ of the Big Delta C-2, the NE ¼ of the Big Delta B-3, and most of the NW ¼ of the Big Delta B-2 quadrangles. Glaciation, periglacial processes, and mass movement combine to create an unstable geologic environment at high elevations in the study area. Avalanche cones, debris flow deposits, rubble sheets, steep colluvial aprons, and active thaw lakes indicate unstable conditions. Avalanches responsible for cone development are capable of moving and depositing boulders exceeding 2 m in diameter. Debris flow deposits are common in glacial cirques and locally extend into valley bottoms. The surficial-geologic map is almost complete, needing only minor edits. The engineering-geologic map will be created by applying a matrix to the comprehensive map to derive engineering-geologic units from the lithologic units, and will include additional geologic hazard information.

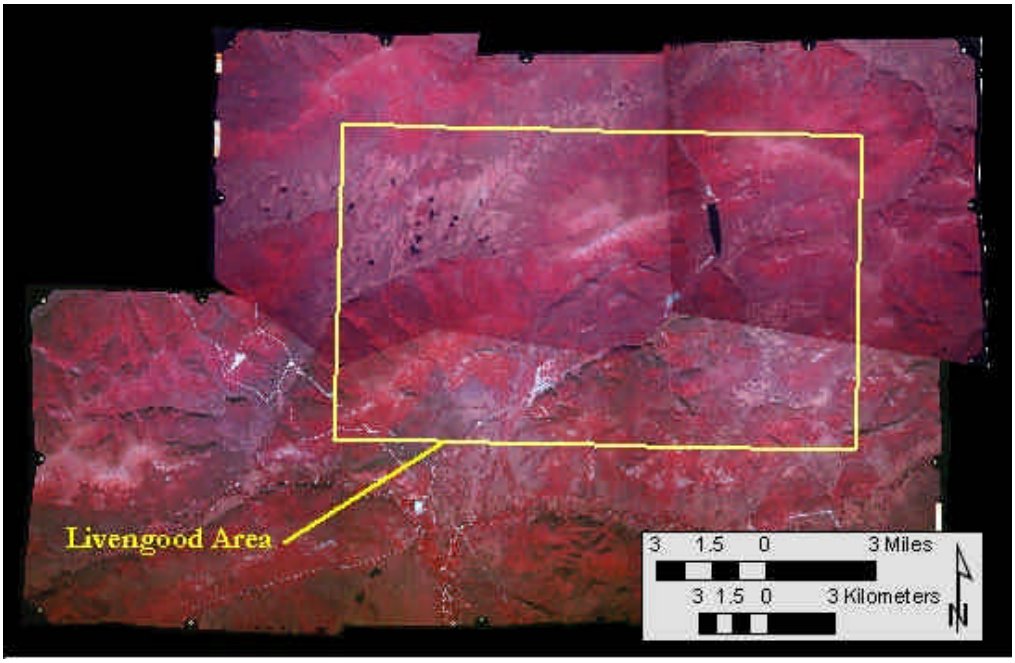

Figure 1 Orthophoto mosaic of the Livengood area generated from 1978 1:63,360-scale CIR aerial photography.

In addition to 1:63,360-scale surficial, engineering, and comprehensive maps, products of the Livengood project include an orthophoto mosaic of the area that may be published at a later date (fig. 1). The geologic maps describe surficial deposits including alluvial, colluvial, complex, and paludal materials. Thaw pond distribution suggests that active thermokarst is most common in fine-grained lowland colluvium and on hillsides and ridges with thick loess accumulation. The surficial-geologic map is complete, and the engineering-geologic map (derived by applying a matrix to the comprehensive map lithologic units) will be complete once it has been updated with photolinears.

The Kanayut River surficial-geologic map refines earlier 1:250,000-scale mapping by Tom Hamilton (U.S. Geological Survey). An engineering-geologic map will be derived from the 1:63,360-scale surficial- and bedrock-geologic maps. The surficial map describes glacial deposits related to four major glaciations as well as three distinct phases of the youngest, Itkillik, glaciation. In addition, various alluvial, fan, colluvial, and polygenetic deposits are mapped. Publication of the surficial geologic map is currently delayed, pending editing and outside peer review. Once the surficial-geologic map is finalized, the engineering-geologic map will be derived by applying a matrix to the comprehensive map lithologic units and including additional geologic hazard information.

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MapTEACH:
FIELD–GEOSCIENCE OUTREACH AND EDUCATION IN RURAL ALASKA

With the support of 10 partner organizations (including private sector, non-profit, and educational institutions), DGGS has begun work on MapTEACH (Mapping Technology Experiences with Alaska's Cultural Heritage), a 3-year NSF-funded collaborative project with the University of Wisconsin Environmental Remote Sensing Center and the University of Alaska Fairbanks Geography Department to develop a field-geoscience outreach program for middle- and high-school students in rural Alaska. This program emphasizes hands-on experience with spatial technology (GPS, GIS, and remote sensing imagery in a local landscape-landform context) in conjunction with traditional activities, and will be piloted in the Minto-Nenana, Nome, and Fairbanks areas (fig. 1). Since participants will work directly with DGGS geologists, they will be presented with a chance to authentically emulate scientific activities at a novice level, using real data in a real-world setting. Concurrently, DGGS will learn to incorporate education and outreach into its geological practices when working in rural Alaskan communities.

Figure 1. DGGS geologist guides UAF graduate students documenting "Outhouse Hole Stratigraphy" during the MapTEACH summer data collection efforts in Old Minto.

The program will be implemented in two separate but content-equivalent formats to meet the unique requirements of accessing students in rural Alaska. Students serviced by centralized school districts will take part in an 18-week (standard school semester), after-school, classroom-based curriculum that will culminate in a 7-day summer Capstone Field Experience during which students and teachers will interact in a field camp setting with Native Elders, traditions-based community leaders, and professional geologists from DGGS. Other, more geographically-dispersed students will be brought together in Intensive Studies Institutes at established living-learning facilities for two weeks of full-time classroom instruction, followed by a 7-day Capstone Field Experience.

DGGS's primary MapTEACH responsibilities are to: Compile and publish area-specific field guides that will allow students to locate examples of important geological features in their local area; acquire and process satellite and aerial imagery and GIS data; assemble classroom, technology, and field-geology kits; function-test IT (Information Technology) equipment and software in a field setting; collaborate on curriculum development; serve as the primary liaison with members of the pilot communities, including local and tribal governments, schools, and Native groups; participate in Intensive Studies Institutes at the Nenana Student Living Center and the Northwest Alaska Career and Technical Center; and act as guide and logistics lead for Capstone Field Experiences in all venues.

Introducing students, their families, and their communities to geoscience and geospatial technology in a culturally responsive and stimulating field setting will enhance public understanding of the role of natural resources in developing viable economies for rural Alaska and foster informed management practices using state-of-the-art technology tools and data sets.

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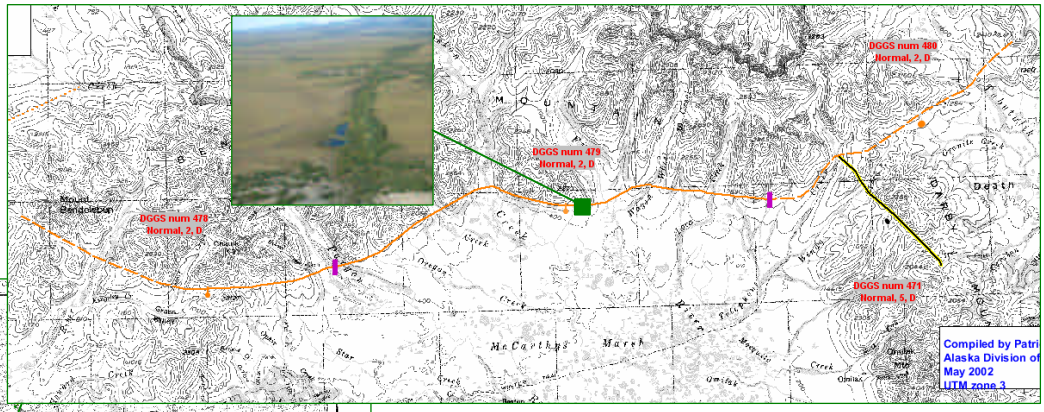
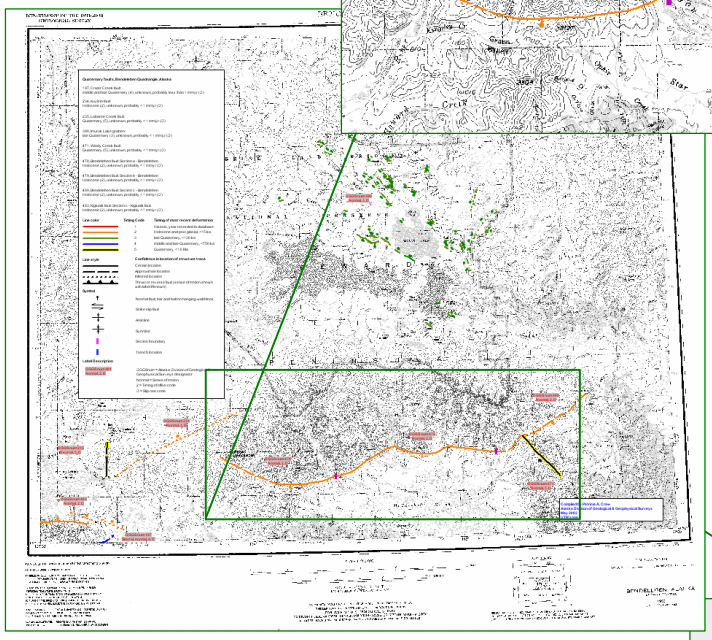
MAPS AND DATABASE OF QUATERNARY FAULTS AND FOLDS

The U.S. Geological Survey (USGS) initiated a cooperative project with DGGS to compile data on active faults and folds in Alaska in GIS and text formats. With funding provided by USGS, DGGS conducted an extensive literature survey to summarize published information on faults and folds that show geologic or seismic evidence of activity during the Quaternary period. In addition, DGGS is digitizing the fault traces and fold axes at 1:250,000 scale and recording associated attribute data in a GIS database. The resulting report and maps will facilitate evaluation of faulting and earthquake hazards for future development projects in the state.

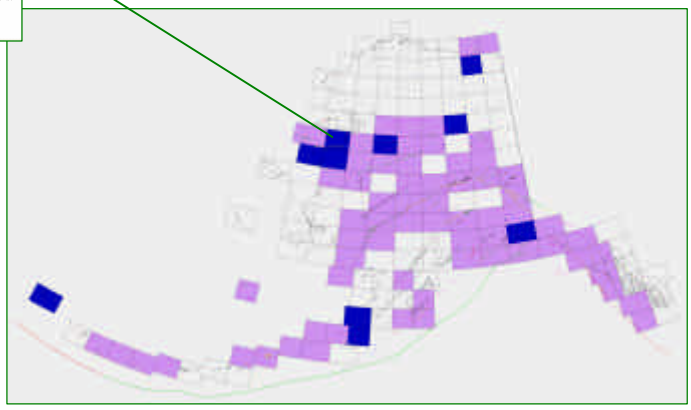




Left: 1:250,000-scale map of Bendeleben Quadrangle with legend describing summarized faults and color coded fault traces indicating fault age.
Above: Holocene Bendeleben fault and Quaternary Windy Creek fault. The three sections of Bendeleben fault are indicated by pink bars. Inset photo is view to the west of Bendeleben fault. Photo taken by De Anne S.P. Stevens.

A comprehensive literature search for pertinent published materials on Quaternary faults and folds in Alaska has been completed.

Remaining tasks include completion of text-based descriptions of faults and folds using a nationally established format, and compilation of fault traces and fold axes in GIS with associated attributes according to national guidelines. Text files and compiled map data were submitted to USGS at the end of FY03 and 75 percent payment (based on the percentage of project work completed) for the work was received.



Quadrangle color:
Blue - Compilation complete, text and maps reviewed by USGS.
Purple - Compilation partially complete. Some text reviewed by USGS.

Work on this project was delayed for more than a year because of the high-priority need to respond to the November 3, 2002, magnitude 7.9 Denali Fault earthquake and its effects. The Denali Fault earthquake also generated significant interest in the Quaternary fault compilation and a desire to complete the work as soon as possible. USGS and DGGS are currently determining the most effective way to complete the project. Once available in a published format this compilation will be useful to municipal and emergency planners, engineers, and researchers.

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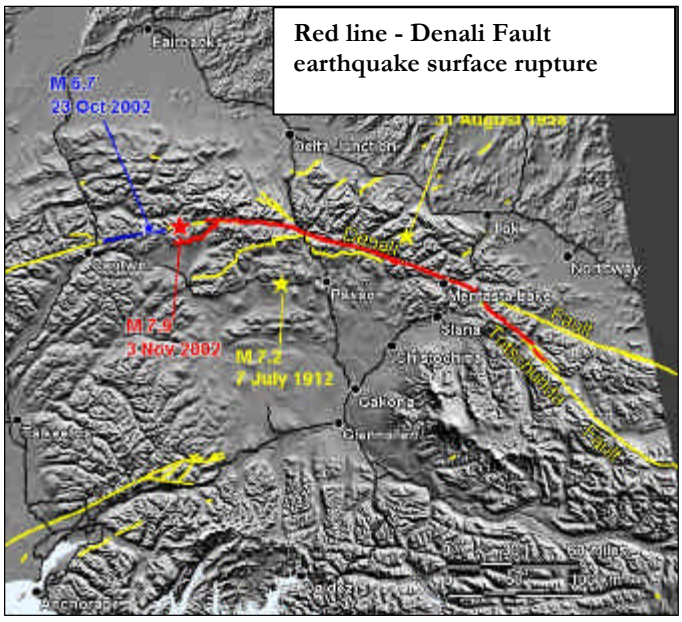
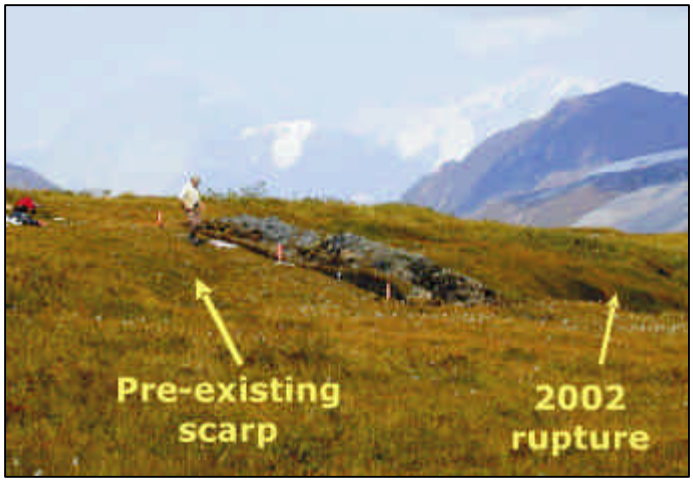
DENALI FAULT EARTHQUAKE RESPONSE

DGGS continues to respond to the November 3, 2002, magnitude 7.9 Denali fault earthquake on several levels including field research, public and professional outreach, and cooperation with various emergency and regulatory agencies.

DGGS initially responded to the Denali fault earthquake by deploying a field geologist to evaluate the fault rupture within 24 hours of the event. Reconnaissance efforts revealed that the earthquake caused a total of 340 km of surface rupture affecting three separate faults in central Alaska—the Denali, Totschunda, and the newly discovered Susitna Glacier fault.





Paleoseismic trench across the Susitna Glacier fault.

With funding from the USGS, DGGS continues to participate in studies directed toward understanding the paleoseismic history of and hazards related to faults that ruptured during the M7.9 Denali fault earthquake. Goals of current research on the fault include: (1) Understanding the behavior of the Denali fault—how often and where the fault ruptures the earth's surface, how large earthquakes on the fault can be, and how the November 3, 2002, event affected stress on the unruptured ends of the fault; and (2) understanding the relationship between the Denali fault and other potentially active faults in the Alaska Range. Currently DGGS's primary involvement in the field effort focuses on the Susitna Glacier thrust fault, which is where the surface rupture initiated during the earthquake.

DGGS involvement in outreach efforts resulting from the Denali fault earthquake are ongoing and include presenting preliminary findings at public lectures, and co-leading a field trip to the Denali fault that was attended by UAF students and faculty, and professional geologists.

Denali Fault fieldtrip participants, September, 2004.

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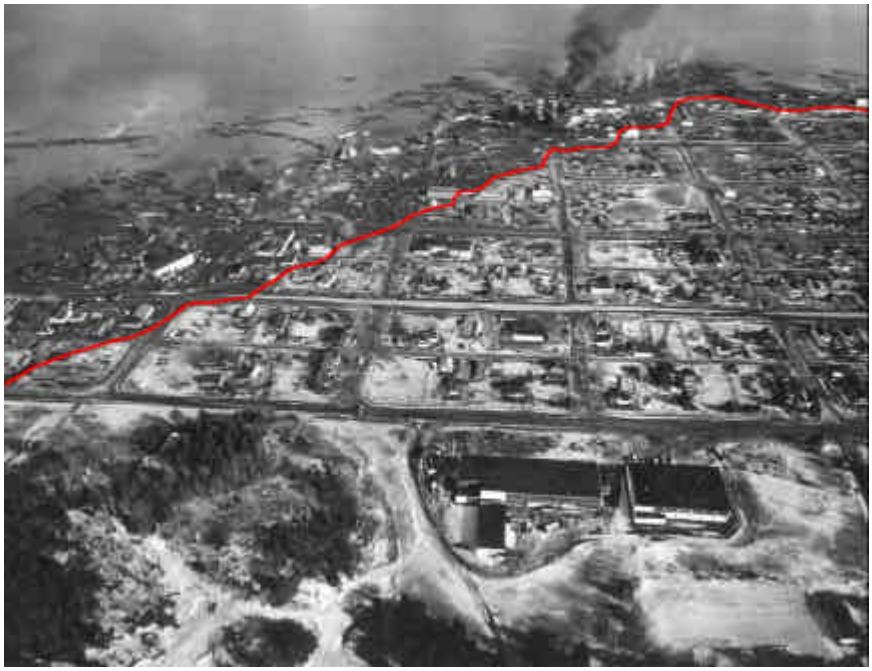
TSUNAMI INUNDATION MAPPING

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 includes 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.

As part of this program, DGGS is participating 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. As a result of a meeting of local, state, and federal representatives in 1999, ten communities were selected and prioritized for future inundation mapping based on population, tsunami exposure, community interest, and data availability. Kodiak was the first community selected for this project. During FY02, we completed and published maps of the Kodiak area to show estimated extent of inundation from tsunamis generated by seven hypothetical distant and nearby earthquakes. Inundation maps of Homer and Seldovia were completed in late 2004. We have begun data compilation and inundation-modeling work for the next community, Seward, for which maps will be completed in 2005.

In this program, we are developing inundation maps using 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 is conducting the wave modeling using facilities at the Arctic Region Supercomputing Center. DGGS imports the results of this modeling to a Geographic Information System (GIS) database for use in depicting projected inundation limits on suitable base maps. DGGS, UAGI, and DHSEM meet with community leaders to communicate progress and results of the project, discuss format of resulting maps, and obtain community input regarding past tsunami effects and extent. DGGS publishes the final maps along with explanatory text, which are available in both hardcopy and digital formats. DGGS also makes the GIS files of inundation-limit lines available to the local communities for use in preparing their own tsunami-evacuation maps.

During preparation of the Kodiak maps, comparison of the modeled 1964 inundation with the observed wave run-up in 1964 verified that the model produced comparable inundation. The maps also show that the modeled 1964 inundation nearly everywhere exceeds the inundation from all other credible source earthquakes. We have presented results of this project at international tsunami symposia in Istanbul, Turkey, and Seattle, Washington in 2001, at the Tsunami Society symposium in Honolulu, Hawaii, in 2002, and at the American Geophysical Union meetings in December 2003 and December 2004. This project was the subject of articles in *Geotimes* and *TsuInfo Alert Newsletter in 2002*.



View of Seward, Alaska, looking east shortly after the M9.2 earthquake of March 27, 1964. Red line shows approximate maximum extent of flooding from the resulting tsunami. New tsunami-inundation maps of Seward are currently in preparation.

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ALASKA COASTAL MANAGEMENT PROGRAM: NATURAL HAZARDS

DGGS is funded through a Reimbursable Services Agreement (RSA) with the Alaska Coastal Management Program (ACMP) to provide support to program personnel and coastal district planners regarding natural hazard issues. DGGS responsibilities include: Reviewing natural hazard aspects of some coastal policy questionnaires during the consistency review process; providing support to coastal district planners revising coastal management plans to meet new statutory requirements; participating in district teleconferences; and periodically reviewing regulatory and planning documents regarding natural hazard issues.

Figure1. DGGS geologists Patty Craw and De Anne Stevens reviewing online resources with planner Mike Harper.

At an October ACMP workshop in Anchorage, DGGS staff distributed resources and made presentations in an effort to guide district planners through the process of designating Natural Hazard Areas, a new program requirement resulting from regulation revisions. During a resource fair held in conjunction with the workshop, DGGS geologists also reviewed online resources useful for designating natural hazard areas in coastal districts on a case-by-case basis with individual district planners (fig. 1).

DGGS is currently reviewing U.S. Geological Survey and DGGS publications for information relating to natural hazards in an effort to develop an online, annotated natural hazards bibliographic database with links to scanned documents and maps. The document review process is prioritized by quadrangle (fig. 2). The natural hazards database will access dynamically linked data served from DGGS's publications database. The database interface will be developed by the ACMP and be made available at the ACMP Web site in early 2005. We expect to complete a review of relevant documents in high-priority quadrangles by the end of December 2004. If additional funding is secured, we will review low-priority quadrangles at a later time.

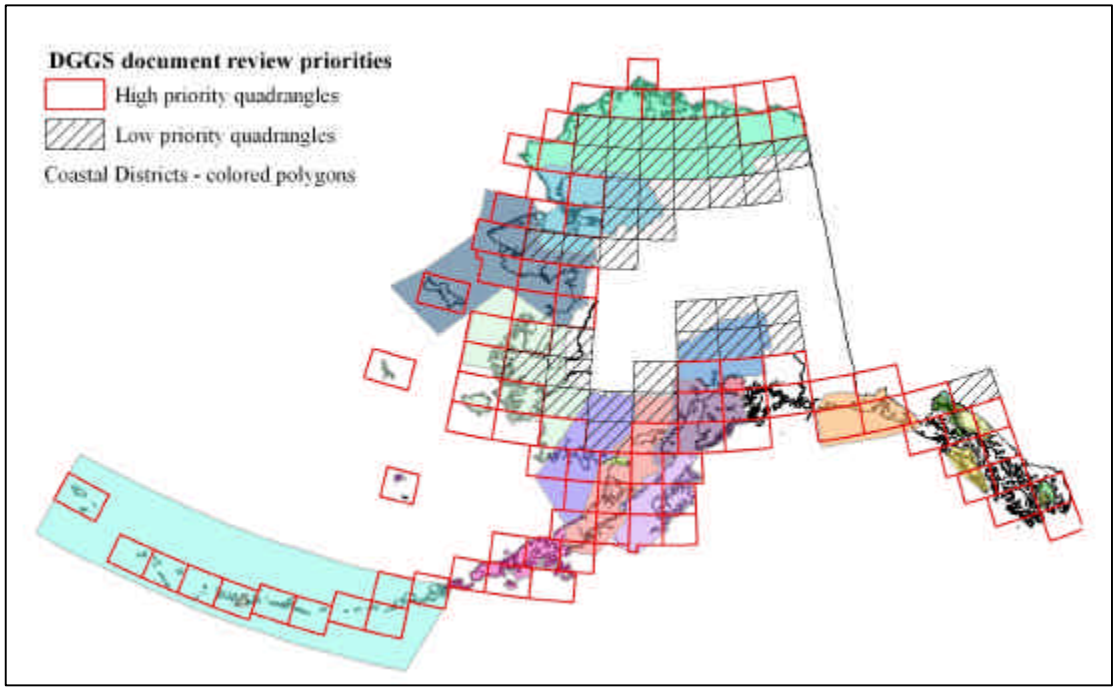

Figure2. Document review priorities for the Natural Hazards bibliographic database

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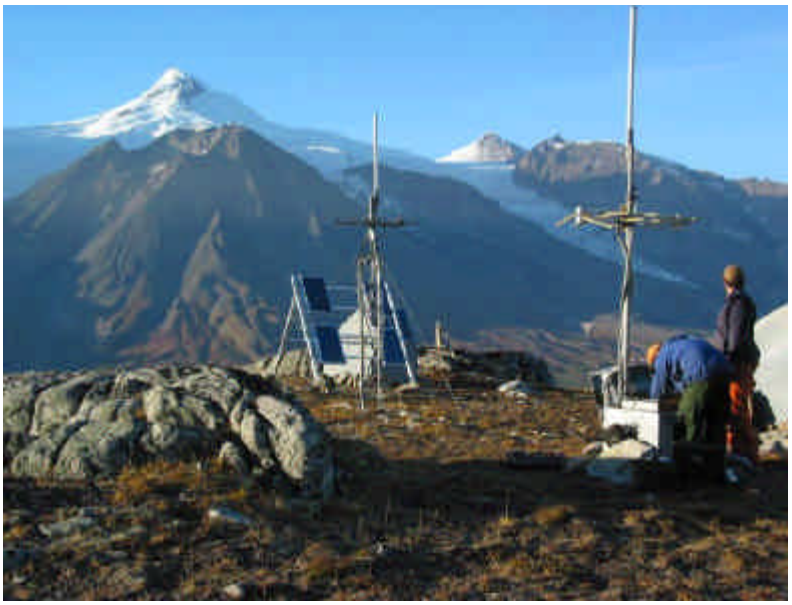
ALASKA VOLCANO OBSERVATORY MONITORING, GEOLOGIC MAPPING, VOLCANO-HAZARD ASSESSMENT, HELICOPTER LOGISTICS

The Alaska Volcano Observatory (AVO) is a multi-agency program that uses state, federal, and university resources to monitor and study Alaska's hazardous volcanoes, predict and record eruptive activity, and implement public safety measures. AVO, the largest volcano observatory on earth, is a cooperative program of the Alaska Division of Geological & Geophysical Surveys, the U.S. Geological Survey, and the University of Alaska Fairbanks Geophysical Institute.



Tim Plucinski and Cyrus Reed of the Alaska Volcano Observatory, Anchorage, work on a seismometer south of Mount Spurr, near the Chakachatna River. The summit of Mount Spurr and Crater Peak are visible in the background (Spurr's summit is the snow-capped mountain, upper left; Crater Peak is the snow-free peak immediately below Spurr's summit). Crater Peak was the site of the 1992 eruption. Photo by Sigrun Hreinsdottir.

Volcano Monitoring. The AVO continues to excel in integrated monitoring of volcanoes using short-period seismometers, broadband seismometers, continuous telemetered GPS, satellite imagery, gas measurements, webcams, and pilot reports. In 2004, three more volcanoes were added to the list of seismically monitored volcanic centers, bringing the total to 27, up from four in 1996. In addition to seismically monitored volcanoes, about 100 volcanoes in Alaska and Russia are monitored by systematic satellite observations. In response to elevated seismic activity and the appearance of a summit "melt-hole" at Mount Spurr volcano, the AVO installed several new instruments in September 2004. Five new seismometers are now improving our ability to detect and locate small earthquakes that may indicate magma movement and precursory eruptive activity. AVO also installed three permanent, continuous GPS stations to detect bulging of the ground that may indicate magma pushing its way toward the Earth's surface. Mount Veniaminof also showed signs of unrest this year and ash was detected on numerous occasions by satellite imagery, a webcam installed in the community of Perryville, and by local pilots. A third volcano, Shishaldin, was also restless enough to have its level-of-concern color code raised to "Yellow". The AVO issued weekly and daily reports of volcanic activity and contacted officials in the aviation community to warn of ash in the atmosphere.

Geologic Mapping and Volcano-hazard Assessment. Geologic maps and volcano-hazard assessments document the past history of a volcano, helping AVO staff anticipate the course and nature of future eruptions. Hazard reports also identify local infrastructure that may be at risk. DGGS provides field mapping, GIS, and geochemical sampling support to interagency teams working on Veniaminof, Okmok, Tanaga, Gareloi, and Chiginagak volcanoes. At Okmok, DGGS staff has a lead role in mapping the geology of the caldera walls and the precaldera shield. At Veniaminof we map, as well as provide central management and oversight of samples and the evolving geochemical database. At Chiginagak, DGGS is taking the lead role in both the geologic mapping and volcano-hazard assessment work. In December 2004, DGGS will publish the Okmok volcano-hazard assessment. Seven geologic maps are currently in preparation (Spurr, Shishaldin, Veniaminof, Okmok, Tanaga, Gareloi, and Chiginagak).

Helicopter logistics. DGGS manages helicopter procurement for all major AVO projects. In FY05 the helicopter expenses amounted to more than $750,000. Having all the helicopters contracted by a single agency results in significant budgetary and logistic efficiencies. As part of managing the helicopter budget, DGGS also coordinates all AVO field project schedules so that the appropriate helicopters are available throughout the field season to meet the needs of each particular field party.

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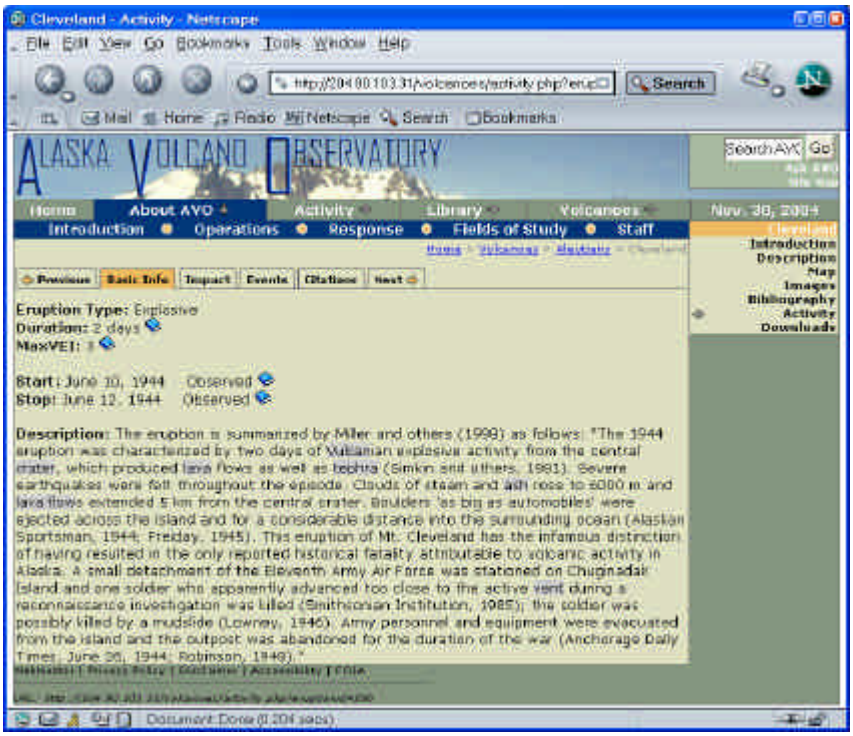
ALASKA VOLCANO OBSERVATORY: GEOLOGIC DATABASE OF INFORMATION ON VOLCANOES IN ALASKA (GeoDIVA), WEB SITE

GeoDIVA: AVO/DGGS staff design, populate, and distribute the Geologic Database of Information on Volcanoes in Alaska (GeoDIVA). The mission of GeoDIVA is to maintain complete, flexible, timely, and accurate geologic and geographic information on Pleistocene and younger Alaska volcanoes for scientific investigation, crisis response, and public information in a dynamic, digital format. This information system will be the most comprehensive, accurate, and up-to-date source of information on Alaska volcanoes available anywhere, online or in book form. As information is collected and integrated into the database, it will become available on both the internal and public AVO Web sites. GeoDIVA currently contains more than 3,500 bibliographic references, and basic physical information for 128 major volcanic features in Alaska. The eruption history module of the database is nearly complete, and will contain detailed eruption information for more than 400 historical eruptions in Alaska. The next modules will contain images and geochemical and sample data. The Web interface to the database is being built as the database is being populated, so that public release will not lag behind the completion of critical modules. In its current form the database contains 99 tables and 18 megabytes of text data.



Example of AVO's new, dynamic, database-driven web site showing detailed eruption information for the 1944 eruption of Mount Cleveland.

AVO World Wide Web site: The AVO public Web site serves about 260,000 pages and approximately 27 gigabytes of data per month, and is among the top ten USGS and USGS-affiliated web sites in the country. DGGS was the original creator of the AVO Web site a decade ago, and continues to be the site manager. DGGS has the primary responsibility for producing and maintaining the site (http://www.avo.alaska.edu), including all the coding, graphics manipulation, and most of the design. This site is heavily used as a source for volcano information, and distributes status reports and information updates to aviation personnel and interested citizens, as well as detailed information on individual volcanoes within Alaska. This site 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 Web site displays complex near-real-time seismological and satellite data over the Web for project participants, making distributed monitoring possible, instead of monitoring only from within the lab. During FY04, AVO/DGGS hired a full-time analyst programmer to build a database-to-Web interface for GeoDIVA, as well as maintain the Web site and server. During FY05, the AVO purchased a new server to host the Web site and enable creation and use of a dynamic, database-driven site. This new site will be the AVO's fifth version of the Web site, and will be much more informative, useable, and more easily updateable than any previous version. The new site is currently in a testing and review phase, and is expected to become available to the public during FY05.

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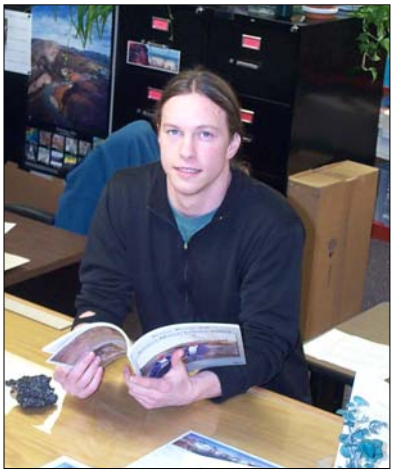
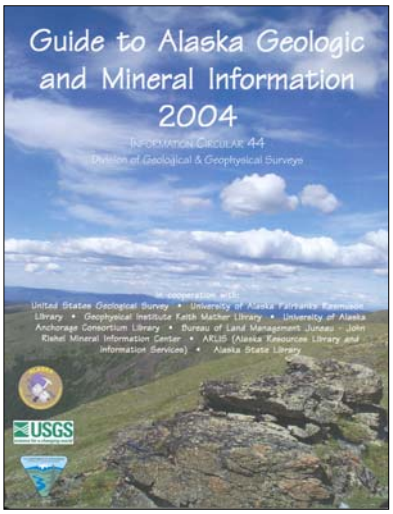
PUBLICATIONS PROJECT

The Publications 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 production and outreach activities. Some of the functions they perform are:

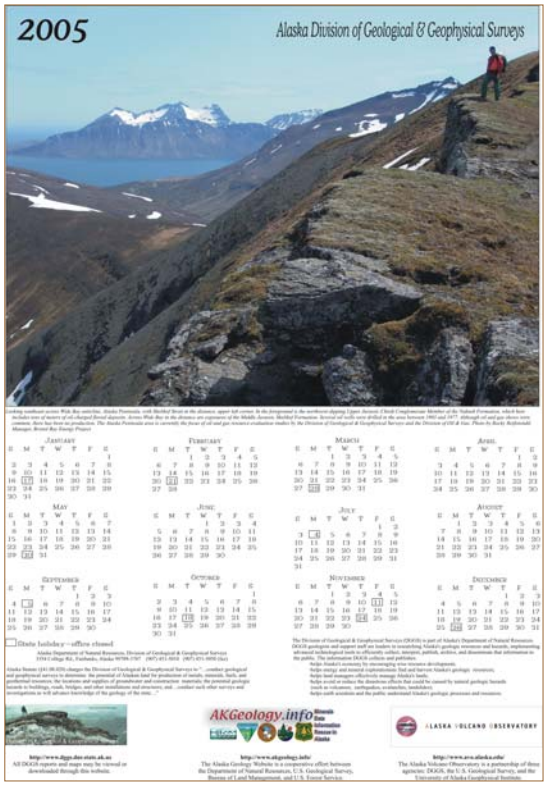


- Staff DGGS's information desk to provide information concerning Alaska's geology.
- Manage sales of DGGS geologic reports, maps and data.
- Prepare displays and represent DGGS at geologic conferences and meetings by providing staff and putting together the booth display.
- Produce an annual report for the Legislature and public, required by statute and written by the geologic staff, summarizing DGGS activities and communicating plans for its future projects.
- Publish a twice-yearly newsletter that communicates DGGS progress and advertises the latest publications.
- Design, produce, and distribute an annual informative DGGS calendar.
- Perform design, layout, and editing, and oversee final production of technical and educational geologic maps and reports in both printed and digital formats.
- Review metadata for each project.
- Manage the DGGS library so that reports are available and locatable.



- Maintain a collection of reports of the U.S. Geological Survey, U.S. Bureau of Mines, and the U.S. Bureau of Land Management.
- Participate in school outreach activities such as helping prepare classroom presentations, judging science fair entries, or helping teachers with earth science units.

The publications produced by this group record and preserve geologic data such as: Definitive statistics for Alaska's mineral industry; detailed (1:63,360-scale) bedrock, surficial, and engineering geology for specific areas in the state; sources of Alaska's geologic information; annual information about DGGS's programs and accomplishments; 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 2003; Bedrock geologic map of the Salcha River–Pogo area, Big Delta Quadrangle;* a proposed access corridor study (MP 45–122 and MP 129); and replotted geophysical surveys for Fairbanks, Richardson, Valdez Creek, Nyac, and Circle mining districts. Publications are available on paper (printed on demand and sold for the cost of printing) and as PDF documents and scanned compressed maps on the World Wide Web (no charge).



Work will continue in FY2005 to increase the availability of digital datasets from which GIS maps are produced, so that customers can manipulate data in any way they choose, and publishing documents in digital format first, then using the digital publication to produce a paper copy when necessary. The availability of data encourages exploration of Alaska's natural resources and increases the dollars invested in Alaska's economy.

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GIS–IT INFRASTRUCTURE PROJECT

The main focus of the Geographic Information Systems–Information Technology (GIS–IT) team is to provide primary computer and GIS service and support to DGGS staff and to streamline information delivery to the public. The team is made up of a Microcomputer/Network Specialist, a half-time Microcomputer/Network Technician, and a Cartographer.

DGGS IT staff identify projects that will provide improved computer services to our users. IT service initiatives completed this year included an upgrade of the Solaris operating environment to Solaris 9, installation of a DHCP server, and an upgrade of the SAMBA server, as well as configuration of a Gigabit LAN that is connected via Cisco Catalyst switches. In addition to IT service initiatives, over the last year DGGS IT staff were able to assist with several other DGGS projects. Most notably, we participated in the DGGS Database Project by installing and maintaining hardware and software for the Oracle server.

GIS users in the Division have benefited from the maintenance, upgrade, and support for ArcInfo licenses. The desktop GIS, Arc 8.1.2, implemented a year ago, has required new approaches to GIS that depart from our long-term Unix/ArcInfo background. To assist with GIS project work, the GIS staff have maintained plotters and digitizers and have participated in and completed maps for publications.

While providing DGGS staff with computers, network, and GIS, support is the primary function of the GIS–IT infrastructure project. Each year we embark on new projects, either to provide custom support or to improve the stability or efficiency of the support services we provide DGGS. Projects for FY2005 include upgrades to the current Web server and offering public access via the Internet to our geological database.

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U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER AND BULLETIN SCANNING AND DOCUMENT CONVERSION PROJECT

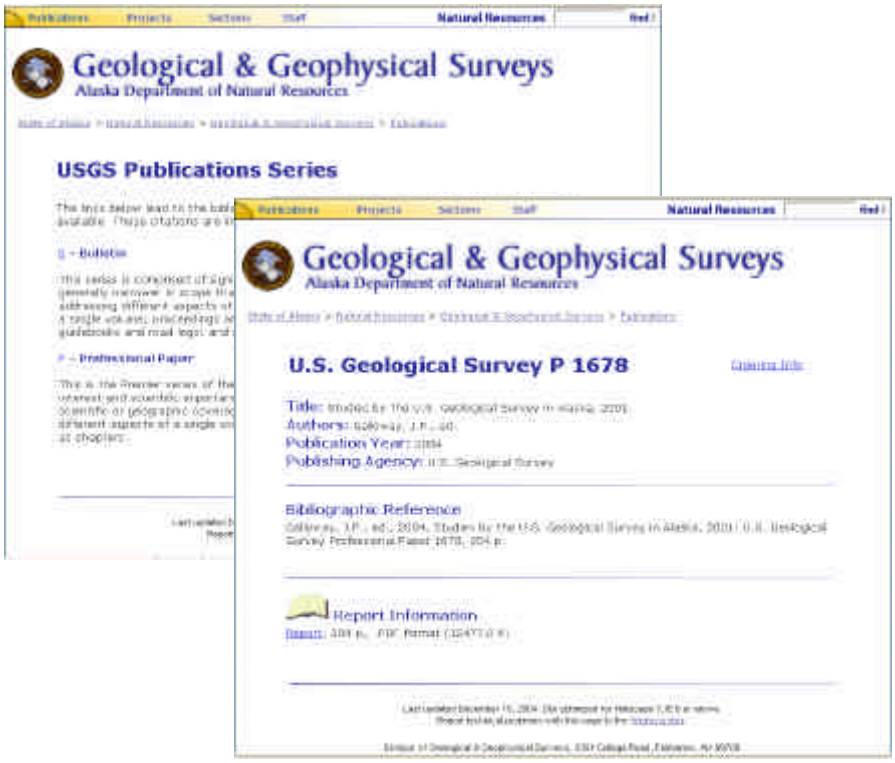
Over the last century the United States Geological Survey (USGS) has published a wealth of geologic research and information about the geology, natural resources, and geologic hazards of Alaska. Alaska's difficult terrain and logistical challenges contribute to a very high cost per mile for geologic mapping, which often makes legacy reports published by the USGS for many of the remote areas in Alaska remain the primary sources of geologic information. The maps, reports, and informational publications produced by the USGS in Alaska are widely utilized by oil companies, mining companies, resource-based companies, consultants, universities, schools, government agencies, scientists, and private individuals. With the exception of maps and reports published in the past few years, all of the USGS Alaska publications have existed solely on paper. A great majority of these documents are rare and out of print. Convenient access to complete collections of Alaska USGS reports is effectively restricted to patrons of the Alaska Division of Geological & Geophysical Surveys (DGGS) library and research libraries in Fairbanks, Anchorage, and Juneau.

DGGS holds an extensive collection of Alaska-related USGS Bulletins and Professional Papers. The collection includes about 1,000 text reports, consisting of approximately 55,000 pages of text, photographs, data tables, and small (page-sized or up to 11 x 17 inch) illustrations. Various documents in the collection also include "oversize" (larger than 11 x 17 inch) illustrations (about 1,300 sheets).

Funded by a grant from the USGS under the Minerals Data and Information Rescue in Alaska (MDIRA) Program, DGGS has finished the task of completing and cataloging this collection, converting the documents to digital files, archiving them in TIF format, and making them available to the public for downloading via the Web. The standard sized pages were formatted as text-recognized Adobe Acrobat 6.0 Portable Document Format (PDF) files and the "oversize" pages were formatted as standard image-only PDF files. DGGS has found that the Adobe Version 6 PDF format offers an excellent compromise between image resolution, user friendliness, and file size. The PDF format can be read from almost all computer platforms using free viewer software distributed by http://www.adobe.com/. The USGS Bulletin and Professional Paper collection is currently available via the MDIRA Interagency Bibliography Index (http://www.bib.akgeology.info/mbib/index.html), which includes simple keyword and quadrangle search options as well as user-defined advanced search options.

For the future, DGGS has proposed and received funding for a similar project that would include Alaska-related USGS Open-File Reports, Miscellaneous Field Studies, Geologic Quadrangle Maps, Miscellaneous Investigations/Geologic Investigations, Mineral Investigations Resources Maps, and various other short series USGS publications.

Work is underway to integrate all of these files into DGGS's existing Web page infrastructure. We are also investigating options for further enhancing users' ability to query these files and retrieve multiple documents from the Web site. Completion of the USGS Bulletin and Professional Paper scanning project has almost doubled the number of investigative documents in DGGS's "virtual library," making it a truly powerful tool for distributing information about Alaska's geologic resources.



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DIGITAL GEOLOGIC DATABASE PROJECT

In October 2000, the Division of Geological & Geophysical Surveys (DGGS) began creating a geologic database system to provide consistent data and information input, organization, and storage architecture. The database system will also provide data identification and retrieval functions to guide and encourage users to access appropriate data on-line. This project is part of the federally funded Minerals Data and Information at Risk in Alaska (MDIRA) program.

The Digital Geologic Database Project has three primary objectives: (1) Establish a spatially referenced geologic database system in a centralized data and information architecture with networked data access for new DGGS geologic data; (2) 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) Cooperatively integrate DGGS minerals-related data with data from other agencies through a MDIRA Web page <http://akgeology.info>.

During the first 4 years, the project work group identified geologic data for inclusion in the database, created a secure and stable database structure, and began loading data into the database. Publications are now searchable and served to the public through the DGGS Web site publications pages <http://www.dggs.dnr.state.ak.us/pubs>, the MDIRA Geologic Map Index Search Engine <http://maps.akgeology.info/>, and Interagency Bibliography <http://bib.akgeology.info/>. Starting in December 2004, DGGS geochemical data can be searched and viewed at http://www.dggs.dnr.state.ak..us/WebGeoChem, initially with a limited dataset, but with continuous additions through the next year. The project group is preparing to load geospatial data index information (metadata) into the database where it will be the basis for distributing DGGS spatial data on the web. Team members are also working to integrate DGGS data with other MDIRA datasets both within the DGGS database and on the MDIRA Web Page <http://akgeology.info>.

The DGGS Geologic Database will include location and geometry of spatially referenced information. Examples of spatially referenced information to be in the DGGS database include geologic sample locations, fault surface traces, areas covered by geologic maps, or surface exposures of geologic formations. All of the information in a spatially referenced database can be used in spatial analysis; for instance, a miner can find geologic maps in the area of a gold prospect. Geologic data to be contained in the DGGS database include bibliographic information, geologic map features, field observations, geochemical analyses, minerals resource data, and information for evaluating geologic hazards. Spatially referencing descriptive and analytical information in a relational database structure will allow more effective search methods for geologic information.

The database system consists of a data server, relational database management software, and utilities to interface with the DGGS Local Area Network (LAN) and Geographic Information System (GIS). The database is available to DGGS staff through the DGGS LAN using GIS software, database client software, and Web-based forms. The public can access the information through the DGGS Web site via searchable listings of publications and their associated data as well as through search engines allowing selection of customized data independent of individual project areas or publication. Minerals-related data will be also accessible through the MDIRA interagency data portal, which is concurrently under development by DNR. Ongoing development of data input forms, Web-based query forms, and geographic search engines will provide staff and public additional improved access to DGGS data.

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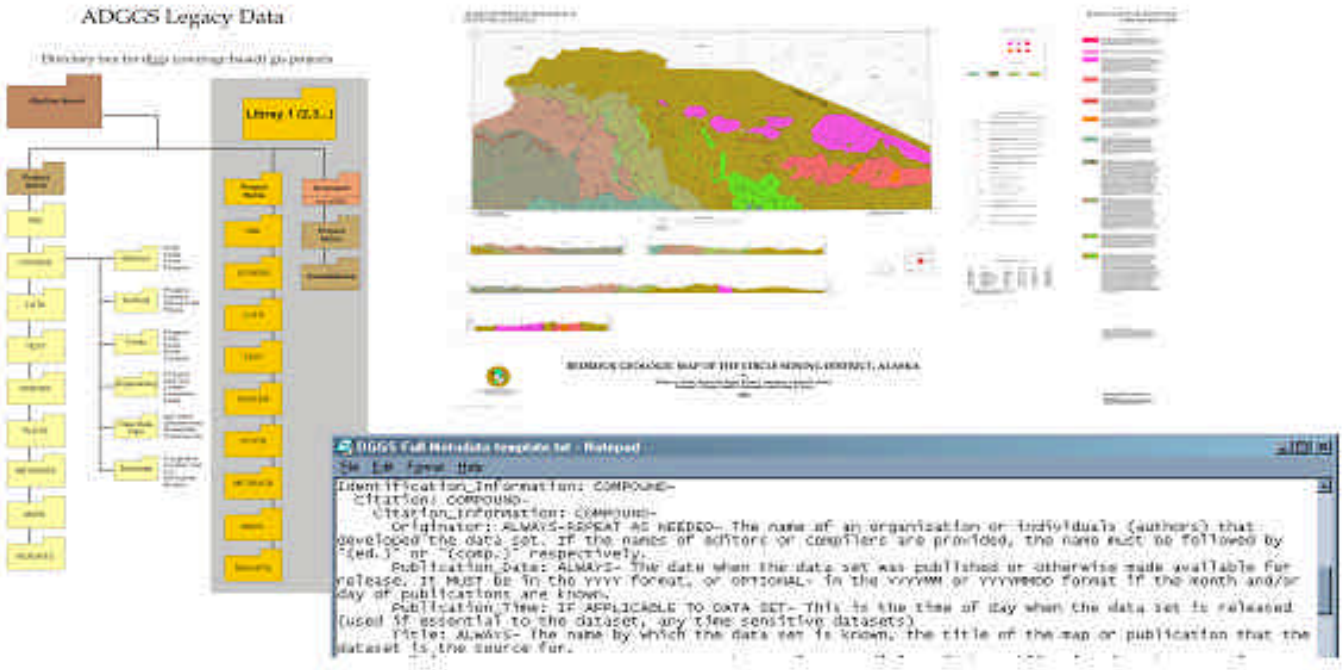
CONVERSION OF LEGACY DIGITAL GEOLOGIC MAP DATA

TO MODERN FGDC STANDARDS

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

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

The primary objective of this project is to have a temporary Geologist I produce FGDC-compliant metadata for our legacy GIS files in preparation for conversion to modern GIS data formats. This will require recovering much of the data from backup sources such as tapes and CD-ROMs, interviewing accessible geologists who produced the data, and gleaning as much information about the data as possible from available electronic and paper files. The end result will be to make DGGS GIS data more widely available, and the project will facilitate loading and integration of DGGS GIS data into the MDIRA-funded interagency database system.



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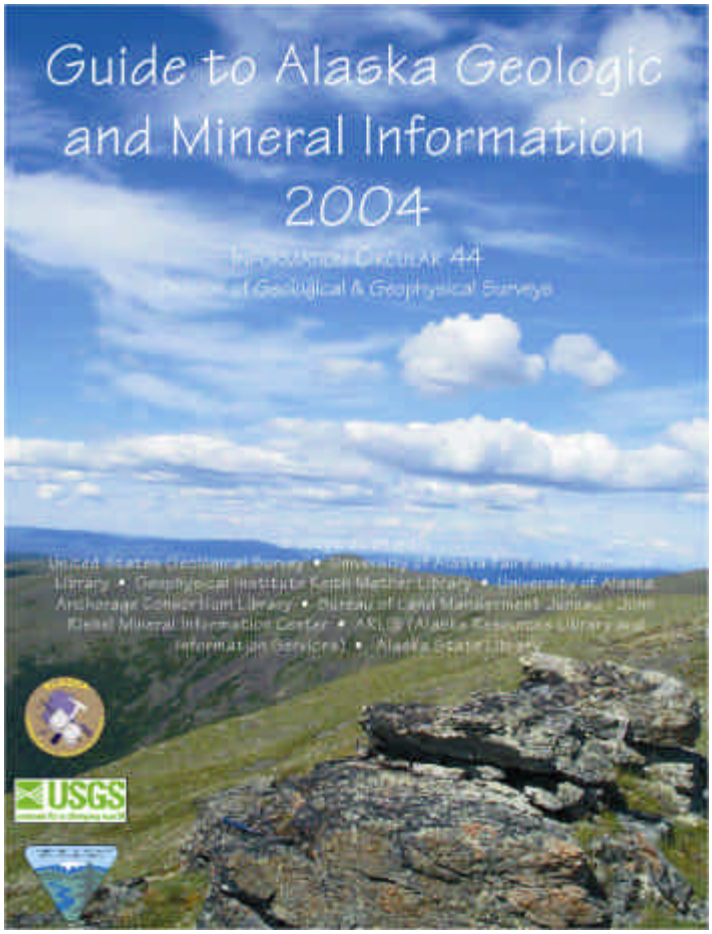
GUIDE TO ALASKA GEOLOGIC AND MINERALS INFORMATION

The Division of Geological and Geophysical Surveys (DGGS) completed its update of the popular Guide to Alaska Geologic and Mineral Information, which was first published in 1998 as Information Circular (IC) 44. Like the original document, the updated publication is available as a full-color, professionally printed 92-page volume and in a Web-based version. The printed version is available free of charge to the public, and reference copies are available at libraries, information centers, and selected government agencies in Alaska. The Guide was printed in August 2004.

The Guide identifies informational resources for topics that range from geology and mineral occurrences, to non-technical or ancillary issues such as permitting and land ownership and use. Although targeted to the mining and mineral exploration community, many resources identified in the Guide are relevant to the oil and gas and coal exploration industries, to the general geologic community, and to organizations and agencies that gather, disseminate, or utilize information about mining and geology in Alaska.

Resources in the Guide include those organizations that create and publish geologic and mineral industry information in Alaska; organizations that hold, distribute, or lend information such as libraries, agencies, and archives; Web-based and other digital sources of data; and sources of specific information about a wide variety of technical and regulatory/permitting issues that affect mineral exploration in Alaska.



The information in the Guide has been updated extensively to reflect, for example, changes in agency roles, changes in physical and electronic addresses, many new and expanded sources of digital maps and data, and the addition of online databases of land status and land-use records. The layout of the document and the Web site were changed very little, and consequently the new version of the Guide will be familiar to previous users.

Librarians from the eight major research collections in Alaska were the principal sources of information for the Guide. These include: Alaska Resource Library and Information Service (ARLIS, Cathy Vitale), UAA Consortium Library, USGS Technical Data Unit (Jill Schneider), UAF Rasmuson Library (John Kawula), Geophysical Institute Library (Julia Triplehorn), the Alaska State Library (Kay Shelton), DGGS (Dawn Roberts), and Bureau of Land Management John Rishel Mineral Information Center (Jane Albrecht). A contract editor, Ellen Daley, Ph.D., who had originally compiled and edited the Guide, also updated it, and worked with the librarians' group and DGGS Geologic Communications personnel to finalize the document.

This publication is a small, but highly visible part of the Minerals Data and Information Rescue in Alaska (MDIRA) program, which is a cooperative effort of DGGS, the U.S. Geological Survey (USGS), Bureau of Land Management (BLM), and major research libraries in Alaska. The goal of this program is to improve the quality and accessibility of mineral information in Alaska. Such information is seen as critical in making informed decisions about mineral development, land use, and future legislation related to minerals in Alaska.

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DGGS WEB PAGE

http://www.dggs.dnr.state.ak.us

During FY04 the front page of the DGGS Web site received 42,373 hits. The Generalized Geologic Map of Alaska continues to be popular, as well as the extensive series of DGGS publications and maps. In order of popularity, the files downloaded most in FY04 were IC 50, *Alaska's Mineral Industry 2003: A Summary*; RI 2002-1, *Tsunami Hazard Maps of the Kodiak Area, Alaska*, IC 44, *Guide to Alaska Geologic and Mineral Information*, and the page-sized *Generalized Geologic Map of Alaska*.

Much work was done during FY04 to improve the functionality, organization, appearance, and efficiency of the DGGS Web site and online file distribution infrastructure. To facilitate faster download times, ensure uninterrupted service, and eliminate file storage conflicts, Internet files and Web applications were transferred to a new Web server. In response to both customer feedback requesting scaled print and export functionality and to take advantage of improved file compression algorithms utilized by Adobe Acrobat version 6, DGGS has begun to distribute oversized page files (maps, posters, etc.) in Adobe Acrobat format. The DGGS Web site appearance and organization was significantly redesigned to comply with the new State of Alaska and DNR standard look and feel. Changes implemented in response to the statewide standard facilitate and encourage customer use via a more attractive and inviting graphics and layout scheme, a statewide uniform navigation structure, and a more predictable viewing interface. The efficiency of the DGGS Web site and online file distribution infrastructure has been significantly improved with implementation of "live" publication distribution pages. As a user browses through the publication pages, each page is automatically generated from a Division-wide ORACLE database to reflect that user's specific search criteria.

DGGS recently completed scanning U.S. Geological Survey Bulletins and Professional Papers on Alaska geology. Work is underway to make these reports available through the DGGS Web site. Also in progress is a system for distributing digital data online.

Contact Simone Montayne, Geologist, Geologic Communications Section, 907-451-5036, simone_montayne@dnr.state.ak.us

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 that were derived from Federal, State, and private lands of Alaska, including the Alaska outer continental shelf. Of this footage, there are 211,300 feet of diamond-drilled hard rock mineral core. This GMC collection includes rock materials from more than 1,300 oil and gas exploratory or production wells, rock core from more than 1,000 exploratory hard-rock mineral holes, and surface 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. The GMC cooperating government agencies are 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 concept of the GMC is to be an archive facility for all worthwhile rock samples collected in the state of Alaska and on the Alaska outer continental shelf. The chief users of the GMC are the oil and gas industry, although use by the minerals industry, government, and academic institutions is increasing.

As of mid December, the GMC had 216 visitations and 1,170 contacts during FY05. It has also received so far 11,543 processed oil/gas petrographic–microfossil–geochemical glass slides and three technical data reports, which include the U.S. Department of Interior Minerals Management Service entire microfossil (mostly Foraminifera) collection for Alaska as well as the Chevron Foraminifera collection for Alaska. There were a total of 427 visitations and 2,170 contacts to/with the facility for FY04, and increased numbers are expected for FY05. There were also a total of 1,242 processed slides and seven data reports for FY04, and increased numbers already exist and most likely will exist for FY05.

For FY05, the GMC has successfully received, stored, and is in the process of inventorying two 40-foot trailer loads of rock samples: representing collections from ChevronTexaco for the Milne Point oil field, the Resources Associate of Alaska collection for Interior Alaska through the University of Alaska Museum, and the "released" Alaska Oil and Gas Conservation Commission well samples. So far for FY05, samples for more than 15 oil/gas wells and more than 31 hard-rock mineral holes were received/donated.

The GMC now has a total of 54 shelved CONNEX containers with seven still empty of samples. The shelving space in the existing main GMC main warehouse has been increased by 20 percent for FY05 by building existing shelves up to 18 feet in height. No additional large rock donations are expected for the rest of FY05.

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PUBLICATIONS RELEASED IN 2004

GEOPHYSICAL MAPS & REPORTS

GPR 2004_1. Selected plot files of the airborne geophysical survey data of the Fairbanks and Richardson areas, interior Alaska. **1 CD-ROM**. Contains the **12 maps** listed below as GPR2004_1_xy in both HPGL/2 format and postscript printer format. **Software is needed** with **ability to plot HPGL2 files for an HP Design Jet 5000 series plotter** or **postscript files designed for an HP Design Jet Designjet 2500 using Postscript 3 printer driver v5.0**. The postscript files **should plot on all Hewlett Packard plotters that can interpret Postscript 3 files.** $10.

GPR 2004_1_1a. Total magnetic field of the Fairbanks mining district, interior Alaska, 2 sheets, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2004_1_1b. Total magnetic field of the Fairbanks mining district, interior Alaska, 2 sheets, **scale 1:63,360. Magnetic contours and section lines included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2004_1_2a. 7200 Hz coplanar resistivity of the Fairbanks mining district, interior Alaska, 2 sheets, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2004_1_2b. 7200 Hz coplanar resistivity of the Fairbanks mining district, interior Alaska, 2 sheets, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi. $26.

GPR 2004_1_3a. 900 Hz coplanar resistivity of the Fairbanks mining district, interior Alaska, 2 sheets, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2004_1_3b. 900 Hz coplanar resistivity of the Fairbanks mining district, interior Alaska, 2 sheets, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi. $26.

GPR 2004_1_4a. Total magnetic field of the Richardson mining district, interior Alaska, 1 sheet, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $13.

GPR 2004_1_4b. Total magnetic field of the Richardson mining district, interior Alaska, 1 sheet, **scale 1:63,360. Magnetic contours and section lines included. Full-color plot** from electronic file, 600 dpi. $13.

GPR 2004_1_5a. 7200 Hz coplanar resistivity of the Richardson mining district, interior Alaska, 1 sheet, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $13.

GPR 2004_1_5b. 7200 Hz coplanar resistivity of the Richardson mining district, interior Alaska, 1 sheet, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi. $13.

GPR 2004_1_6a. 900 Hz coplanar resistivity of the Richardson mining district, interior Alaska, 1 sheet, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $13.

GPR 2004_1_6b. 900 Hz coplanar resistivity of the Richardson mining district, interior Alaska, 1 sheet, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi. $13.

GPR 2004_2. Line, gridded, and vector data of airborne geophysical survey data for the Fairbanks and Richardson mining districts, interior Alaska. **1 CD-ROM set. Line data in ASCII format; gridded data in Geosoft format; vector files in Autocad 13 dxf files.** $20.

GPR 2004_3. Line, gridded, and vector data, and selected plot files of the airborne geophysical survey data of the Valdez Creek mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**. 1 CD-ROM**. **Line data in ASCII format; gridded data in Geosoft format and ER Mapper; vector files in Autocad 13 dxf files. 12 maps** listed below as GPR2004_3_xy are included as **plot files for** in both HPGL/2 format and postscript printer format. **Software is needed** with **ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter** or **postscript files designed for an HP Design Jet Designjet 5000/5500 using Postscript 3 printer driver v5.0**. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. *Supercedes PDF 94-15 and PDF 94-35.* $10.

GPR 2004_3_1a. Total magnetic field of the Valdez Creek mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full-color map; topography included.** *Supercedes RI 94-18; see also GPR 2004_3_1b.* $13.

GPR 2004_3_1b. Total magnetic field of the Valdez Creek mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full-color map; magnetic contours and section lines included.** .*Supercedes RI 94-18; see also GPR 2004_3_1a.* $13.

GPR 2004_3_2a. 7200 Hz coplanar resistivity of the Valdez Creek mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full-color map; topography included.** *Supercedes RI 94-20; see also GPR 2004_3_2b.* $13.

GPR 2004_3_2b. 7200 Hz coplanar resistivity of Valdez Creek mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full-color map; resistivity contours and section lines included**. *Supercedes RI 94-20; see also GPR 2004_3_2a.* $13.

GPR 2004_3_3a. 900 Hz coplanar resistivity of the Valdez Creek mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full-color map; topography included.** *Supercedes RI 94-21; see also GPR 2004_3_2b.* $13.

GPR 2004_3_3b. 900 Hz coplanar resistivity of the Valdez Creek mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full-color map; resistivity contours and section lines included**. *Supercedes RI 94-21; see also GPR 2004_3_2a.* $13.

GPR 2004_4. Line, gridded, and vector data, and selected plot files from the **aeromagnetic** survey of the **Nyac mining district**, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**. 1 CD-ROM**. Line data in ASCII format; gridded data in Geosoft format; vector files in Autocad 13 dxf files. **2 maps** listed below as GPR2004_4_1a and 1b are included as **plot files for** in both HPGL/2 format and postscript printer format. Software is needed with ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter or postscript files designed for an HP Design Jet Designjet 5000/5500 using Postscript 3 printer driver v5.0. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. *Supercedes PDF 94-15 and PDF 94-34.* $10.

GPR 2004_4_1a. Total magnetic field of the Nyac mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full color map; topography included.** *See also GPR 2004_4_1b.* $13.

GPR 2004_4_1b. Total magnetic field of the Nyac mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full color map; magnetic contours and section lines included.** *See also GPR 2004_4_1a.* $13.

GPR 2004_5. Line, gridded, and vector data, and selected plot files of the airborne geophysical survey data of the **Circle** mining district, central Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**., 2004, 1 CD-ROM**. **Contractor's report, previously released as PDF 94-36, is also included.** Line data in ASCII format; gridded data in Geosoft and ER Mapper format; vector files in Autocad 13 dxf files. 6 maps listed below as GPR 2004_5_1a through 3b are included as plot files for in both HPGL/2 format and postscript printer format. Software is needed with ability to plot HPGL2 files for an HP Design Jet 5000/5500 series plotter or postscript files designed for an HP Design Jet Designjet 5000/5500 using Postscript 3 printer driver v5.0. The postscript files should plot on all Hewlett Packard plotters that can interpret Postscript 3 files. *Supercedes PDF 94-15 and PDF 94-33.* $10.

GPR 2004_5_1a. Total magnetic field of the **Circle** mining district, interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**.,** 2004**,** 1 sheet, scale 1:63,360. **Full color map; topography included.** *Supercedes RI 94-14; see also GPR 2004_5_1b* $13.

GPR 2004_5_1b. Total magnetic field of the **Circle** mining district, interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**.,** 2004**,** 1 sheet, scale 1:63,360. **Full color map; magnetic contours and section lines included.** *Supercedes RI 94-14; see also GPR 2004_5_1a.* $13.

GPR 2004_5_1c. Color shadow total magnetic field of the **Circle** mining district, interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**.,** 2004**,** 1 sheet, scale 1:63,360. **Full color map; section lines included.** *Supercedes RI 94-15.* $13.

GPR 2004_5_2a. 7200 Hz coplanar apparent resistivity of the **Circle** mining district, interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp**.,** 2004**,** 1

sheet, scale 1:63,360. **Full color map; topography included.** *Supercedes RI 94-16; see also GPR 2004_5_2b.* $13.

GPR 2004_5_2b. 7200 Hz coplanar apparent resistivity of the **Circle** mining district, interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full color map; resistivity contours and section lines included.** *Supercedes RI 94-16; see also GPR 2004_5_2a.* $13.

GPR 2004_5_3a. 900 Hz coplanar apparent resistivity of the **Circle** mining district, interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full color map; topography included.** *Supercedes RI 94-17; see also GPR 2004_5_3b.* $13.

GPR 2004_5_3b. 900 Hz coplanar apparent resistivity of the **Circle** mining district, interior Alaska, by L.E. Burns, Fugro Airborne Surveys Corp., and Stevens Exploration Management Corp., 2004, 1 sheet, scale 1:63,360. **Full color map; Resistivity contours and section lines included.** *Supercedes RI 94-17; see also GPR 2004_5_3a.* $13.

INFORMATION CIRCULARS

IC 50. Alaska's mineral industry 2003: a summary, by D.J. Szumigala and R.H. Harris, 2004, 12 p. Free.

MISCELLANEOUS PUBLICATIONS

MP 45-122. Survey of geology, geologic materials, and geologic hazards in proposed access corridors in the *(see list below)* Quadrangle, Alaska

MP 45. Ambler River, 5 sheets. $65.
MP 46. Anchorage, 5 sheets. $65.
MP 47. Baird Mountains, 4 sheets. $52.
MP 48. Barrow, 5 sheets. $65.
MP 49. Barter Island, 5 sheets. $65.
MP 50. Beechey Point, 5 sheets. $65.
MP 51. Bendeleben Mountains, 5 sheets. $65.
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MP 120. Unalakleet, 5 sheets. $65.
MP 121. Utukok River. 5 sheets. $65.
MP 122. Wiseman, 5 sheets. $65.

MP 129. Survey of geology, geologic materials, and geologic hazards in proposed access corridors in selected quadrangles, Alaska, by R.D. Reger, D.S.P. Stevens, G. R. Cruse, and H.R. Livingston, 2003, 72 p. $7.

MP 132. Geologic hazards in and near the northern portion of the Bristol Bay Basin, by D.S.P. Stevens and P.A. Craw, 2003, 11 p. $2.

MP 134. Geologic hazards on and near the northern coast of the Alaska Peninsula, by D.S.P. Stevens and P.A. Craw, 2004, 20 p. $2.

PRELIMINARY INTERPRETIVE REPORTS

PIR 2003-2. Principal facts for gravity data collected in the Copper River Basin area, southcentral Alaska, by J.F. Meyer Jr. and P.L Boggess, 2003, 12 p. $2.

PIR 2003-3. Principal facts for gravity data collected in the Sustina Basin area, southcentral Alaska, by J.F. Meyer Jr. and P.L Boggess, 2003, 13 p. $2.

PIR 2004-2. 2003 Megafossil report from the Chandler Lake Quadrangle, North Slope, Alaska, by W.P. Elder and Andrea Loveland (comp), 2004, 5 p. $2.

PIR 2004-3. Geologic maps of the Livengood SW C-3 and SE C-4 quadrangles, Tolovana mining district, Alaska, by J.E. Athey and P.A. Craw, 2004, 24 p. $3.

PIR 2004-3a. Geologic map of the Livengood SW C-3 and SE C-4 quadrangles, Tolovana mining district, Alaska, by J.E. Athey, M.B. Werdon, R.J. Newberry, D.J. Szumigala, P.A. Craw, and S.A. Hicks, 2004, 1 sheet, scale 1:50,000. $13.

PIR 2004-3b. Bedrock geologic map of the Livengood SW C-3 and SE C-4 quadrangles, Tolovana mining district, Alaska, by J.E. Athey, D.J. Szumigala, R.J. Newberry, M.B. Werdon, and S.A. Hicks, 2004, 1 sheet, scale 1:50,000. $13.

PIR 2004-5. Reservoir characterization pilot study: porosity and permeability of 148 Tertiary to Mississippian age outcrop samples, eastcentral Brooks Range Foothills, and North Slope, Alaska, by R.R. Reifenstuhl and A.L. Strauch, 2004. $3.

RAW DATA FILES

RDF 2004-1. 40AR/39AR ages of rocks collected in the Livengood C-3, C-4, and B-4 Quadrangles, Alaska, by J.E. Athey, P.W. Layer, and Jeff Drake, 2004, 12 p. $2.

RDF 2004-2. Major-oxide, minor-oxide, and trace-element geochemical data from rocks collected in the Livengood Quadrangle, Alaska in 2001 and 2003, by J.E. Athey, M.B. Werdon, D.J. Szumigala, R.J. Newberry, S.A. Hicks, and H.A. Erickson, 2004, 14 p., 1 sheet, scale 1:63,360. $15.

RDF 2004-3. Summary of May 25-June 4, 2004, field notes and samples, Puale Bay and Wide Bay areas, Alaska Peninsula, by R.R. Reifenstuhl, D.C. Shafer, T.J. Ryherd, D.W. Brizzolara, and R.B. Blodgett, 2004, 16 p. $3.

REPORTS OF INVESTIGATIONS

RI 2004-1b. Bedrock geologic map of the Salcha River–Pogo area, Big Delta M.B. Werdon, R.J. Newberry, J.E. Athey, and D.J. Szumigala, 2004, 19 p., 1 sheet, scale 1:63,360. $15.

SPECIAL REPORTS

SR 58. Alaska's mineral industry 2003, by D.J. Szumigala, R.A. Hughes, and R.H. Harris, 2004, 69 p. Free.


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