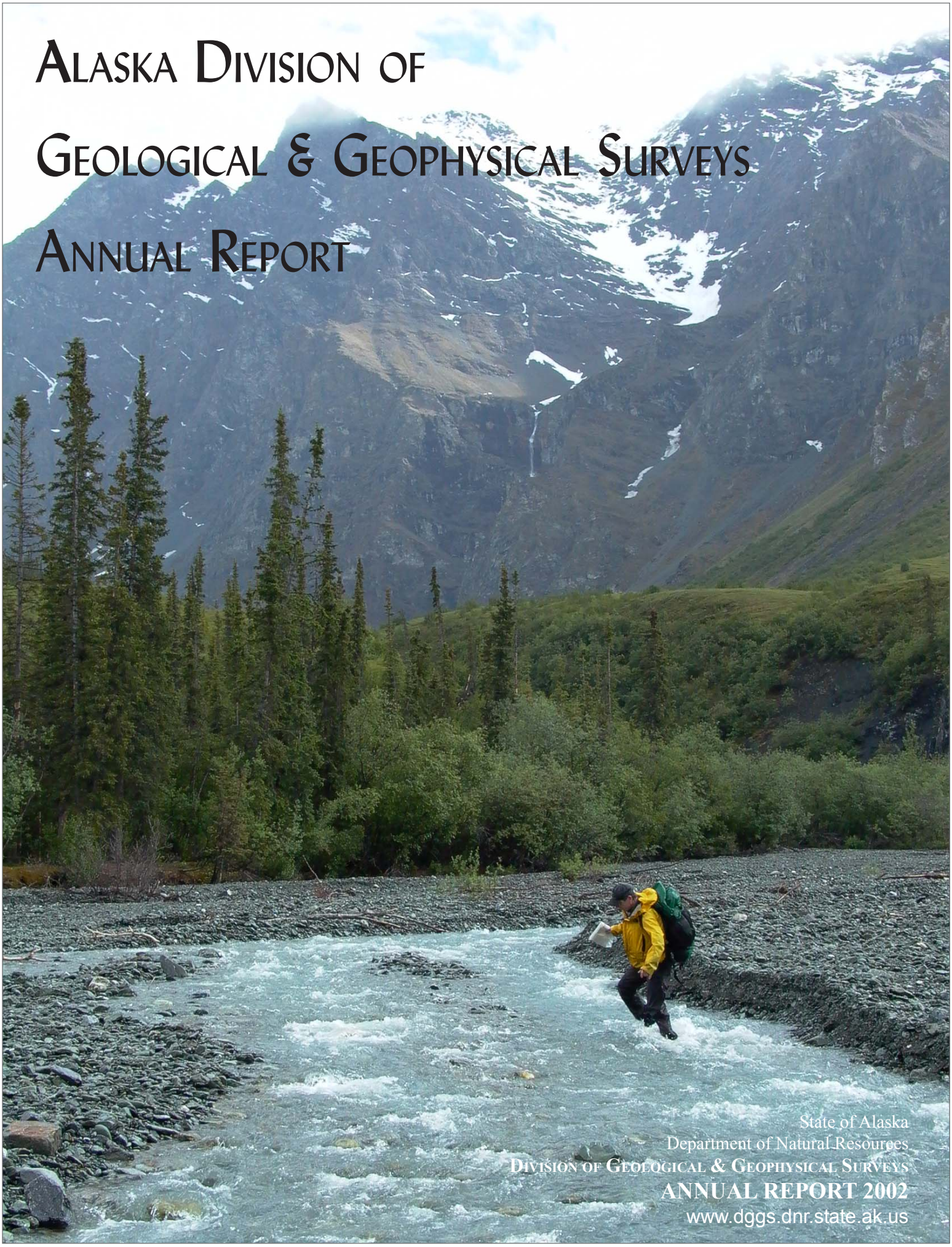
Alaska Division of Geological & Geophysical Surveys Annual Report



State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
ANNUAL REPORT 2002
www.dggs.dnr.state.ak.us

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

Sec. 41.08.017. Hydrological and seismic hazard data declared to be of public interest.

(a) Systematic collection, recording, evaluation, and distribution of data on the quantity, location, and quality of water of the state in the ground, on the surface of the ground, or along the coasts, are in the public interest and necessary to the orderly domestic and industrial development of the state.

(b) Systematic collection, evaluation, archival, and distribution of geologic data and information on earthquakes, volcanic eruptions, and engineering geology and identification of potential seismic, volcanic, and other geological hazards throughout the state are in the public interest and necessary to orderly, safely, and cost-effective development in the state. (§ 1 ch 41 SLA 1977; am § I ch 101 SLA 1983; am § 3 ch 36 (sic) SLA 1987)

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 the state. With the approval of the commissioner, the state geologist may acquire, by gift or purchase, geological and geophysical reports, surveys, and similar information.

(b) In addition, the division of geological and geophysical surveys shall:

(1) collect, record, evaluate, and distribute data on the quantity, quality, and location of underground, surface, and coastal water of the state;

(2) publish or have published data on the water of the state;

(3) require the filing with it of the results and findings of surveys of water quality, quantity, and location;

(4) require of water well contractors, the filing with it of basic water and aquifer data normally obtained, including but not limited to well location, estimated elevation, well driller's logs, pumping tests and flow measurements, and water quality determinations;

(5) accept and spend funds for the purposes of this section, AS 41.08.017, and 41.08.035 and enter into agreements with individuals, public or private agencies, communities, private industry, state agencies, and agencies of the federal government;

(6) collect, evaluate, and distribute geologic data on seismic events and engineering geology of the state;

(7) identify potential seismic hazards that might affect development in the state;

(8) inform public officials and industry about potential seismic hazards that might affect development in the state.

(§ 1 ch 93 SLA 1972; am § 2 ch 41 SLA 1977; am § 7 ch 175 SLA 1980; am § 2 ch 101 SLA 1983; am § 4 ch 36 SLA 1987)

Front Cover: *DGGS geologist Rocky Reifenstuhl crosses an unnamed tributary of the North Fork Koyukuk River in July 2002 while on a recreational outing. In this view looking south toward Mt. Doonerak in the northeastern Brooks Range, the north-dipping Lisburne Limestone forms part of the north limb of a several-kilometers-thick thrust sheet that moved many tens of kilometers northward during Early Cretaceous time (starting about 135 million years ago). This thrust sheet is known as the Endicott Mountains allochthon, and forms much of the Endicott Mountains in the northeastern Brooks Range. Understanding the geologic history of this and nearby bedrock exposures is fundamental to unraveling the geologic evolution of the Brooks Range and the North Slope. The Lisburne Limestone, which crops out at the surface here, is 8,900 feet below ground near Prudhoe Bay, where it has produced 143 million barrels of oil and natural gas liquid since production of the Lisburne pool began in 1981. Photo by Gail Koepf.*

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State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
ANNUAL REPORT 2002

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
  794 University Avenue, Suite 200
  Fairbanks, Alaska 99709-3645

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

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

- 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

Publication of this report is required by Alaska Statute 41.08.

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FOREWORD

In its February 2003 annual report to the Governor and Legislature, the Alaska Minerals Commission stressed the importance of baseline geologic-data acquisition for encouraging exploration and development of the state's mineral resources. The report indicated that potential investors decide where to commit resources for exploration partly on the basis of whether detailed, public geologic data are available. Although the Division of Geological & Geophysical Surveys (DGGS) is making steady progress in mapping known and potential mineral-rich areas of the state, Alaska "continues to lag far behind the remainder of the continent in geological knowledge of its land base," according to the Minerals Commission. For both mineral and fossil energy resources, many investors and exploration companies lack the resources to commit to area-wide framework geologic studies. The few that do perform field geologic inventories understandably keep these data proprietary. Clearly, the objective, peer-reviewed geological and geophysical information that DGGS collects and makes available to the public is highly beneficial for encouraging competitive mineral and fossil-fuel exploration in Alaska.

While many have recognized that collecting and publishing new geologic data in frontier areas are critical to marketing the state's mineral resources, the mining and geological communities in Alaska have also recognized the importance of legacy geological information collected during the past century. Much of this information has become unavailable to the public because reports are out of print, data were never published, or information is in computer formats that are no longer readable. At the request of the minerals community in Alaska, Congress initiated the *Minerals Data and Information Rescue in Alaska (MDIRA)* program in 1997 to bring together federal and state agencies, the University of Alaska, the Alaska Federation of Natives, and the private sector in a coordinated effort to recover these data from obscurity and make them easily available to the public. DGGS has taken a significant role in this program by converting all of its legacy minerals-related data, as well as much data from federal agencies, to Web-accessible digital formats. In the process, DGGS is taking the opportunity to revise its business processes so that all Division-generated geologic data, old and new alike, will reside in a state-of-the-art, mostly geographically referenced database system that will be continually kept up to date and facilitates efficient public access to the information in digital electronic formats.

The dynamic geologic processes that make Alaska rich in mineral and energy resources also give rise to significant geologic hazards that threaten the state's infrastructure and safety of its citizens. Through cooperative programs with Federal and State agencies, the University of Alaska, and community governments, DGGS maintains active programs to collect and publish information on earthquakes, volcanoes, tsunamis, and other hazards to help reduce future losses, thereby minimizing casualties and reducing Alaska's dependence on disaster relief. Additionally, DGGS continues to pursue support for performing baseline engineering-geologic assessments along major proposed transportation and pipeline corridors. If performed in advance of development, these assessments can provide important information for selecting routes, designing structures, avoiding future threats from large-scale processes like active faulting and landsliding, and minimizing long-term maintenance costs.

Now more than ever, wise development and stewardship of Alaska's natural resources are critical to the health of the state's economy and to the economy and security of the nation. DGGS's team of top-notch, highly motivated employees is excited to provide the baseline earth-science information to help guide Alaska's economic future.

Sincerely,

Rodney A Combellick

Rodney A. Combellick
Acting Director

Division of Geological & Geophysical Surveys
ANNUAL REPORT 2002

INTRODUCTION

LEGISLATIVE MISSION AND MEASURES STATEMENT

The following mission statements and accompanying measures are based on the statutory mandates of AS 41.08 and the guidance of the Alaska State Legislature.

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)*

Activities

Effort	Business Processes	Outputs
33%	Generate new geologic data and information that apply specifically to Alaska mineral and energy resources, construction materials, and geologic hazards	Studies, published papers, electronic publications, digital databases
65%	Compile, analyze, and publish summary reports and maps that identify source areas for minerals, energy resources, and construction materials and provide for the mitigation of natural geologic hazards	Studies, published papers, electronic publications, digital databases
2%	Help coordinate the geologic and archive activities of other state and federal agencies	Five-year priority list, Geologic Materials Center archives

Results (Outcomes)

I. Encourage private-sector investment in ventures that will develop Alaska's mineral, oil and gas, coal, and construction materials
II. Mitigate the adverse effects of naturally occurring geologic hazards on the economy of Alaska and the safety of Alaskans

Measures

1. Maintain the total value of Alaska's mineral industry at greater than $1.0 billion dollars.
2. Acres of ground under private-sector mineral exploration.
3. Complete geophysical/geological mineral surveys of 1,000 square miles of Alaska land at a target scale of 1 inch = 1 mile reported by category.
4. New acres of ground explored by the private sector for oil and gas.
5. Numbers of users requesting information on the geology of Alaska from the DGGS web site.
6. Number of responses to requests for information or assistance relating to engineering geology or hazards in Alaska.

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 name and mission of the Division were stabilized 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

Seven 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—similar to the process by which judicial appointees are selected. The qualifications and responsibilities of the State Geologist and the mission of DGGS are defined by statute.

STATUTORY MANDATES

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.

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 27 permanent full-time professional and support personnel, two non-permanent professional geologists, a Director, and six 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 junior geologist.

ORGANIZATION

DGGS is one of seven Divisions within the Alaska Department of Natural Resources (fig. 1).

DEPARTMENT OF NATURAL RESOURCES
CURRENT ORGANIZATIONAL CHART

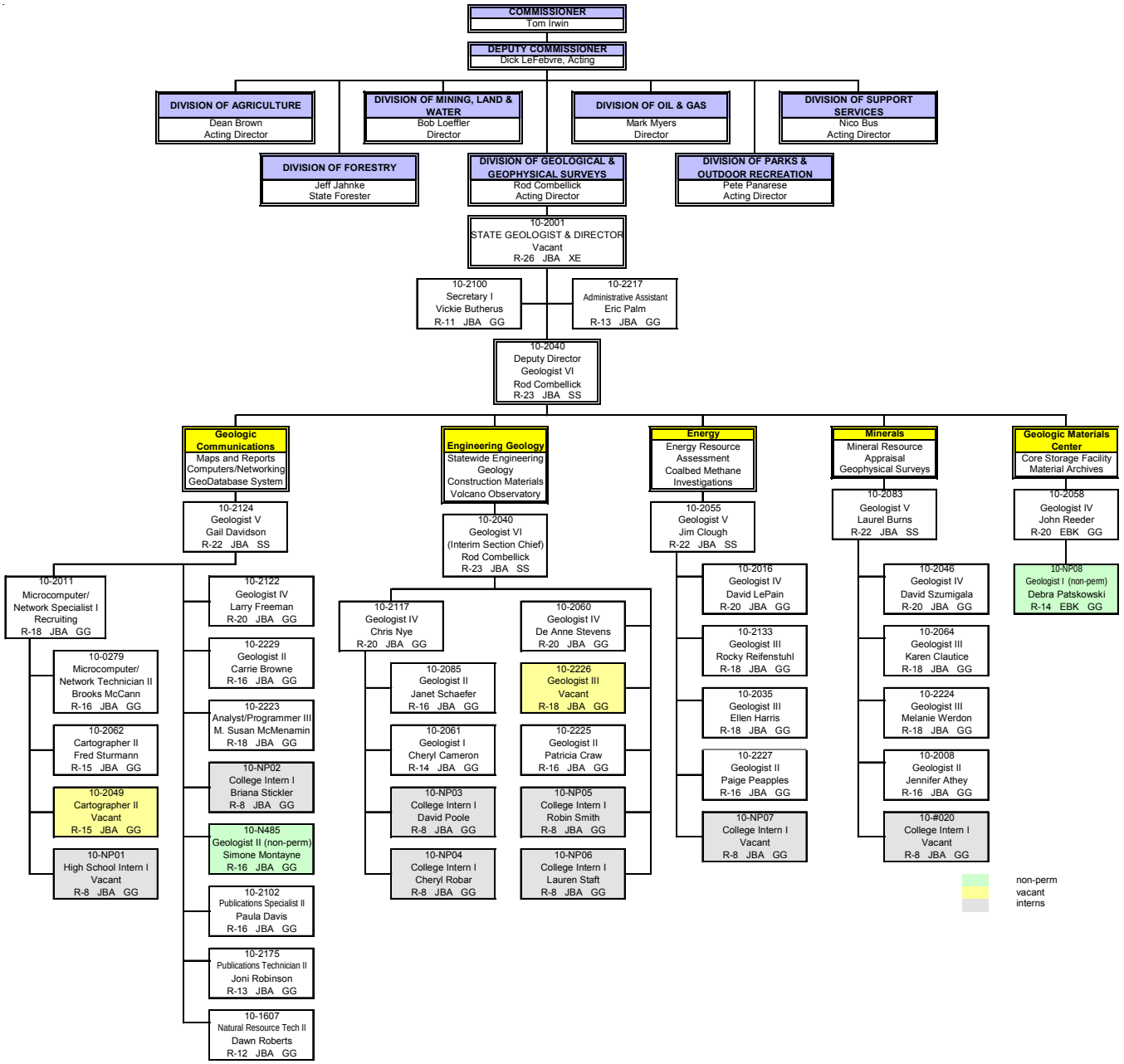
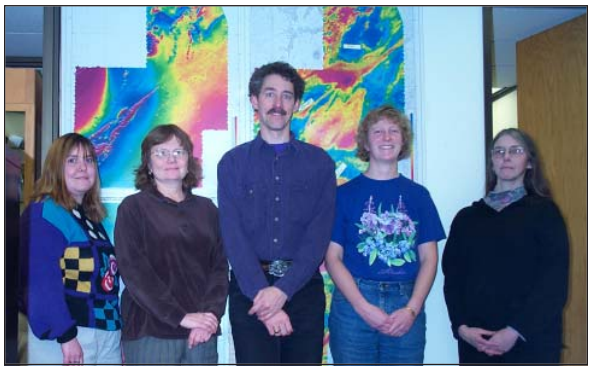


Figure 1

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.

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 all Alaska citizens.



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.

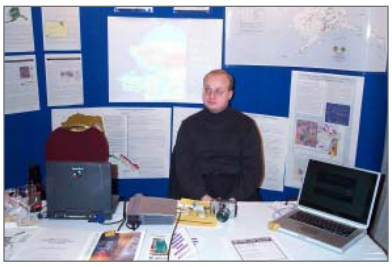
The **Engineering Geology Section** collects, analyzes, and compiles geologic data useful for engineering and hazard-mitigation purposes. Surficial-geologic maps portray the distribution of surficial geologic materials and provide information on their engineering properties and potential as construction-materials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

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.

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 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 works closely with the State Pipeline Coordinator's Office when geotechnical information about future access corridors is needed. We have an increasing amount of interaction with the Land Records Information System group in the DNR Support Services Division as more of our geologic data are compiled and organized in digital format amenable to merging with other land information. The DGGS energy group often works 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 Division of Community & Business Development of the Department of Community & Economic Development. DGGS works closely with Division of Emergency Services in the Department of Military and Veterans Affairs to evaluate hazards and design scenarios for hazards events.



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. We are currently engaged in a cooperative project with the Division of Oil and Gas to characterize the sedimentary petrology and reservoir potential of oil and gas exploration targets in the North Slope foothills.

DGGS provides ongoing geologic technical services to other DNR divisions and line agencies of state government. Typically these activities occupy from 5 to 10 percent of our total effort. Over the last few years, interagency funding from other DNR divisions has been about one percent of our total budget.

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, in FY02, DGGS participated a federally funded cooperative program to develop tsunami-inundataion maps for coastal communities. In Kodiak, the first community 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 the Kenai Peninsula Borough and the cities of Homer, Seldovia, and Seward for the next tsunami-inundation maps to be generated by this program. The Engineering Geology section has also been working 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). We are currently working with BLM to catalog the thousands of mineral-related reference samples stored at the Alaska Geologic Materials Center in Eagle River. DGGS also receives 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-related work and studies related to oil and gas potential in interior basins and the North Slope. 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.

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 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 thirtieth year in business in 1999.

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 is currently Head of the Department of Geology and Geophysics, a position he has held for 5 years.

Irene Anderson

Sitnasuak Native Corporation, representing rural Alaskans in western Alaska

Irene Anderson is the Land Manager for the Sitnasuak Native (village) Corporation headquartered in Nome, Alaska. Mrs. Anderson has first-hand knowledge of the mineral, energy, and engineering geology needs throughout a wide region of rural Alaska.

Norman Phillips

Doyon, Ltd. Native Corporation, providing a perspective from the largest of Alaska's private-sector regional Native corporations

Norm Phillips is a geological engineer serving as the Resource Manager for Doyon Ltd. Native (regional) Corporation. In this capacity Mr. Phillips oversees the geologic resource conservation and development efforts for an area encompassing much of interior Alaska.

FY03 DIVISION BUDGET

Section	General Fund	CIP	Federal receipts	Interagency receipts	Program receipts	Total by Section
Mineral Resource Appraisal	475.0	500.0	865.2	0.0	0.0	1,840.2
Energy Resource Appraisal	361.0	0.0	238.3	0.0	190.4	789.7
Engineering Geology	238.4	0.0	600.4	308.7	0.0	1,147.5
Geologic Maps and Reports	556.2	0.0	672.4	30.0	0.0	1,258.6
Geologic Materials Center	130.2	0.0	38.6	0.0	0.0	168.8
Technical Support	232.3	0.0	0.0	42.7	0.0	275.0
Total by Funding Source	**1,993.1**	**500.0**	**2,414.9**	**381.4**	**190.4**	**5,479.8**

KEY ISSUES

ESCALATING COST OF FIELD OPERATIONS AND DECLINING GENERAL FUND BUDGETS

Rising costs of field operations concurrent with General Fund budget reductions and a projected tightening of Federal funding sources because of Homeland Security issues creates a growing concern for the long-term viability of DGGS geologic data generation projects. Currently about 50 percent of the DGGS annual program is funded by Federal receipt funds. During the past 18 months, DGGS field operation costs have risen about 20 percent for geologic ground-truth geologic mapping and cost increases approach 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 field programs have always had to rely on

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. In the summer of 2000 that four hours cost a project $2050 per day; in 2001 it cost $2680 per day; in 2002, it cost $5050 per day. We currently have no plausible strategy that would allow us to meet this kind of cost escalation while maintaining current information quality and annual tract coverages.

DGGS is much more than just a database. Our geologic staff have many decades of combined expertise on the resource endowment of the state. We have reached a point at which DGGS either must receive an increase in its annual General Fund base budget appropriation or we must begin to curtail field operations and new data generation in order to preserve the state's core body of geologic knowledge, materials, and expertise.

GEOLOGIC INFORMATION ACCESSIBILITY

DGGS products and services are specifically aimed at supporting statewide economic development and the mitigation of natural geologic hazards. People engaged in development and policy activities can only benefit from DGGS geological and geophysical data, maps, and reports when they are aware that the data exist and they are accessible in useful formats. Additionally, private sector enterprises and government decision makers are under increasing pressure to produce results on a shorter time line. These time pressures are transferred to DGGS when these entities seek geologic information.

DGGS faces increasing demand for: (1) more widespread and faster access to our 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 conventional paper-based publications.

The key to meeting these demands is the use of computer technology. During FY01, DGGS secured Federal funding to convert all of its maps and reports to digital format. Early in FY02, nearly all of these maps and reports were made accessible on the Internet. Funded by a Federal grant, we are now working with contractors to implement 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 digital data files of original DGGS numeric, text, and graphical geologic data over the Internet.

The foundation of this project has been the Federally funded Minerals and Data Information Rescue in Alaska (MDIRA) project. The primary goal of this project is the rescue of previously generated geologic data that has been all but lost over the years, partly because of the lack of resources for a sustained data management program. As part of this geologic data management project, a data management system is being developed and installed in the business practices of DGGS as well as collaborating Federal agencies. We view this effort as the last chance to recover and stabilize decades of Alaska geologic information that will otherwise be forever lost to the state.

Federal support for the MDIRA project ends in FY04. Completion and implementation of the data management system, as well as ongoing maintenance with modest continuing State General Fund support, are critical to prserving the Alaska geologic database for future generations.

RURAL ENERGY

The lack of developed sources of local energy in rural Alaska is a continuing problem that DGGS is addressing through its coalbed methane 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 soliciting supplemental Federal grants and, more recently, grants from interested private industry sources. The work is now at a stage that actual test drilling is needed at the three high priority sites to determine whether coalbed methane gas is present in useful quantities in the subsurface.

The cost of drilling is high. Thus, both the private sector and State and Federal governments are reluctant to support the needed drilling. In an attempt to move beyond this impediment, DGGS has developed a detailed proposal with Los Alamos National Laboratory to seek Federal Department of Energy funds to deploy a new light-weight, and ultimately more economical, microdrilling technology to test both the technology and the coalbed methane potential at three high priority sites in Alaska. We have no assurance that the proposal will be funded. However, if it is funded, the Los Alamos technology will be used at Chignik, Fort Yukon, and

Wainwright to test local coalbed methane resources near those villages.

MAJOR PENDING INFRASTRUCTURE PROJECTS AND GEOLOGIC HAZARD ASSESSMENTS

Alaska appears to 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 an extension of the Alaska Railroad to Canada.

A fundamental and prudent first step in undertaking infrastructure development enterprises of this magnitude is a comprehensive geologic resource, engineering geology, 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. 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.

Prior knowledge of the kind and extent of geologic hazards is the first step in their mitigation. Such knowledge can be factored into design criteria to improve public safety, decrease long-term maintenance costs, and decrease construction costs resulting from encountering unforeseen obstacles. Knowledge of geologic resources within the effective range of transportation corridors may positively affect their projected economic feasibility.

If Alaska's two pending mega-projects are initiated in the shortest time possible, there is currently a window of about two to three years in which to conduct a detailed reconnaissance-level engineering geology and geologic hazard assessments and geologic resource inventories of the probable infrastructure corridors that will host them. Currently, no funds are identified to implement these field studies.

DGGS FY03 PROGRAM OUTLINE

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 FY03 DGGS program is focused primarily on projects designed to foster the creation of future Alaskan jobs and revenue and the mitigation of adverse consequences arising from 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, subsurface 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 Law, Department of Community & Economic Development, Department of Transportation & Public Facilities, Division of Emergency Services, 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 Alaska geologic information and a primary source of information for mitigating geologic hazards (for example, volcanic hazards, coastal erosion, and earthquake hazards). To focus attention on Alaska's subsurface resource potential, DGGS makes the state's geologic information available on statewide, national, and international levels.

Detailed project summaries for the following mineral resource, energy resource, engineering geology, and geologic information tasks appear in the section "Project Summaries—FY03."

PROGRAM OBJECTIVES AND TASKS—FY03

STATE GEOLOGIST/DIRECTOR

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

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, and local, federal, and private entities.
2. Stimulate discovery and development of the geologic resources of the state through support of detailed geological and geophysical surveys.
3. Mitigate the adverse effects associated with natural geologic hazards.
4. Provide secure archival storage and access to the state's growing legacy of oil- and minerals-related geologic reference cores and samples, and other geologic data.

TASKS

1. Prepare annual Division funding plan including Alaska General Fund base budget, Capital Improvements budget, and federal initiatives.
2. Educate Alaska state legislators and Alaska federal delegation about the DGGS geologic program and its significance.
3. Focus the Division's geologic expertise on addressing Alaska's highest priority needs for geologic information.

STATEWIDE MINERAL RESOURCE APPRAISAL

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 FY03 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 also participates 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 2002.

TASKS

Project tasks and products financed by FY03 General Funds, CIP funds, Program Receipts, and Federal Receipts are:

1. Supported by FY03 CIP funds, geophysically survey the Council mining district of high-potential mineral tracts per year to provide the geophysical data needed to sustain Alaska's mineral industry investments and create jobs throughout Alaska.
2. Supported by FY03 General Fund base-budget and committed airborne geophysical/geological mineral inventory CIP funds, conduct ground-truth geologic mapping and release interim geologic maps of the Big Delta C-3 Quadrangle and two adjacent quarter quadrangle areas; the Big Delta SW C-2 and NE B-3, that lie within the Salcha River - Pogo airborne geophysical tract. Preliminary geologic maps, sample location maps, and tables of analytical data will be produced.

3. Gather, verify, and collate pertinent statistics and summary observations about the status of Alaska's mineral industry to document the industry's annual achievements and encourage others to participate. The summary of these data will be published as the FY03 edition of the annual report, *Alaska's Mineral Industry 2002*.
4. Produce a ground-truth geologic map of the Delta mining belt from data contributed to DGGS by the private sector.
5. Work on a cooperative project with the Geologic Survey of Canada to prepare a ground-truth geologic map of the Broxson Gulch area near to better understand and disseminate knowledge about regional metallogeny in a 600-kilometer-long metallogenic terrane that ranges from British Columbia to southcentral Alaska. The map is scheduled to be published in FY04.
6. Supported by Federal funding, continue a two-year project to compile a georeferenced database of geochemical data for the Aniak mining region in southwestern Alaska. The data will be published by U.S. Bureau of Land Management in cooperation with DGGS.
7. Supported by Federal funding, compile a GIS-based georeferenced bibliography of bedrock geologic mapping of Alaska showing what geologic mapping is available for the state, its vintage, and level of detail. Make this information accessible on the Internet.
8. Supported by Federal funding, compile a georeferenced database of internal geochemical data from past DGGS projects and make this information accessible on the Internet.
9. Supported by Federal Receipts as part of the Alaska Resources Data File (ARDF) project, compile mineral deposit data files for three 1:250,000-scale quadrangles that encompass prospective mineral terranes.
10. Contingent on funding from the Federal STATEMAP program, initiate ground-truth geologic mapping of part of the Livengood C-4 Quadrangle that lies within the Livengood airborne geophysical tract.
11. Supported by Federal funding, conduct and release an airborne geophysical survey of the southern Delta River area in east-central Alaska. This unanticipated project was requested and funded by the U.S. Bureau of Land Management The data will be published by DGGS in cooperation with DGGS in FY03.
12. Supported by Federal funding, conduct an airborne geophysical survey of the Sleetmute area in southwestern Alaska. This unanticipated project was requested and funded by the U.S. Bureau of Land Management The data will be published by DGGS in cooperation with DGGS in FY04.

13. DGGS Mineral Appraisal Project geologists will provide timely responses to verbal and written requests for mineral information from other State agencies, local government, and the general public.
14. 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.

STATEWIDE ENERGY RESOURCE ASSESSMENT

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 catalyzing industry interest in the west-central Arctic. Therefore, in FY03 this program continues to focus significant effort on frontier state lands in the central North Slope and within the southeastern corner of the National Petroleum Reserve—Alaska (NPRA).

The Statewide Energy Resource Assessment program also is pursuing a solution for village and commercial enterprise energy needs in rural Alaska, and 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. Catalyze active private-sector oil and gas exploration on the North Slope beyond the Prudhoe Bay–Kuparuk field areas.
2. Identify sources of energy in rural Alaska for the local generation of heat and power.
3. 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 can be made.

TASKS

Project tasks and products financed by General Fund, industry Program Receipts, and Federal Receipts in FY03 are:

1. Supported in part by Legislatively Designated Program Receipts as part of the NPRA-Brooks Range Foothills Program, complete year four of a five-year project to determine the stratigraphy and reservoir potential of sandstone in the Nanushuk and Tuluvak formations exposed along 120 miles of the northern Brooks Range foothills and Colville River. This program also addresses the petroleum source rock potential of selected formations in the same area.

2. Funded by a CIP appropriation, complete evaluation of potential hydrocarbon source rocks in Tertiary (66.4 -1.6 million year old) rocks in the Holitna Basin, southern McGrath Quadrangle.
3. Supported by Federal funding, initiate the first year of a three year program to develop lightweight coiled-tubing microborehole drilling technology to test coalbed methane potential and gas producibility at three high-priority rural Alaska sites, and evaluate effects of drilling and completion fluids in shalebed methane reservoirs at Red Dog Mine.

4. Funded by a Federal contract as part of the National Coal Resource Data System, acquire new geochemical data for coal in the Kobuk River and Nulato coal fields in order to classify that coal resource's quality in support of future coal prospecting, leasing, and coalbed methane leasing in Alaska.
5. Funded by a Federal contract, conduct the first year of a two year basinwide energy resource assessment of the Yukon Flats potential to contribute oil, conventional gas, and coalbed methane to domestic United States commercial markets through existing and proposed pipelines.
6. Funded by a combination of General Fund, CIP, and industry Program Receipts, conduct the first year of a two-year project to evaluate the coalbed methane potential of the Delta area in eastern middle Tanana basin.
7. Supported by Federal Receipts as part of the Statemap program, conduct a field program to map the geology of the Chandler Lake C-2 and northern half of the Chandler Lake B-2 quadrangles in the Kanayut River area to better understand the oil and gas potential of the central Brooks Range foothills belt and adjacent North Slope.
8. Upon request, provide written evaluations of minable coal potential for lease areas in response to requests from Division of Mining, Land and Water Management.
9. 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).

STATEWIDE ENGINEERING GEOLOGY/CONSTRUCTION MATERIALS

The Statewide 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.

A common view held by the general public is that insurance provides the best protection against losses from major disasters. However, in the wake of several recent costly disasters from earthquakes, hurricanes, floods, and landslides, insurers and the federal government are re-examining past practices regarding disaster recovery. Insurers are restricting coverage in whole regions, increasing premiums and deductibles, and trying to move toward a risk-based rather than a market-based pricing system. Internally, the federal government is voicing resistance to the self-insurance practices of state and local governments because after catastrophic damage to infrastructure, these entities invariably turn to the federal government seeking monetary relief for recovery. There is growing resistance by the federal government to fund disaster recovery for damage that could have been avoided through prior mitigation. Every person and enterprise within Alaska's high-risk communities is going to be directly affected by these policy trends.

Alaska's communities at high risk from major geologic hazards include 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 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. Within these towns and cities, damage to existing infrastructure as well as individual buildings can be reduced. Informed construction practices, planning, building-code application, and emergency preparedness can reduce damage costs and casualties from future events. However, economics dictates 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 DGGS Construction Materials Resources program provides information on the riprap, sand, and gravel construction materials needed for private and public infrastructure construction. The information provided expedites the design and planning phases of state and

private construction projects and helps control the cost of those projects for which this information is available. Sources of construction materials are of special concern in much of rural Alaska where coarse riprap is needed for erosion control near towns and villages, and gravel is needed for local and regional roads.

The FY03 Statewide Engineering Geology and Construction Materials projects outlined below are supported by General Fund and Federal Receipts.

OBJECTIVES

1. Protect health and public safety by providing information on geologic hazards as they affect human activity.
2. Lower the costs of construction design and improve prior planning to mitigate consequences arising from natural geologic hazardous 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, such as tourism, in the state of Alaska.

TASKS

Project tasks and products financed by General Fund and Federal Receipts in FY03 are:

1. Partially supported by Federal Receipts as part of the Anchorage Geotechnical Project, (1) publish 1:25,000-scale earthquake site-response maps and accompanying text that depict estimated ground-motion amplification for shaking frequencies of 1 Hz, 5 Hz, and 0.35 Hz, and (2) publish a 1:25,000-scale map of seismic site classifications that corresponds to provisions of the International Building Code.
2. Supported partially by Federal funding through a cooperative project with the University of Durham, complete a study of sedimentologic evidence of great earthquakes in the Anchorage region as a basis for identifying possible methods for forecasting similar future events.
3. Supported partially by Federal funding and in cooperation with the Division of Emergency Services, University of Alaska Geophysical Institute, and coastal communities, publish tsunami-inundation maps for Homer and Seldovia.

4. Supported by Federal funding as a participant in the Alaska Volcano Observatory (AVO), publish a geologic map of Mt. Spurr volcano.
5. Supported by Federal funding through AVO, participate in the second year of geologic mapping and hazards evaluation of Mt. Veniaminof volcano, Alaska's largest volcano, and one of the most poorly known. FY03 is the second year of a planned three-year project.
6. Supported by Federal funding, maintain and enhance the AVO web site. With as many as 500 visitors per day, the AVO web site is one of our most important information dissemination activities
7. Supported by Federal funding through AVO, publish a CD-ROM disk containing georeferenced bibliographic data for the entire Aleutian volcanic arc.
8. Supported by Federal funding through AVO, provide oversight, coordination, and helicopter contracting for multi-team fieldwork to conduct geologic-hazards studies and seismic monitoring of active volcanoes in the Cook Inlet, Alaska Peninsula, and Aleutian Islands regions.
9. Supported by Federal funding through AVO, participate in volcano eruption response and hazard mitigation as needed to provide timely and accurate warnings and eruption information to emergency-response agencies and air-traffic controllers.
10. Supported by Federal funding through AVO, provide field database and GIS support to ongoing geologic and hazards mapping projects at Okmok Volcano and Veniaminof Volcano.

11. Supported by Federal funding through AVO, initiate monitoring and hazards evaluation of far western Aleutian volcanoes.
12. Funded by a Federal grant, implement the second phase of a three year project to apply remote sensing technology to an investigation of the Council mining district to identify prospective areas that may host previously overlooked placer gold resources.
13. Supported partially by Federal Receipts through the Statemap program, and in support of the Statewide Mineral Resource Assessment program, publish surficial- and engineering-geologic maps of the Big Delta C-3, SW Big Delta C-2, and NE Big Delta B-3 quadrangles in the Salcha River – Pogo area.
14. Partially supported by Federal Receipts secured in FY01, publish a compilation of all available information on active faults in Alaska, including maps on a CD-ROM showing fault traces at 1:250,000 scale and a report that presents all information in a format consistent with the national fault database.
15. Partially supported by Federal receipts, complete the conversion and publication of 376 1:250,000-scale geologic, materials, hazards maps of proposed transportation corridors to modern GIS format and make them available digitally via CD-ROM and the DGGS Web site.
16. Supported by General Fund receipts and in cooperation with the Department of Community & Economic Development, update the digital directory of construction-materials producers and develop an interface to serve the data interactively over the World Wide Web.
17. Supported by General Fund receipts, complete and publish a 1:63,360-scale combined bedrock- and surficial-geologic map of the Petersville (Yentna) mining district.
18. Supported partly by Federal funds, participate in an evaluation of the hazards from a large landslide in Tidal Inlet, Glacier Bay, as a potential source of landslide-induced waves that could severely impact cruise ship traffic and other activities.
19. 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).
20. As part of the Alaska Coastal Management Program, conduct reviews of Coastal Policy Questionnaires and consistency applications to ensure compliance with the state's geophysical hazards standard (6 AAC 80.050)
21. 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 MAPS AND REPORTS

The Geologic Maps and Reports project edits, publishes, and disseminates technical and summary reports and maps about Alaska's geologic resources generated by the Division's technical projects. The maps and reports released through this project 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 engineering geology. These documents focus attention on Alaska's most geologically prospective and useful lands and are the authoritative basis for many of the state's resource-related land policy decisions. They also stimulate geologic exploration investment leading to resource discoveries and subsequent major capital investments. Timely availability of information derived from DGGS geological surveys is a significant factor in creating a more sustainable economy to offset the decline in Prudhoe Bay oil production.

This project began extensive use of the Internet in FY98 to enhance the disbursement of the Division's informa-

tion 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 interagency Internet-accessible Alaska geologic database management system. The Geologic Maps and Reports project 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 interested DNR policy and regulatory groups, and to all other interested parties within one year of its acquisition.
2. Preserve and manage the data and knowledge generated by the Division's special and ongoing projects in an organized, readily retrievable, and reproducible form consistent with pertinent professional standards.
3. Focus public awareness on Alaska's most prospective mineral and energy lands.

TASKS

Project tasks and products funded by General Fund, Federal Receipts, and Program Receipts in FY03 are:

1. Assemble and edit the technical and educational maps and reports of DGGS in both conventional and digital format.
2. Supported by Federal funding, complete the design and construction of a Division-wide digital geologic database management system so that DGGS can improve its cycle time for responding to geologic resource and engineering geology queries and for completing its mineral and energy inventory studies in frontier areas.
3. Supported by Federal funding, initiate the first year of a two-year project to scan and convert to digital format all U.S. Geological Survey Bulletins and Professional reports in the DGGS library and make them available via the World Wide Web.
4. Assemble, edit, and publish the annual *Alaska's Mineral Industry* report. This report preserves the definitive statistics for Alaska's mineral industry.
5. Maintain the DGGS information management micro-computer network infrastructure.
6. Maintain the DGGS Web site and make all DGGS publications available via the site.

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.

TASKS

Project tasks and products financed by FY03 General Funds, Program Receipts, and Federal Receipts are:

1. In accordance with a framework of multiple interagency cooperative agreements, maintain the state's interagency archive of geologic materials (voucher samples of rocks, oil and gas well processed samples, core, rock, thin-sections, ore samples, and hard-rock mineral core) acquired from private companies and State and Federal agencies.
2. Systematically record and archive new geologic material pertinent to Alaska's energy and mineral resource development as they are submitted to the Geologic Materials Center.
3. Supported by Federal funding, install an updated GMC sample database on the World Wide Web so that the catalog of the Center's holdings is accessible to mineral and energy explorationists and other interested parties via the Internet.
4. With Federal funding, catalog all historical U.S. Bureau of Mines statewide mineral samples stored at the interagency Geologic Materials Center.

TECHNICAL SUPPORT

The Technical Support 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

1. 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.
2. Provide accurate, timely reporting of project expenditures and current balances; encourage prudent money management.
3. 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.
4. Make travel arrangements and complete travel authorizations to ensure use of the lowest cost travel options.
5. Provide communication between remote field camps and office, allowing for unforeseen circumstances, expediting field supplies, and ensuring safety of field personnel.
6. Assist staff with personnel matters; keep staff informed 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 produce the greatest amount of resource information.

PROJECT SUMMARIES—FY03

Alaska faces the challenge of developing a viable economy from our 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 science required to guide critical policy decisions, catalyze investment, mitigate the effects of geologic hazards, and improve the quality of life for all Alaskans.

The following overviews of the 37 projects that are being pursued by DGGS in FY03 span the scope of our legislative mission statement. Each of these projects is making a positive difference for Alaska. Each is implemented through various cooperative agreements with other state and federal agencies, in-house project teams, and contract. We seek to leverage state General Funds through these arrangements so that we can maximize the annual coverage of our work.

AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY

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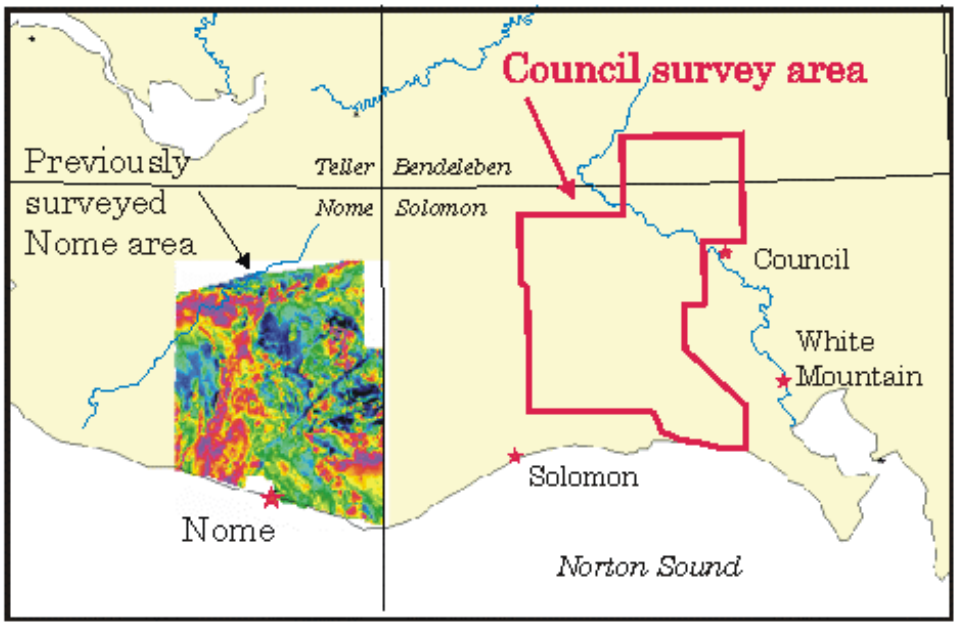
The Airborne Geophysical/Geological Mineral Inventory project is a special multi-year investment to expand the knowledge base of Alaska's mineral resources and catalyze private-sector mineral development. The project seeks to delineate mineral zones on Alaska state lands that: (1) have major economic 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; (4) 1:63,360-scale land status map; and (5) various other geological, geochemical, and geophysical data compilations.

Our long-term objective is to acquire airborne geophysical and ground-truth geological data for the highly prospective terranes of the Nome mining district. Because funding is often limited, the geophysical surveys and geologic work are being accomplished in stages. In 1993, the Division of Geological & Geophysical Surveys (DGGS) conducted airborne-geophysical and ground-truth geological mineral surveys in the western part of the Nome mining district. For FY03, DGGS initiated an airborne-geophysical survey near Council, a village about 60 miles northeast of Nome. This current 618-square-mile survey will provide part of the missing data.

The eastern Nome district encompasses the smaller Solomon, Bluff, and Council districts, which have collectively produced 1,019,513 ounces of gold from 1898-1999. Dredges were worked on all of the major streams of the area. The lode source of the gold is not known. 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 geologic data that are produced from these studies are released to the public and will be used for decades. Data acquisition for the Council geophysical survey was completed by Stevens Exploration Management Corporation and their subcontractor Fugro Airborne Surveys in August 2002. Aeromagnetic and apparent resistivity maps will be produced in a variety of map formats and will be released in early 2003. Digital data were also made available to the public at a very low price 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.



GEOLOGIC GROUND-TRUTH INVENTORY OF THE SALCHA RIVER–POGO GEOPHYSICAL SURVEY TRACT

Contact: Melanie B. Werdon, Mineral Resources Section, 907-451-5082, melanie@dnr.state.ak.us

During the summer of 2002, DGGS conducted a 57-day geologic field mapping project within the boundary of the 1,032-square-mile Salcha River-Pogo airborne geophysical survey (fig. 1). This is the second year of a planned three-year study. Mapping was funded by the federal STATEMAP program and the Alaska Airborne Geophysical/Geological Mineral Inventory Project. The objective of this project is to produce 1:63,360-scale ground-truth geologic maps of a portion of the geophysical tract, and to evaluate the mineral resource potential of the area. Currently the southern portion of the area is of intense interest to the mineral exploration industry since it includes the Pogo property (a high-grade, plutonic-related, 5.5-million-ounce gold deposit). Other promising gold targets occur throughout the study area, and there is the potential for ultramafic-hosted, platinum-group-element lode occurrences. The northern quarter of the region contains several metasediment-hosted base-metal occurrences.

Several greenschist- to amphibolite-facies metamorphic rock suites were delineated by previous 1:250,000-scale mapping of the Big Delta Quadrangle. Contact relationships between these suites are poorly known, and there are conflicting interpretations in the literature. DGGS carefully located these boundaries and determined the types of contact relationships. DGGS has also delineated many previously unrecognized high- and low-angle faults, and has determined their sense of motion, cross-cutting relationships, and timing. Identification of low-angle structures is important because they host some of the gold deposits in Interior Alaska (for example, Pogo, True North). We are also testing a 75-km left-lateral displacement model for the prominent high-angle northeast-striking Shaw Creek fault; it has important implications for offset of lithologic units and mineralization in the Pogo and Richardson areas.

Our detailed mapping documents a complex polydeformational structural history within the metamorphic suites, and enables us to subdivide the suites into metamorphic–stratigraphic units. The metamorphic rocks have been intruded by numerous igneous/meta-igneous suites of varying ages (Devonian to Tertiary) and compositions (felsic to ultramafic[?]). DGGS efforts are focused on classifying the many types of plutonic, metavolcanic, metaplutonic, orthogneiss, and augen gneiss suites in the study area based on rock textures, petrographic observations, mineralogy, modal percentages determined from feldspar staining, major- and minor-oxide and trace-element compositions, ages, geophysical signatures, and trace-element-indicated tectonic origin. Consistent classification facilitates comparison of these rocks, and evaluation of their mineral favorability.

A reconnaissance geologic map of the Pogo area, and results of geochemical analyses from DGGS's summer 2000 reconnaissance work were published in June 2001. DGGS's analytical work from summer 2001 was published in June 2002. DGGS plans to publish summer 2002 analytical data, and geologic maps of the Big Delta C-3, southwest quarter of the C-2, and northeast quarter of the B-3 quadrangles by June 2003.

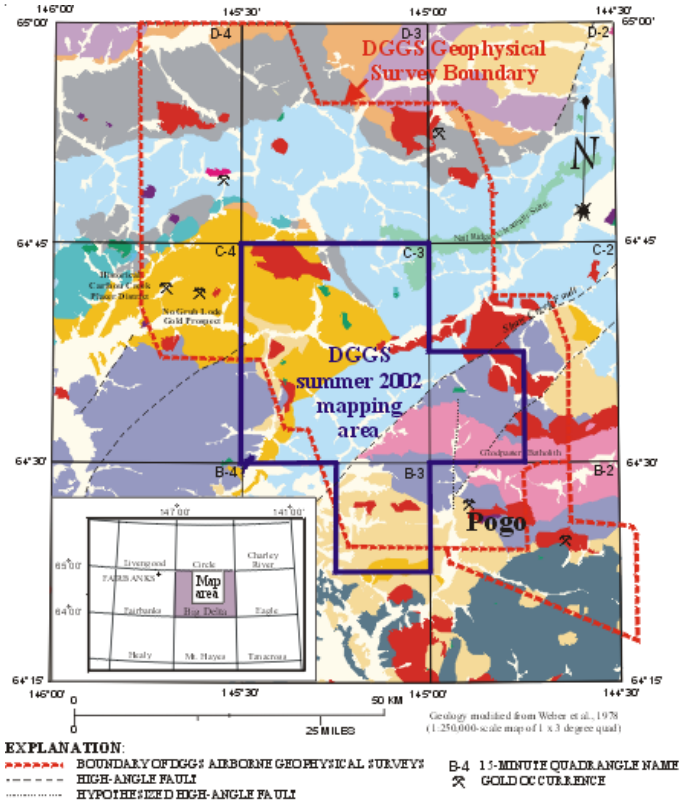


Figure 1. Regional geologic map of a portion of the Big Delta quadrangle.

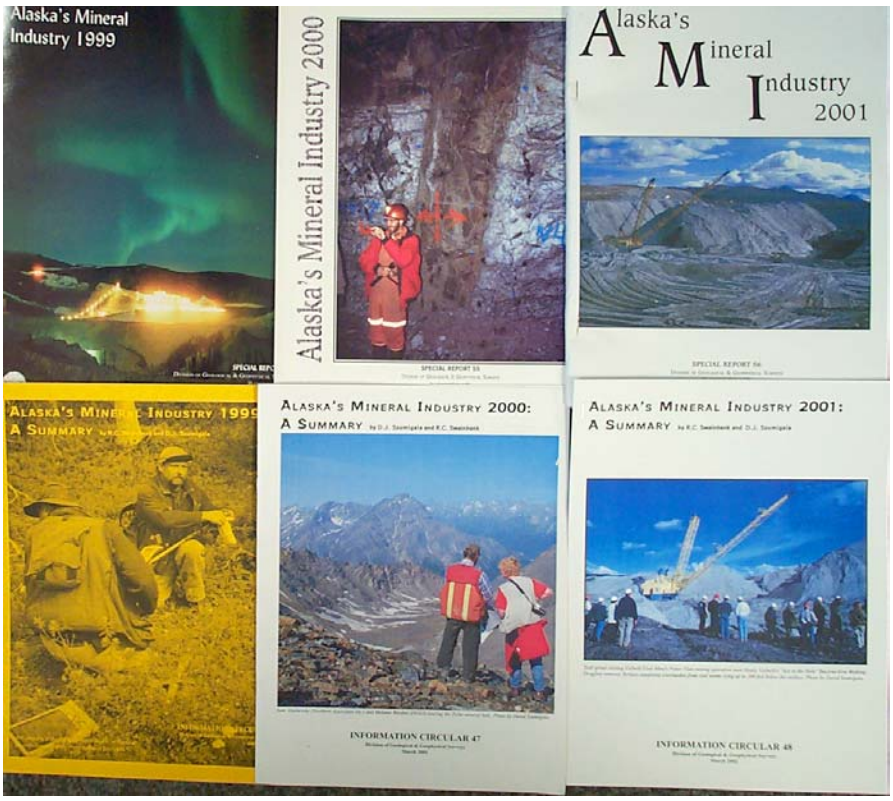
ANNUAL ALASKA MINERAL INDUSTRY REPORT

Contact: David J. Szumigala, Mineral Resources Section, 907-451-5025, zoom@dnr.state.ak.us

DGGS produces an annual summary report on the Alaska mineral industry. The report has been published for 21 consecutive years as a cooperative venture between the Department of Natural Resources' (DNR) Division of Geological & Geophysical Surveys and the Division of Community & Business Development (DCBD) in the Department of Community & Economic Development (DCED), with help from the Division of Mining, Land & Water (DMLW) in DNR. The summary of the 2001 Alaska mineral industry is made possible by information provided through replies to questionnaires mailed by DGGS, phone interviews, press releases, and other information sources.

Publication of the annual mineral industry report by DGGS is motivated by Alaska Statute 41.08, which charges the division *"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."* Our objective is to gather, verify, collate and supply statistics and summary observations about Alaska's mineral industry in a timely manner to assist the mining industry and foster 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 development and provides briefings about the status of Alaska's mineral industry, State support for mineral ventures, and recently acquired geophysical and geological data. 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.



GEOLOGY OF THE DELTA MINERAL BELT

Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us

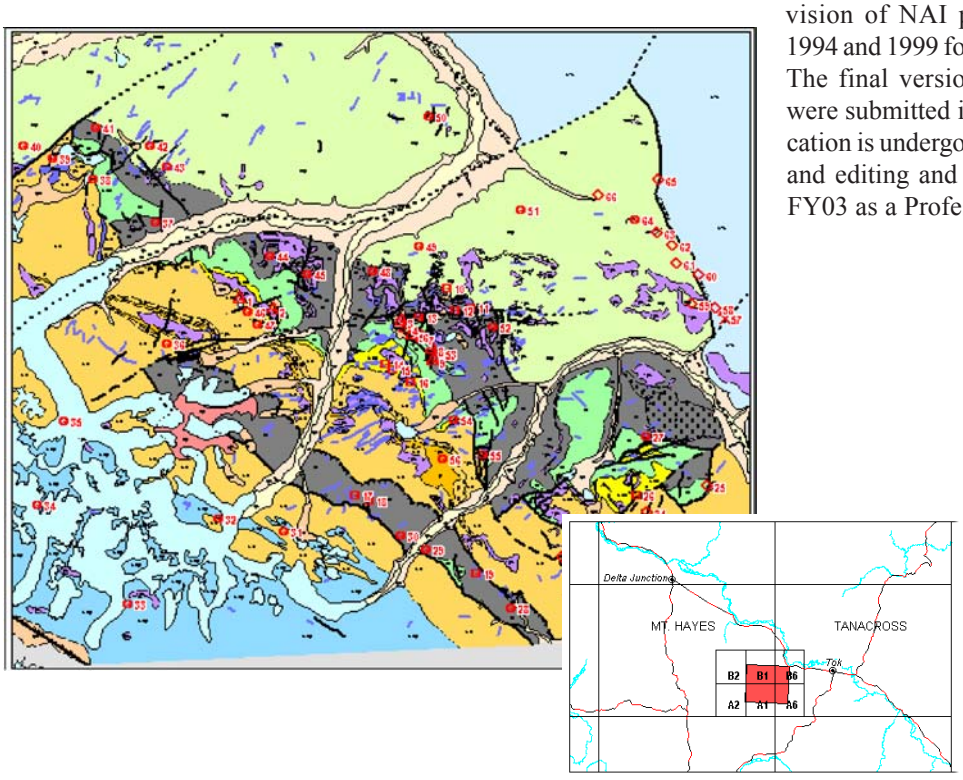
DGGS began a cooperative project with Northern Associates, Inc. (NAI) to prepare and release to the public a bedrock geologic map of the Delta mineral belt. This area is in the eastern Alaska Range in the Tok mining district about 85 km west of Tok. The Delta mineral belt has been the subject of intense geologic investigation since volcanogenic massive sulfide occurrences were found there in 1976. The purpose of this project is to place in the public domain knowledge that was previously available only to a few private companies. Grayd Resource Corporation (Grayd) is the present owner of the geologic data and geologic materials upon which this project is dependent and has donated the data included in the report to DGGS.

According to Grayd Resources, from 1976 though 1990 about nine companies spent a total of approximately $10 million on exploration in the Delta district. The money provided geophysical surveys, geochemical data, drill core, and geologic mapping at scales between 1:1,200 and 1:30,000. Many types of geophysical data including CEM, PEM, magnetics, Max-Min EM (HLEM), IP, Airborne EM 225 line-km gravity, down-hole PEM and seismic data, were acquired. The amount of core totaled 16,746 m for the 134 drill holes. Approximately 24,000 rock, drill core, stream sediment, and pan concentrate samples were analyzed.

In 1993 American Copper & Nickel Company (ACNC) and Pacific Northwest Resources Corporation renewed exploration efforts in the area as a joint venture. They were given access to previous mapping, drill core, and other existing data. Between 1993 and 1998, these companies spent an additional $8 million in the area. Over a 6-year period, these companies conducted both reconnaissance and detailed geologic mapping of the area, analyzed an additional 2,600 rock samples and 1,890 core samples, conducted airborne and ground geophysics, and drilled 44 holes totaling about 10,800 m.

More than 40 mineral occurrences have been discovered at Delta. An inferred resource has been calculated for eight deposits. Study of the core and geologic mapping has led to detailed stratigraphy of the area. The stratigraphy suggests that massive sulfide mineralization occurs in at least four stratigraphic levels.

The report and map to be published through this project are put together by NAI and are based on the geologic mapping, lithochemistry, airborne geophysics and core drilling carried out under the supervision of NAI personnel between 1994 and 1999 for ACNC and Grayd. The final versions of the products were submitted in FY02. The publication is undergoing final formatting and editing and will be released in FY03 as a Professional Report.

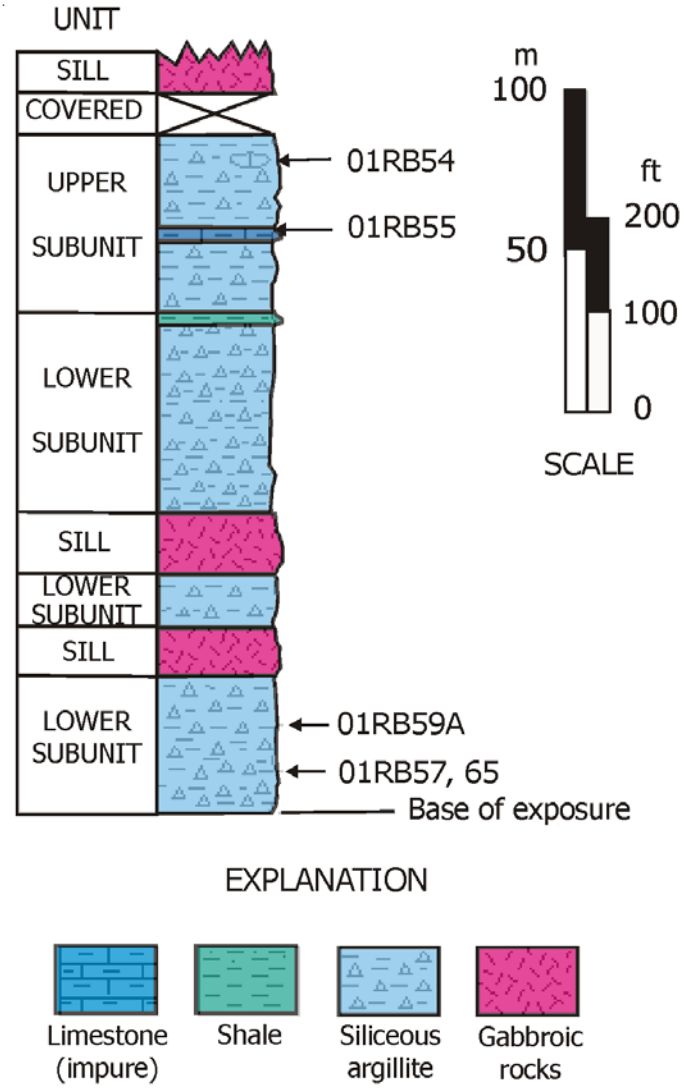


GEOLOGY OF THE BROXSON GULCH AREA, SOUTHCENTRAL ALASKA

Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us

This project is a cooperative effort initiated in June 2000 involving the Geological Survey of Canada (GSC), M.A.N. Resources, Inc. (MAN), and DGGS to better understand and disseminate knowledge about regional metallogeny and Triassic magmatism in Wrangellia. Within the last 10 years, a metallogenic terrane of mafic and ultramafic rocks favorable for deposits of Ni–Cu–PGE, +/-Au has been identified to extend about 600 km along strike on the margin of "Wrangellia" from northern British Columbia into Alaska south of the Denali fault. One of the best exposures of this terrane is present in the Broxson Gulch area, about 180 miles north of Valdez. The ultramafic rocks form sill-like intrusive centers thought to have acted as subvolcanic magma chambers that fed the thick, overlying basalts of the Nikolai Group. This area has been of much interest to the mining community in the last several years because of the potential for platinum-group-element (PGE) metal deposits. BLM and DGGS are currently conducting a BLM-funded geophysical survey over the area. The geology of the area is, however, very poorly known.

For this cooperative project DGGS contracted for and published a fossil report related to the area and will publish the geologic mapping created by the GSC and MAN. The final geologic map will be provided by GSC at the end of FY03 for publication by DGGS in FY04. Currently DGGS and GSC are working on the map surrounds and information to be displayed in the map.

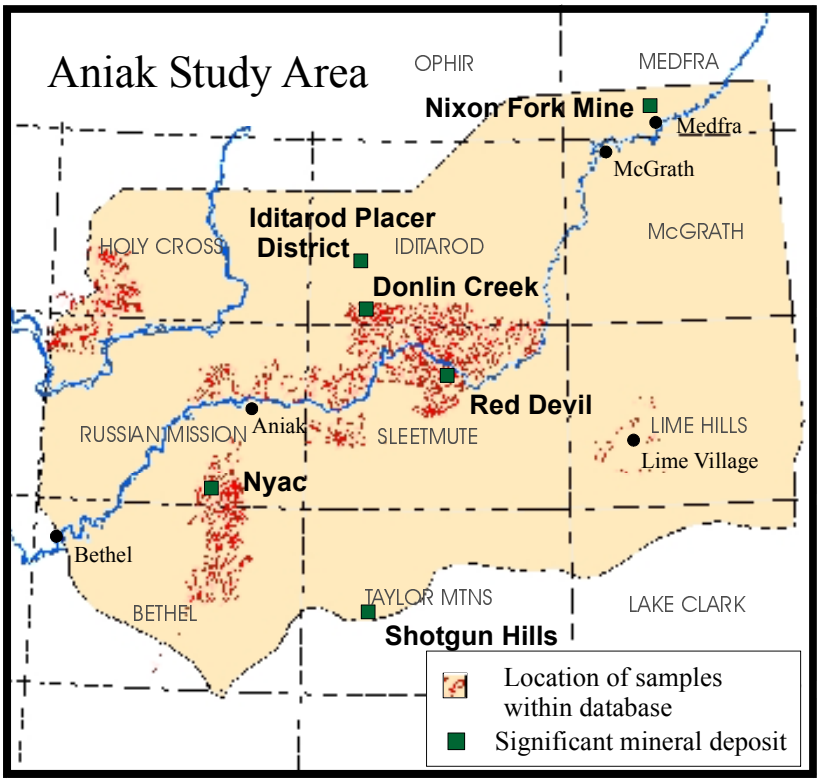


The paleontological part of the project is completed. DGGS contracted Dr. Robert Blodgett to work in the study area with the GSC for 10 days during July 2001 to produce a summary fossil report. Dr. Blodgett conducted paleontological sampling and study of pre-Nikolai Greenstone sedimentary rocks belonging to the Tangle subterrane of Wrangellia in the area of the Amphitheater Mountains, Mt. Hayes A-4 and A-5 quadrangles. Two subunits were recognized in the rocks immediately beneath the ultramafic intrusions. These subunits both appear to have been deposited in a euxinic ("nonaerobic") paleoenvironment, as metazoans are notably absent. The lithology of the upper subunit suggests correlation in part with the unnamed Triassic shale, lime, and chert unit recognized in the adjacent Slana River subterrane in the southeastern part of the Mt. Hayes Quadrangle. The lower subunit consists primarily of medium- to thick-bedded, green siliceous argillite and is in part of Early Permian age, based on the poorly preserved megafossils. DGGS published the fossil report near the end of FY02.

It is hoped that the information gained from this project will encourage understanding and mineral exploration of the potential platinum-group-element deposits within the Wrangellia belt in Alaska and will help further the knowledge produced from the airborne geophysical survey.

DATABASE OF GEOCHEMICAL DATA FROM THE ANIAK MINING DISTRICT

Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us



The Aniak Geochemical Database project is a cooperative project between the U.S. Bureau of Land Management (BLM) and the Alaska Division of Geological & Geophysical Surveys (DGGS). The 1- to 2-year project is funded by BLM as part of their study of the "Aniak mining district," a 42,200-square-mile "mega-district" that encompasses all of the Aniak–Tuluksak and parts of the Iditarod, Marshall, Anvik, Innoko–Tolstoi, and McGrath mining districts. For this project, DGGS will create a database of available geochemical data from samples collected within the study area. The project is designed to include rock, soil, stream-sediment, pan-concentrate, and placer samples collected by government agencies, the private sector, and Native corporations. The data have not been previously made available to the public and are currently held in various private depositories around the state in a variety of formats. The goal of this project is to incorporate the disparate data into a relational database, preserving the original data attributes in the process, and make the information available to the general public.

Several mineral deposits and many prospects are known within the area. Donlin Creek, a major gold deposit near the center of the area, is a structurally controlled quartz–sulfide veinlet deposit associated with 70-Ma felsic dikes. Placer Dome's 1998 core-drilling program indicated that Donlin Creek has 11.5 million ounces of contained gold. Volcano-plutonic complexes in the area are considered favorable for polymetallic vein deposits; these deposits may contain base-metal sulfides, sulfosalts, or gold. Epithermal mercury-rich vein prospects are also present in the survey area.

DGGS originally planned to create a database of approximately 8,000–10,000 samples during a 2-year project. During initiation of the project, however, Calista Native Corporation contributed over 17,700 sample analyses from the region that are grouped in about 160 computer files. The information covers more than 25 years of mineral exploration in the Aniak mining district and was collected by Calista employees and various exploration companies under contract to Calista. The data include analyses from Donlin, Nyac, and Red Devil mining areas among others, and should prove to be of much interest to the mining community. Varying amounts of background documentation, such as laboratory of data origin and method of analysis, are available for the Calista datasets. The limitations of each dataset will be highlighted in the database so that the user does not inappropriately combine analyses.

Contingent on additional federal funding, analyses from other sources will be added to the database. For the final product, DGGS will provide the data in tables in Microsoft Excel format, comma-delimited files, and in a Microsoft Access database for publishing by BLM.

COMPILATION OF ALASKAN BEDROCK AND SURFICIAL MAP INDEX PROJECT

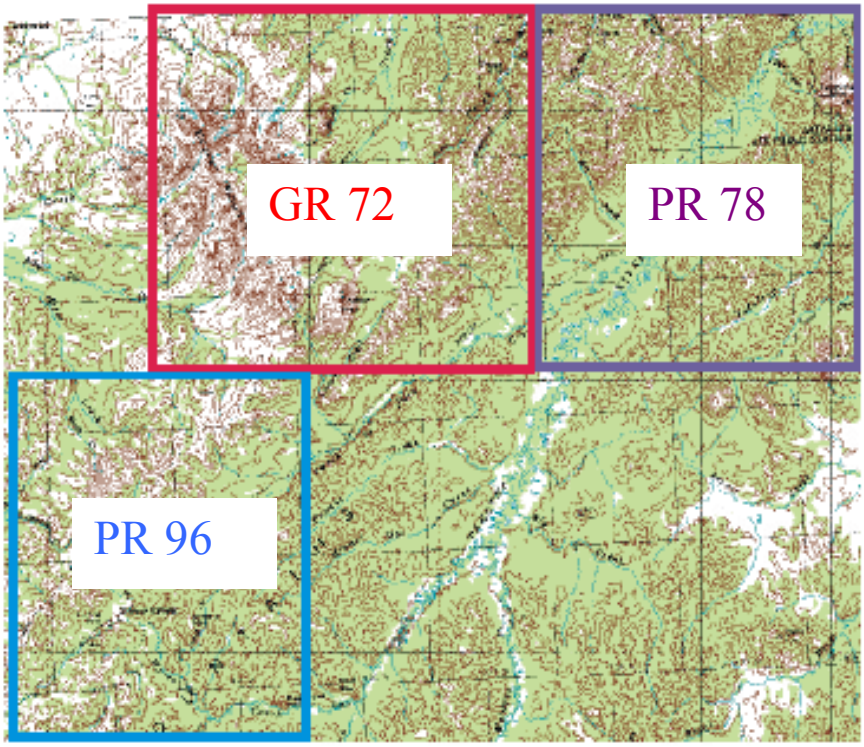
Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us

The Alaska Division of Geological & Geophysical Surveys (DGGS) has 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 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. One component of this program is a digital (electronic) database of bedrock and surficial geologic map locations of Alaska known as the Alaska Map Index Project.

The objective of the Alaska Map Index Project is to determine the current status of bedrock and surficial geologic mapping of Alaska and make this information widely accessible to the mineral industry and others. Currently, no up-to-date index of DGGS, USGS, U.S. Bureau of Land Management (BLM), and U.S. Bureau of Mines (BOM) bedrock and surficial geologic maps exists. The most complete bedrock- and surficial-map listing, Galloway and Laney (1995), lacks DGGS and USGS data published after about 1994 and omits completely any BLM and BOM geologic mapping. No index map is included with this publication. The latest listing and index of surficial geologic maps is Pinney (1991). This publication includes USGS and DGGS maps published through 1990 and a Series E-scale index map.

The Map Index project is collating, expanding, and updating previous indexes into a single multi-agency database of Alaska geologic mapping. Currently about 950 geologic maps of Alaska are included in the database. Each map citation will be linked to a geographically-referenced outline denoting the map area. Efforts continue to correct inaccuracies in the map index and to create the appropriate outlines.

The link to the final database will be placed on the Interagency Minerals Coordinating Group (IMCG) website. Records for DGGS maps will be linked to digital files of the appropriate scanned maps that are accessible on the Web as MrSID files. An interactive map, able to display the map boundaries on an Alaska map, will be developed for the database. Hardcopy versions of the index maps and appropriate metadata will be published.



COMPILATION OF ALASKA STATE AGENCY LITHOCHEMICAL DATA

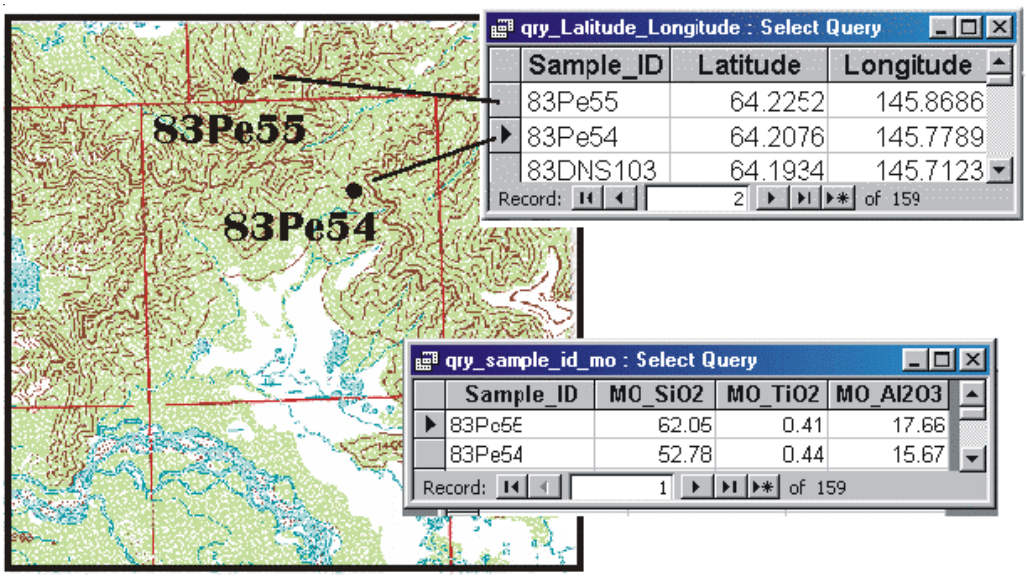
Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us

The Alaska Division of Geological & Geophysical Surveys (DGGS) has 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 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. As part of this program, all minerals-related Alaska geochemical datasets need to be incorporated in a comprehensive interagency geochemical database system. One component of this program is a digital (electronic) database of lithochemical data known as the Alaska State Agency Lithochemical Data Project.

The objective of the Alaska State Agency Lithochemical Data Project is to make more DGGS lithochemical data accessible via the Interagency Minerals Coordinating Group (ICMG) Web site. As part of the federally funded 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 datasets. 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.

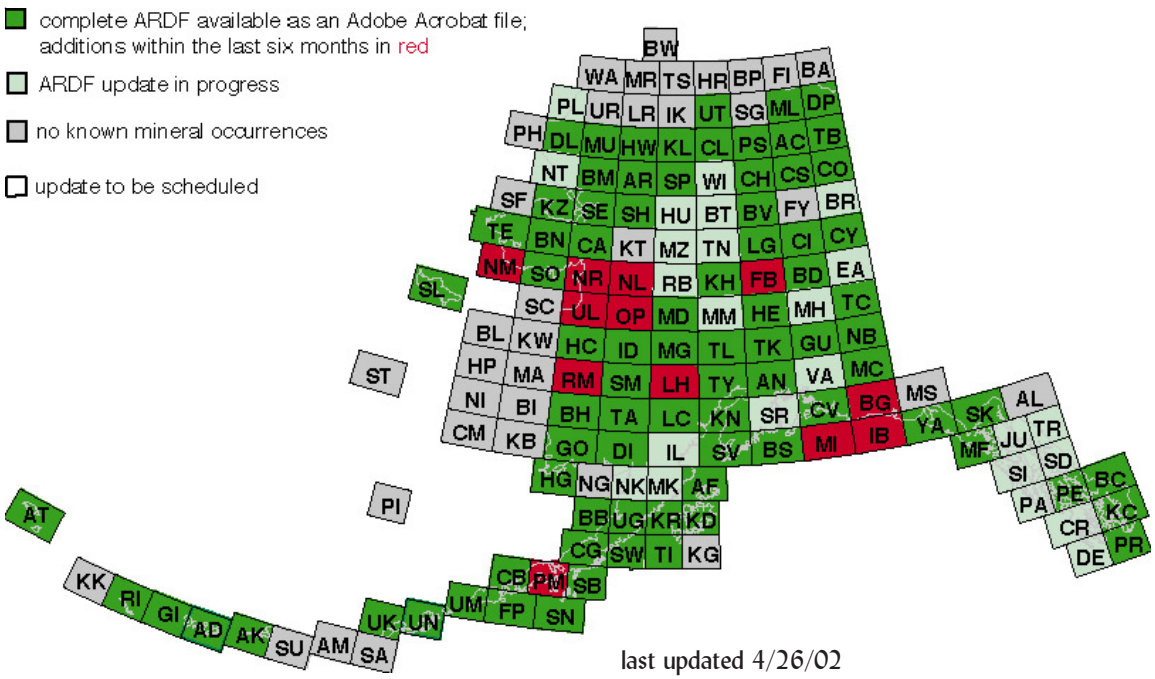
DGGS is assembling the various at-risk lithochemical data that have been generated by DGGS, or in some cases generated by the University of Alaska, organizing these data into rational datasets and linking them with georeferenced locations. The DGGS system will be designed and implemented in a manner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

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 datasets, and 500 or 600 mineral compositions datasets. An additional 1,000 major oxide or trace-element datasets from unpublished Masters' Thesis research done at UAF also will be included. Data exist 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 should be completed by the end of June 2003.



ALASKA RESOURCE DATA FILE PROJECT
(ALASKA MINERAL DEPOSIT DATABASE)

Contact: David J. Szumigala, Mineral Resources Section, 907-451-5025, zoom@dnr.state.ak.us



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DGGS has 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 management policy decisions in both the public and private sectors. Higher quality data should lead 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 Web site (http://ardf.wr.usgs.gov/). The 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.

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.

DGGS will complete nine quadrangle mineral deposit record-sets that meet peer review and USGS ARDF staff review criteria. DGGS minerals section geologists and interns have already completed ARDF files for the Big Delta, Black River, Tanacross, Kantishna River, Charley River, and Ruby quadrangles. In FY03, final review comments will be addressed for the Eagle, Tanana, and Melozitna quadrangles, and will conclude our part of the project.

GEOLOGIC GROUND-TRUTH INVENTORY NEAR LIVENGOOD, TOLOVANA MINING DISTRICT GEOPHYSICAL SURVEY TRACT

Contact: David J. Szumigala, Mineral Resources Section, 907-451-5025, zoom@dnr.state.ak.us

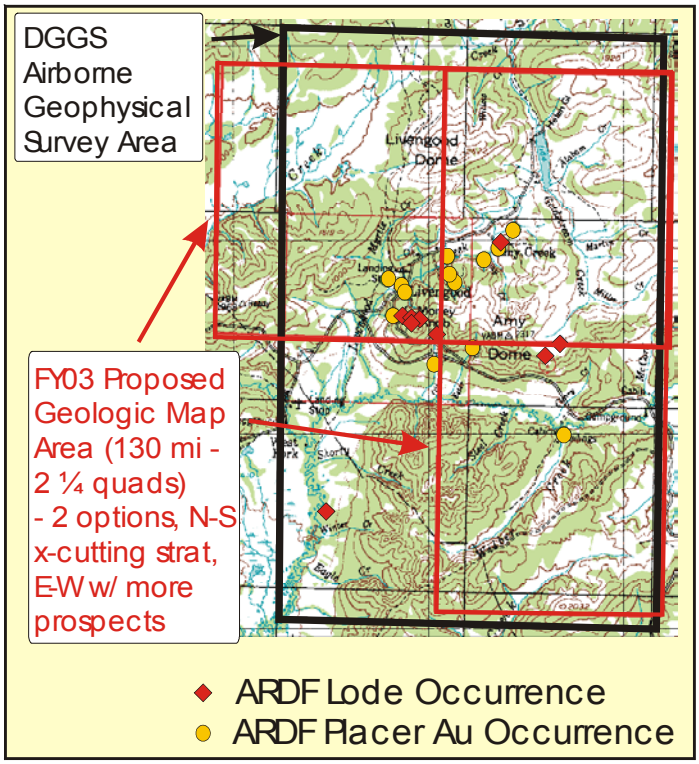
DGGS released airborne magnetic and electromagnetic geophysical maps for 229 square miles near Livengood, Tolovana mining district, in February 1999. DGGS plans to map about 130 square miles of the geophysical survey tract during the summer of 2003 as part of the federal STATEMAP program, with funding from state and federal sources. The Livengood project is part of DGGS's airborne geophysical/geological mineral inventory project, a special multi-year investment by the State of Alaska to expand Alaska's geologic and mineral resources knowledge base, catalyze future private-sector mineral exploration and development, and guide state planning.

The Livengood area is located about 75 miles northwest of Fairbanks, Alaska, and the Livengood subdistrict is the most productive part of the Tolovana mining district. Approximately 500,000 ounces of placer gold have been mined from the region since 1914, with most production from Livengood Creek. The area is highly accessible, with road access provided by the Elliot Highway and numerous mine roads. The Trans-Alaska Pipeline also crosses the proposed map area and the pipeline corridor provides additional access. Existing infrastructure would facilitate mineral development of this area.

The Livengood district is in the northwestern part of the Yukon–Tanana upland. Bedrock units consist of variably deformed and metamorphosed chert, shale, dolomite, argillite, and sandstone in fault or unconformable contact with a thick flysch sequence to the north. Highly altered, probably Devonian, basalt is spatially associated with low-angle thrust faulting on the north flank of Money Knob south of the Livengood townsite. Minor diorite, gabbro, greenstone, and serpentinite crop out on the south flank of Amy Dome. Late Cretaceous to earliest Tertiary intermediate to felsic igneous rocks intrude the metamorphic rock packages. Numerous felsic dikes and sills have been previously mapped in the central part of the Livengood district on Money Knob and the igneous rocks have a spatial association with the headwaters and presumed source area for most of the district's placer gold, especially deposits in Ruth, Lillian, and Olive creeks.

Fourteen inactive placer gold mines and nine metallic lode occurrences occur in the Livengood geophysical tract (Alaska Resource Data Files [ARDF]). Lode prospects with gold, mercury, and/or antimony mineralization are concentrated on the west end of Money Knob. Current lode mineral exploration continues in the Money Knob–Amy Dome area. South of Money Knob, anomalous base-metal concentrations have been found in stream-sediment samples from Ranney Hollow and copper–molybdenum porphyry mineralization was drilled near Winter Creek. There is also potential for ultramafic-hosted precious-metal deposits throughout the area.

New geologic mapping with interpretation of DGGS geophysical data will lead to better understanding of the geologic framework for ore deposits in the Livengood area and should stimulate increased mineral exploration investment within this belt of rocks. This project's products will be a series of geologic and geophysical maps at 1:63,360 scale, and reports containing geological, geochemical, and geophysical data compilations. Geologic maps will be completed by June 2004.



DELTA RIVER AIRBORNE GEOPHYSICAL PROJECT

Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us

The Delta River airborne geophysical project, a cooperative project between the U.S. Bureau of Land Management (BLM) and the Alaska Division of Geological & Geophysical Surveys (DGGS), is funded by BLM as part of their Delta River mining district study, part of the mineral assessment of federal lands in Alaska required by Section 1010 of ANILCA (Alaska National Interest Lands Conservation Act). This project is the fifth such cooperative BLM–DGGS airborne geophysical project since 1995. The role of DGGS is to contract and monitor geophysical data acquisition and processing, and to release the geophysical data to the public. BLM geophysical projects are similar to the geophysical part of the Alaska Airborne Geophysical/Geological Mineral Inventory program funded by the State of Alaska, but differ in that they concentrate on federal lands instead of State lands. These airborne surveys are an essential element of the State of Alaska's and U.S. Bureau of Land Management's ongoing programs to encourage exploration in promising mineral districts within Alaska and to make mineral information available to the public.

This survey tract lies in the south-central part of the Mt. Hayes Quadrangle, about 180 miles north of Valdez. Most historic prospecting of the area has concentrated on placer gold deposits as well as copper in amygdaloidal basalts, quartz veins, and skarn occurrences. More recent investigations have concentrated on the potential for nickel–copper deposits and their associated platinum-group-element (PGE) metals. The rocks particularly favorable in the area for these deposits are ultramafic sills, dikes, and stocks thought to be feeders for the coeval Triassic Nikolai basalts of the Wrangellia terrane. Within the last 10 years, it has been realized that the ultramafic rocks in this region form the western part of a metallogenic terrane of mafic and ultramafic rocks favorable for deposits of Ni–Cu–PGE, +/-Au that extend about 600 km along strike on the margin of "Wrangellia" from northern British Columbia into Alaska. The ultramafic rocks form sill-like intrusive centers thought to act as subvolcanic magma chambers that fed the thick, overlying basalts of the Nikolai Group. Many of the intrusive bodies in the area are covered by the basalts as well as other surficial deposits and vegetation. Regional aeromagnetic surveys were flown of this area in the early 1970s, but we believe that modern, more closely spaced—and thus more detailed—surveys will provide better control to more accurately determine folding and faulting, mineral phases, and alteration critical to defining geology and locating different types of mineralization.

Acquisition of aeromagnetic and electromagnetic data for the 353-square-mile Delta River survey tract was accomplished in August and September 2000 by Stevens Exploration Management Corp. who subcontracted Fugro Airborne Surveys. The new geophysical data will be merged with previously acquired private-sector data collected by American Copper and Nickel Company in 1995. The maps and digital data will be released to the public by mid-March 2003.

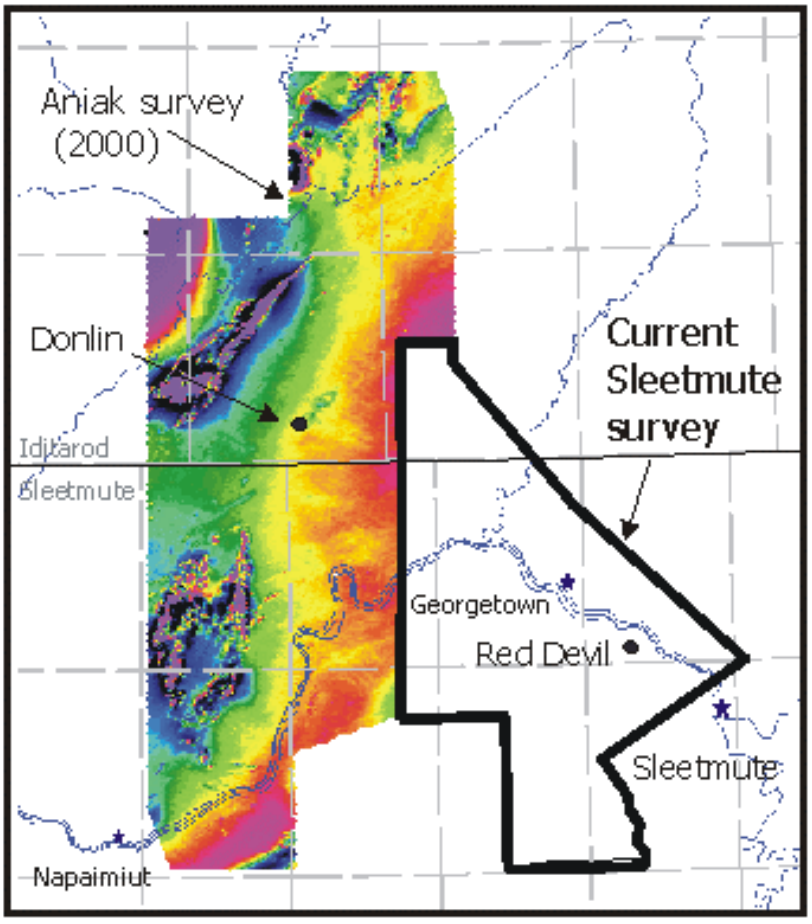
SLEETMUTE AIRBORNE GEOPHYSICAL PROJECT

Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us

The Sleetmute Airborne Geophysical Project, a cooperative project between the U.S. Bureau of Land Management (BLM) and the Alaska Division of Geological & Geophysical Surveys (DGGS), is funded by BLM as part of their Aniak region mineral assessment program, part of the mineral assessment of federal lands in Alaska required by Section 1010 of ANILCA (Alaska National Interest Lands Conservation Act). This project is the sixth such cooperative airborne geophysical project funded by BLM since 1995. The role of DGGS is to contract and monitor geophysical data acquisition and processing, and to release the geophysical data to the public. The BLM geophysical projects are similar to the geophysical part of the Alaska Airborne Geophysical/Geological Mineral Inventory program funded by the State of Alaska, but differ in that they concentrate on federal lands instead of State lands. These airborne surveys are an essential element of the State of Alaska's and U.S. Bureau of Land Management's ongoing programs to encourage exploration in promising mineral districts within Alaska and to make mineral information available to the public.

The Sleetmute survey area covers 641 square miles in the north-central part of the Aniak–Tuluksak mining district. Most of the survey area is composed of the Cretaceous Kuskokwim Group, which consists of marine turbidites with lesser shallow-marine and fluvial rocks. A few volcano-plutonic complexes of Cretaceous–Tertiary age are exposed in the survey area and consist of andesite, basalt, plutonic rocks (ranging from alkali-gabbro to monzonite to granite), and rhyolitic and basaltic dikes. Several mineral deposits and numerous prospects are known within the survey area, but are difficult to trace because of poor exposure.

The volcano-plutonic complexes are considered favorable for polymetallic vein deposits; these deposits may contain base-metal sulfides, sulfosalts, or gold. Epithermal mercury-rich vein prospects and deposits, such as Red Devil, are also present in the survey area. Donlin Creek, a major gold deposit about 10 miles west of the Sleetmute survey area, is a structurally controlled quartz–sulfide veinlet deposit associated spatially and temporally with 70-Ma felsic dikes. Placer Dome's 1998 core-drilling program indicated that Donlin Creek has 11.5 million ounces of contained gold.



The aeromagnetic and electromagnetic data from the previously acquired Aniak geophysical survey, completed in 2000, will be merged with the new Sleetmute data. The Aniak survey also was funded by BLM and managed by DGGS as part of the Aniak region mineral assessment study. The new data should be released by mid-June 2003.

NPRA–BROOKS RANGE FOOTHILLS PROGRAM

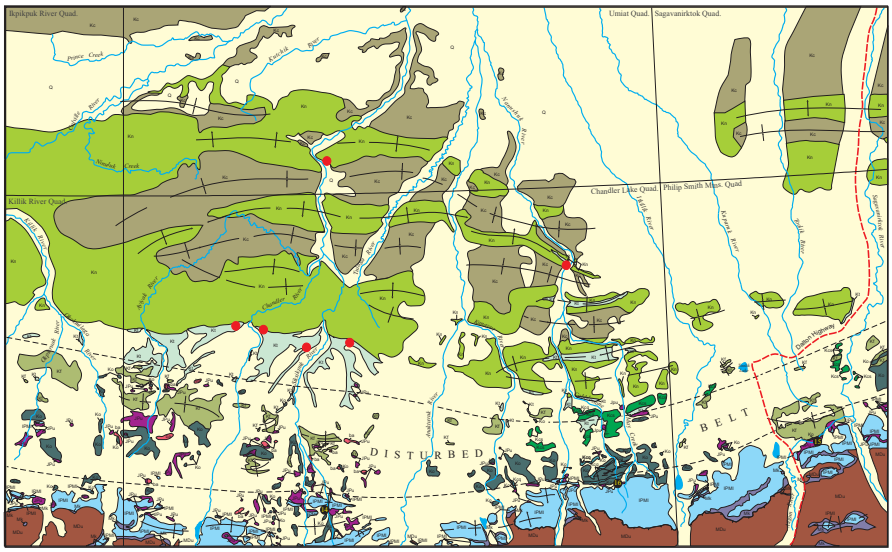
Contact: David L. LePain, Energy Resources Section, 907-451-5011, davele@dnr.state.ak.us

The goal of this 5-year program, scheduled for completion in FY04, is to develop a detailed sequence stratigraphic framework for Cretaceous sedimentary rocks exposed in the foothills belt north of the Brooks Range, between the Dalton Highway in the central Arctic and the DeLong Mountains in the western Arctic. The reservoir quality of selected sandstone bodies and source rock potential of shales in the Cretaceous succession will then be evaluated within this detailed stratigraphic context. The geographic focus of the program is a six-quadrangle area shown in the inset map below.

During the FY03 field season, detailed stratigraphic sections were measured through portions of the Torok, Nanushuk, and Tuluvak formations near the Chandler and Colville rivers south and west of Umiat, respectively. High-frequency sequence-bounding unconformities in the upper Nanushuk at Ninuluk Bluff were reexamined. In addition, exposures of the Carboniferous Lisburne Group and the Triassic Otuk Formation were examined near the mountain front along Tiglukpuk Creek, and a 3,700-meter-thick basin-to-shoreline transition succession of Upper Cretaceous strata exposed immediately east of the Dalton Highway was examined in detail. Of particular economic significance, several sandstone beds in the Torok and Nanushuk formations, and in the Upper Cretaceous succession east of the Dalton Highway exhibited strong hydrocarbon odors. Over the past four field seasons, oil-stained sandstones have been observed in the Torok and Nanushuk formations over a large geographic area in the Chandler Lake, Umiat, and Sagavanirktok quadrangles, including Alaska State lands (red dots on inset show locations of oil-stained sandstones). The discovery of oil-stained Upper Cretaceous strata east of the Dalton Highway (immediately east of eastern edge of the inset map) expands the geographic and stratigraphic extent of hydrocarbon shows in the foothills belt. Results from this program have identified key sequence-bounding unconformities and potential reservoir facies that are important for understanding the distribution of potential hydrocarbon reservoirs in the foothills belt and in coeval deepwater strata to the north in the northeastern NPRA.

In conjunction with stratigraphic studies during the FY03 field season, a 19-meter-thick section of Jurassic age organic-rich shale with up to 14 percent total organic carbon was sampled in detailed for source rock evaluation, and field reconnaissance was conducted along the Brooks Range mountain front in preparation for 1:63,360-scale geologic mapping planned for the FY04 field season. In addition, field checking digitized copies of older 1:125,000-scale geological maps of the Chandler Lake, Ikpikpuk River, Killik River, and Umiat quadrangles was completed. These maps are part of a series of maps being digitized by the U.S. Geological Survey in a collaborative program with this project. The first in this series (Umiat Quadrangle) is in final review and will be released Fall FY03.

Products from this project will include: Measured sections (released during the winter following each field season); summary of the petrology and reservoir quality of selected sandstone bodies (released winter FY04); and a report summarizing the sequence stratigraphy and reservoir quality of Cretaceous rocks (released winter FY05).



HOLITNA BASIN ENERGY RESOURCE STUDY

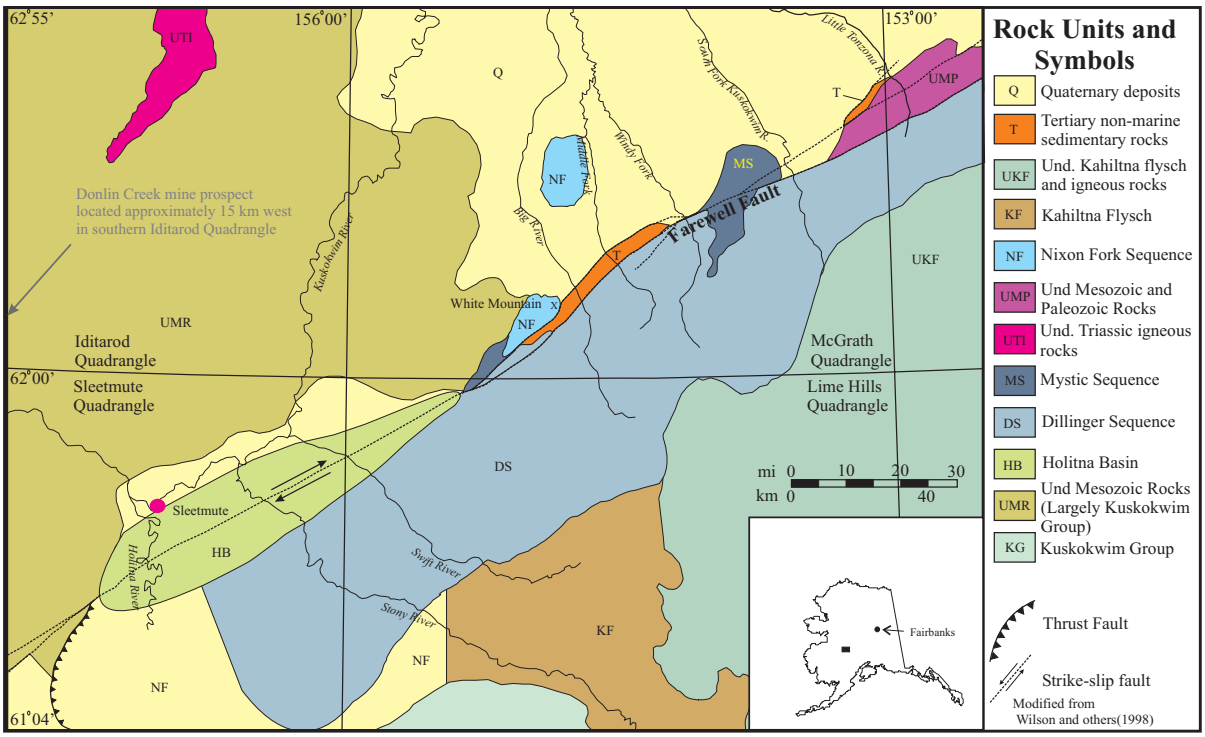
Contact: David L. LePain, Energy Resources Section, 907-451-5011, davele@dnr.state.ak.us

The Division of Geological & Geophysical Surveys (DGGS) is conducting a study to evaluate the potential for gas in Tertiary strata of the Holitna basin. A local source of gas in the Holitna basin would meet the needs of local communities and promote development of nearby mineral resources, such as the Donlin Creek Mine. The small amount of detailed information available regarding the geology of the basin discourages future exploration of the basin's energy resources.

The Holitna basin is a subsurface strike-slip basin located south of the Kuskokwim River, near the village of Sleetmute. Gravity data suggest that the basin contains up to 6,000 meters of Tertiary age sedimentary rocks. The location of the basin astride the Farewell fault suggests that its formation and fill are related to right-lateral strike-slip motion on the fault. No exposures of the basin-fill exist, making direct evaluation of its gas potential possible only through an expensive drilling program. However, exposures of Tertiary age coal-bearing rocks are present northeast of the Holitna basin, along a northeast-trending belt that straddles the Farewell fault.

During the FY01 and FY03 field seasons DGGS conducted detailed stratigraphic studies of Tertiary strata in this belt to characterize the reservoir quality of sandstones and conglomerates, and the gas potential and thermal maturity of coals and carbonaceous shales. Preliminary organic geochemical samples collected during the FY01 season indicated good gas source potential and some liquid hydrocarbon potential. Organic geochemical samples collected during the FY03 season will provide more detailed information on the gas and liquid hydrocarbon source potential of non-marine strata thought to fill the basin. In addition to fieldwork, DGGS has nearly completed an integrated interpretation of high-resolution aeromagnetic and detailed regional gravity datasets covering the basin. Interpretation of these geophysical datasets will result in a better understanding of the origin, deep structure, and sedimentary fill of the basin. DGGS is also evaluating shallow seismic techniques to assess the subsurface structure and will complete a 1:63,360-scale geologic map of the nearby Sleetmute A-2 Quadrangle. The dataset resulting from this project will allow DGGS to make meaningful general conclusions regarding the petroleum potential of the basin.

Products from this project will include a report summarizing the reinterpreted high-resolution aeromagnetic and gravity data and a summary report on the gas potential of the Holitna basin that incorporates all available data and makes recommendations, if appropriate, for future work. These reports are in preparation and will be released Fall FY03. The geologic map of the Sleetmute A-2 Quadrangle will be released Fall FY04.



COALBED METHANE FOR RURAL ALASKA ENERGY

Contact: James G. Clough, Energy Resources Section, 907-451-5030, jim@dnr.state.ak.us

The Division of Geological & Geophysical Surveys (DGGS) 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.

DGGS, in cooperation with the U.S. Geological Survey (USGS) and the U.S. Bureau of Land Management–Alaska (BLM), is taking the lead role in evaluating Alaska's remote coal basins for their shallow coalbed gas potential, and is focusing on three sites that have the highest potential for coalbed gas: (1) Wainwright on the western North Slope, (2) Fort Yukon in the Yukon Flats, and (3) Chignik area communities on the Alaska Peninsula.

In 2000, DGGS entered into a cooperative research agreement with the Kansas Geological Survey to conduct a shallow seismic study at Fort Yukon to evaluate the lateral continuity and thickness of coal seams beneath the community. Approximately 8.5 line miles of seismic reflection study was conducted using the Kansas Geological Survey's IVI mini-vibrator (figs. 1 and 2). Processing of the acquired data shows a number of significant reflectors present, including the top of the lignite (at »1,200 feet) and indications that at least two more significant coal-bearing zones are present beneath the upper lignite and these coal intervals underlie the entire community (fig. 2). Planning is underway to reenter the 1994 USGS climate test hole at Fort Yukon, sample the coal interval for gas content and conduct geophysical logging of the drill hole.

During November 2002, a water well rig drill hole near Chignik Lake will be monitored for coal intervals to the depth of 750 feet. If coals are encountered, they will be collected and tested for gas content by canister desorption.

DGGS is currently working with the U.S. Department of Energy's Los Alamos National Laboratory to obtain the funding to develop coiled-tubing microhole drilling technology with the capability to drill to depths of 3,500 feet at approximately one-third the cost of conventional coalbed gas drilling, estimated to be as high as $1.8 million per site. The University of Alaska will participate with DGGS, Los Alamos, USGS, and BLM in the development and implementation of this new technology.

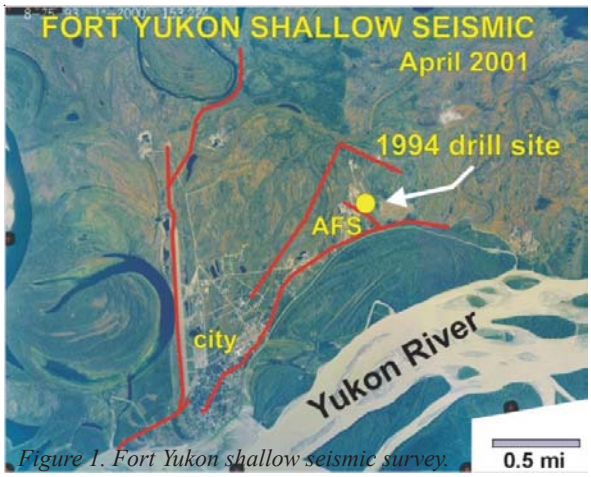


Figure 1. Fort Yukon shallow seismic survey.

Figure 2. Minivibrator at Fort Yukon.

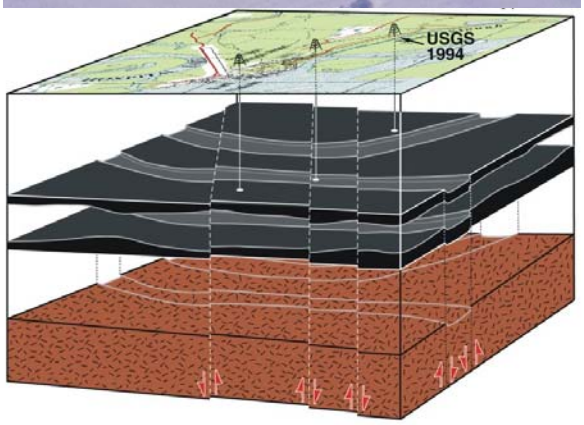


Figure 3. Coal seams beneath Fort Yukon based on shallow seismic survey.

EVALUATION OF EFFECTS OF DRILLING AND COMPLETION FLUIDS IN SHALEBED METHANE RESERVOIRS—RED DOG MINE

Contact: James G. Clough, Energy Resources Section, 907-451-5030, jim@dnr.state.ak.us

Preliminary tests of organic-rich shales at the Red Dog mine in northwestern Alaska (fig. 1) suggest potential exists for shalebed methane gas. Red Dog Mine is the world's largest lead–zinc mine with reserves for 50 plus years of mining. Annual costs for diesel-based energy at the Red Dog Mine exceed $20 million. To find an alternative source of energy at the Mine, the U.S. Department of Energy funded a pilot program in 2001 to develop tools and techniques for obtaining key reservoir parameters from slim holes (fig. 2). Several slim-hole test wells were drilled to target the Kuna and Kayak Formations that are shale gas bearing. Ethylene glycol is used to keep the holes from freeze-up during drilling and following completion. Glycol may affect porosity and permeability measurements as they relate to gas production from shalebed and coalbed reservoirs, as well as create permanent formation damage. DGGS is providing

Figure 1


Figure 2. Slim-hole drill rig in open pit

project oversight and geologic framework for a Reimbursable Services Agreement (RSA) to the University of Alaska Petroleum Engineering Department to evaluate the effects of glycol on porosity and permeability measurements on slim-hole drill core from the Red Dog Mine (fig. 3). The overall project objective is to use the permeability measurements to assess formation damage during drilling and well completion.

Project tasks include:

- Measure permeability and porosity from cores obtained from the slim-holes drilled at the Red Dog Mine.
- Evaluate formation damage arising from the drilling and completion fluids used at the Red Dog Mine
- Initiate a program designed to establish laboratory capability at the University of Alaska Fairbanks that can support future shallow gas (primarily coalbed methane and shalebed gas) exploratory drilling and production operations in Alaska.

As coal seams are reservoirs with natural pores, the fracturing fluid can cause more damage to the permeability than in the case of matrix reservoir. Evaluation and research of the resulting damage caused by the fracturing liquid to the permeability of the coal become very important. For this, a system for measuring the permeability of coal core in quasi-triaxial mode will be developed. The system can be used to measure coal sample permeability simulating reservoir temperature and pressure before and after fracturing. The system consists of three main components: Sample holder, hydraulic pressuring system, and pumping system. Experiments will be conducted using specialized equipment that simulates as closely as possible the "downhole" conditions of pressure and temperature. Background information concerning slim-hole drilling at the Red Dog Mine will be collected to support the design of the experiments to measure permeability and assess formation damage.

A final project report documenting project methodology, results, conclusions, and recommendations for drilling and completion of slim-holes to develop shallow gas resources in Arctic Alaska will be completed by the end of FY03. Funding ($37.0) for this project is from State CIP and U.S. Department of Energy funds. The U.S. Geological Survey and the U.S. Bureau of Land Management are cooperative partners in this effort as well.

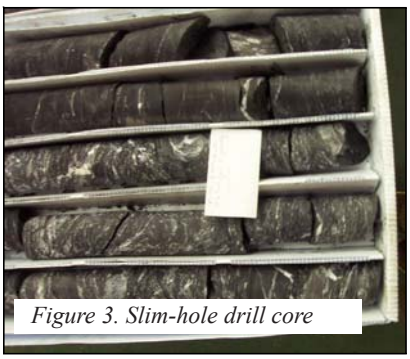
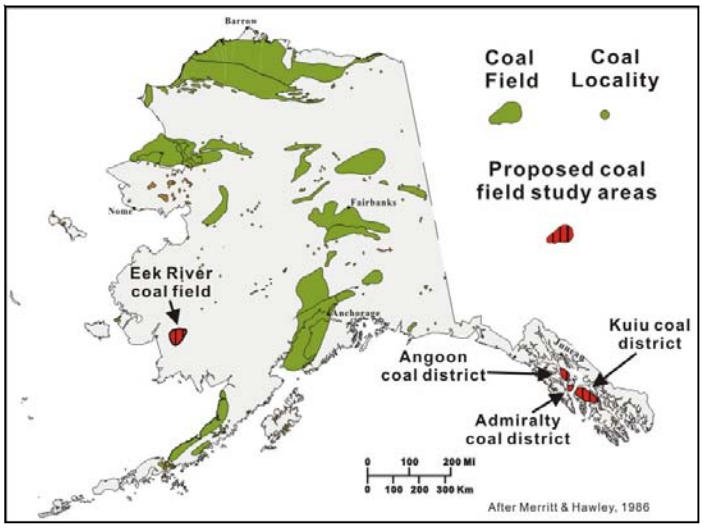


Figure 3. Slim-hole drill core

ALASKA COAL DATABASE
NATIONAL COAL RESOURCE DATA SYSTEM

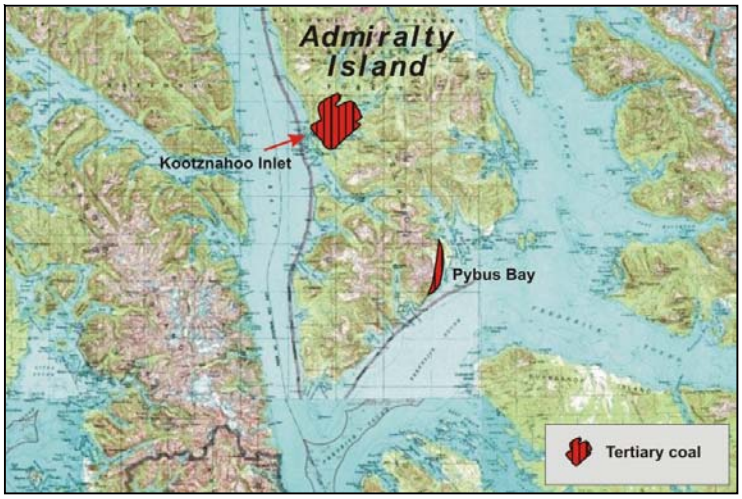
Contact: James G. Clough, Energy Resources Section, 907-451-5030, jim@dnr.state.ak.us

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 website: http://energy.er.usgs.gov/products/databases/USCoal/. Encoded and formatted data for northwestern, northern, interior, southcentral 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 that contains coal quality and stratigraphic data for Alaska, the need for collecting new coal samples and current stratigraphic data was recognized. 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 the southeastern Alaska and the Eek River areas 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 of coalbed methane as a major domestic energy source in the 1980s, 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.

Contingent on federal funding, during the 2003 and 2004 field seasons, DGGS staff will conduct field examinations of coal outcrops in the Angoon, Admiralty, and Kuiu coal districts of southeastern Alaska. During the 2005 field season we will visit the Eek River coal locality. Coal samples collected will be submitted for proximate, ultimate, and trace-element analyses, and selected samples will be submitted for gas isotherm studies. Products from this project are: (1) encoded and formatted coal resource data of new samples submitted to the USGS in their USTRAT and USALYT computer files for inclusion into the Alaska coal database, and (2) a final report detailing coal resource data for each of the coal fields.

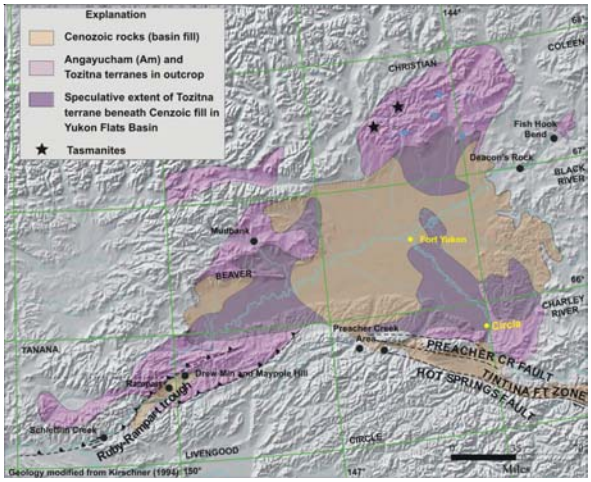


YUKON FLATS BASIN HYDROCARBON POTENTIAL STUDY

Contact: Rocky R. Reifenstuhl, Energy Resources Section, 907-451-5026, rocky@dnr.state.ak.us

The Division of Geological & Geophysical Surveys (DGGS), together with the U.S. Geological Survey (USGS), is evaluating the hydrocarbon potential of the Yukon Flats basin. This evaluation will result in new data on coal quality, sedimentary facies, and hydrocarbon reservoir potential for rocks in the basin.

Background: Several aspects of the Yukon Flats basin (fig. 1) impede evaluation of its energy resource potential:



(1) The tectonic origin of the basin is complex and not well known, (2) detailed information on the stratigraphy and depositional systems in the basin does not exist, (3) the presence and locations of coal and petroleum source rocks is uncertain, and (4) the favorable distribution of reservoir and topseal sediments relative to potential source beds is unknown. The Yukon Flats basin cannot be considered for energy resource exploration until the surface and subsurface geology, as it relates to coal, oil, and gas accumulations, is better known.

Geologic setting: The Yukon Flats basin is a 65-million-year-old extensional basin associated with strike-slip movement along the Tintina fault system. The basin is in east-central Alaska, between the Trans-Alaska pipeline and the Canadian border, and contains known coal-bearing strata on the western, southwestern, and southeastern margins. Associated with the coal-bearing strata are carbonaceous shale and sandstone units that further influence the energy resource potential (coalbed gas and shalebed methane as well as conventional gas and oil) for the Yukon Flats. More oil-favorable sedimentary rocks exist in the Kandik basin thrust belt immediately to the east of the Yukon Flats. Late Cretaceous to Tertiary sedimentary strata (45 to 65 million years old) of the Tozitna terrane is present in widely scattered exposures around the margins of the Yukon Flats basin. These exposures, combined with gravity and two-dimensional seismic data collected in the 1980s (fig.2), indicate the basin is filled with at least 15,000 feet of nonmarine sediments. Seismic stratigraphic observations indicate the basin fill comprises three stratigraphic cycles, each composed of different proportions of lake and river sediments. Extremely rich oil-prone source rocks are known from lake sediment successions in other basins around the world (Southeast Asia and China). Therefore, it is possible that lake sediments in the Yukon Flats basin may include oil-prone or gas-prone organic material. In addition, extremely rich oil-prone marine source rocks (tasmanites) are known from a few widely scattered localities in the pre-Tertiary sedimentary bedrock in the Christian Quadrangle north of the Yukon Flats basin. While the lateral extent of these rocks is unknown, it is possible that they extend under at least part of the Yukon Flats basin. Potential reservoir sandstones may be present in structural and stratigraphic trapping configurations, and lake sediments could serve as reservoir topseals. Given the thickness of the basin fill and assuming a geothermal gradient similar to that of the Nenana basin, temperatures conducive to petroleum maturation and expulsion occur below 7,000 to 10,000 feet. The relative proximity to the Trans-Alaska pipeline and the Yukon River make the Yukon Flats basin an attractive frontier basin for exploration. However, the lack of a basin-wide synthesis of the tectonic setting, structural geology, stratigraphy, and thermal regime discourages exploration activities.

Products: DGGS will synthesize the existing industry dataset and integrate new site-specific data from the perimeter of the basin to develop an up-to-date evaluation of the hydrocarbon potential. Products include: Compilation of all shallow borehole and lithological data; sandstone petrology including mineralogy, cements, porosity, provenance, and diagenetic history; depositional facies and hydrocarbon reservoir potential of Tertiary sandstones; and coal quality and stratigraphic data input into the NCRDS. This project will be completed by June 2003, however, additional funding may be available for future studies.

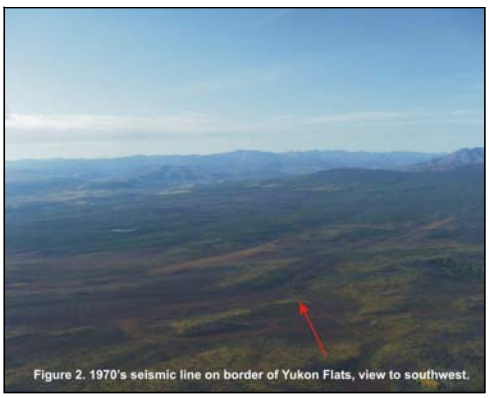


Figure 2. 1970's seismic line on border of Yukon Flats, view to southwest.

DELTA AREA COALBED METHANE, STRUCTURAL AND STRATIGRAPHIC PROJECT

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The Division of Geological & Geophysical Surveys (DGGS) is evaluating the potential coalbed methane in the Delta area of the eastern middle Tanana basin. The presence and quantity of producible coalbed gas in this basin is unknown and untested. The study area (fig. 1) extends from the Jarvis Creek coal field (Mt. Hayes Quadrangle) to north of Delta Junction (Big Delta Quadrangle) and westward to the Wood River coal field (Fairbanks Quadrangle) (fig. 2). Industry is actively exploring this region for its coalbed methane potential to meet energy needs in Delta Junction and Fort Greely. This area is isolated from the existing power grid and diesel and heating fuel are currently used to generate electricity and heat in residences and businesses.

The Delta Area project is a 2-year project that began July 1, 2002, and will be completed June 30, 2004. Project work will consist of the following tasks: (1) Compile existing literature, geologic map data, and structural, geologic, sedimentary, paleontologic, and thermal information, including borehole data from Jarvis Creek; (2) research and evaluate basin hydrogeologic data; (3) reconstruct the tectonic history of the basin; (4) interpret regional and local stresses utilizing GIS software, geo-referenced LANDSAT, and aerial photos; (5) identify potential fracture networks, evaluate fluid flow regime, and model coalbed gas generation-to-production pathways; and (6) conduct volumetric analysis to predict potential coal reserves or gas resources for the basin. Interim products will be publicly released on a timely basis, including coal quality data. Products at the end of year one will include summary reports on preliminary findings of reconnaissance-level fieldwork, coal quality, and preliminary tectonic analyses. Final products at the completion of the project (FY04) will include a final report summarizing the coalbed methane potential and final release of coal quality data. This project is funded by a combination of General Funds, State CIP, and industry Program Receipts.

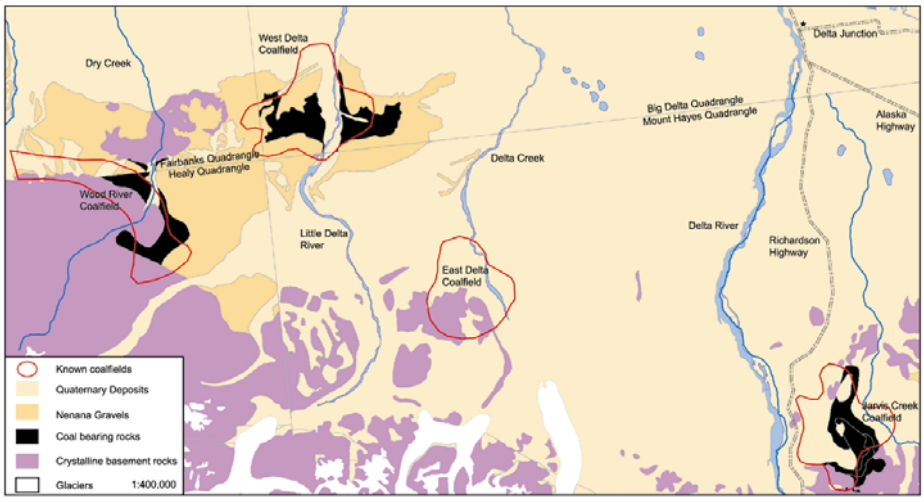


Figure 1. Generalized geology of the eastern Middle Tanana Basin (modified from Wilson and others 1998)

Figure 2. Coal-bearing Suntrana Formation at Wood River Coal Field on Coal Creek.

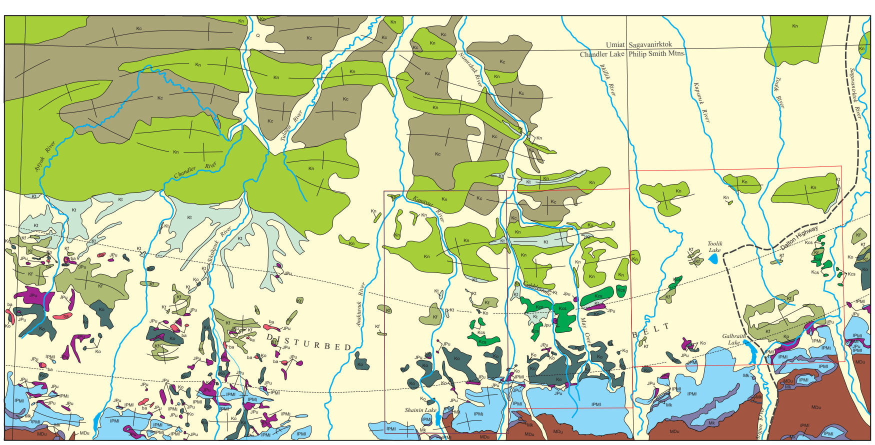
KANAYUT RIVER STATEMAP PROJECT

Contact: David L. LePain, Energy Resources Section, 907-451-5011, davele@dnr.state.ak.us
Contact: Ellen E. Harris, Energy Resources Section, 907-451-5024, ellie@dnr.state.ak.us

Proposed geologic mapping in the Kanayut River area of the Chandler Lake Quadrangle, outlined on the inset map in dark blue, is part of the National Cooperative Geologic Mapping Program which partners 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 encountered in the Prudhoe Bay–Kuparuk area, the Colville Delta, and to recent exploration wells drilled in the 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 Alaskan 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.

Initial assessment of the technical and logistical needs to map the Chandler Lake C-2 and northern half of the B-2 quadrangles during the 2003 field season is underway. Objectives include: 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; evaluating the reservoir potential of selected map units; 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; sampling for organic geochemical analysis to evaluate hydrocarbon source rock potential in upper Triassic through Lower Cretaceous rocks; and petrographic studies to differentiate units and define provenance for Lower Brookian rocks. Supporting investigations include sampling for apatite fission track analysis, porosity and permeability determinations, micropaleontologic and macropaleontologic age determinations, and radiometric dating. This information will be used to produce a comprehensive geologic map of the Kanayut River corridor and to evaluate the petroleum source rock and reservoir potential of selected map units.

This map will advance DGGS's 1:63,360-scale geologic mapping westward along the Brooks Range mountain front and adjacent northern foothills (previous mapping is outlined in red on the above inset figure). Products resulting from this project will include: A comprehensive geologic map at 1:63,360 scale with supporting text (released Winter FY05); a surficial geologic map, and a construction material resources and geologic hazards map (released Fall FY05). All samples will be archived and available in a geographically referenced relational database.



ANCHORAGE GEOTECHNICAL PROJECT

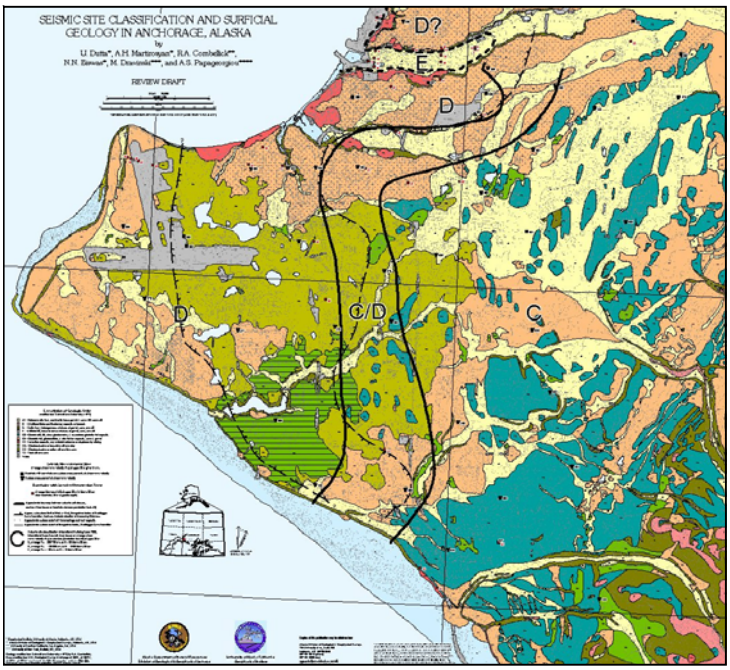
Contact: Rodney A. Combellick, Engineering Geology Section, 907-451-5007, rod@dnr.state.ak.us

DGGS finished compiling historic geotechnical borehole data and deep water-well logs for the Anchorage area in 2000 but continues to add significant data to the database as they become available. Our GIS database index currently contains more than 4,200 borehole and water-well logs from all known public and private sources. Of these, we have entered downhole technical data for over 2,500 boreholes; the remainder are stored in hardcopy format and may be quickly located via the digital index. To the best of our knowledge, the GIS database is complete for all geotechnical boreholes greater than 50 ft deep and all available digital well-log data for water wells greater than 100 ft deep. Development of the database was supported by funding from the U.S. Geological Survey's National Earthquake Hazards Reduction Program (NEHRP).

In conjunction with this project, we are collaborating with the University of Alaska Geophysical Institute (UAGI) on a seismic microzonation project to combine geological and geophysical data in the preparation of maps that will aid planners and developers in the design and construction of more earthquake-resistant facilities. Subsurface geologic information has proven highly beneficial in the processing and interpretation of seismic data collected by UAGI. The first products developed by this project are seismic site-response maps that show the variation in ground-motion amplification that can be expected in Anchorage for three different shaking frequencies, 5 Hz, 1 Hz, and 0.35 Hz. Several dozen copies of these maps have been distributed to potential users in the Anchorage geotechnical community for comments. We are now incorporating these user comments into the revised 1:25,000-scale maps and finalizing the accompanying text for publication as a DGGS Report of Investigations. The data shown on these maps and the shaking frequencies selected for analysis correspond to the seismic provisions of the latest building codes. Consequently, structural-design professionals can use these maps in conjunction with the building codes during the design process and for guiding more detailed site-specific analyses.

During FY01 and FY02, we developed collaboratively with UAGI a seismic soil-type map, which also corresponds to provisions of the latest seismic building code. The draft of this map appears here, and the text is currently in preparation. According to the building code, seismic soil types are ideally assigned according to seismic shear-wave velocities in the upper 30 meters (100 feet) where these data are available. Where velocity data are not available, standard penetration tests (SPT) from boreholes may be used. By combining SPT data from DGGS's borehole database with velocity data from UAGI's seismic measurements, the project team made best use of all available and pertinent data. The map shows that, although there is broad correlation of seismic soil types with geology, the surficial-geologic map is not a reliable indicator of seismic response of the upper 30 meters.

With final map revisions and text preparation nearly completed, the site-response and soil-type maps will be published in early calendar year 2003. DGGS's participation in the seismic microzonation project is supported by USGS/NEHRP.



Seismic soil-type classifications superimposed on a simplifed surficial-geologic map of Anchorage. Seismic soil types, shown here by letters C-E, are defined by criteria in the Uniform Building Code based on seismic-velocity and standard penetration test data.

LATE HOLOCENE GREAT EARTHQUAKES AND ASSOCIATED LAND/SEA-LEVEL CHANGES IN THE GREATER ANCHORAGE AREA

Contact: Rodney A. Combellick, Engineering Geology Section, 907-451-5007, rod@dnr.state.ak.us

DGGS is participating with researchers from the University of Durham, England, in a USGS-funded study of land/sea level changes that occur during and between great earthquakes in the greater Anchorage region. The purpose of the study is to collect detailed stratigraphic and microfossil data in coastal-marsh sediments, which are highly sensitive to changes in relative sea level. By learning the amount and rate at which these adjustments occur in response to the forces that generate these subduction-zone earthquakes, we will not only confirm and refine our estimate of the frequency of these destructive events, but perhaps even forecast them with a lead time of a few years to a few decades. The study is funded by a grant to the University of Durham through the National Earthquake Hazards Reduction Program (NEHRP), from which DGGS receives operational support for its participation in the project.

Paleoseismic investigations conducted by DGGS during the early 1990s identified evidence in Cook Inlet coastal marsh sediments of six to eight great earthquakes during the past 5,000 years, giving an average recurrence interval of 600–800 years. These conclusions were based on the theory that the repeated burial of fresh-water peat deposits by marine tidal muds was due to their subsidence during great earthquakes as occurred in several areas during the 1964 Great Alaska Earthquake. In the present project, we are using the biostratigraphy of microfossils, particularly diatoms, to confirm the sudden transition from fresh-water to marine conditions, estimate the magnitude of the associated change in relative sea level, and identify evidence of sea/land level changes between earthquakes. We do this by comparing the relative abundances of marine, brackish-water, and fresh-water species to those of the modern coastal marsh relative to present sea-level datums.

To date we have confirmed that the abrupt peat–silt transitions in the macrostratigraphy are indeed associated with sudden rises in relative sea level on the order of several decimeters to more than one meter, of the magnitude associated with subsidence during great subduction earthquakes. A second important observation is that the diatoms consistently show evidence of a pre-earthquake reversal in vertical crustal motion, going from typical interseismic uplift to preseismic subsidence some time before a great earthquake. On the basis of correlation of diatom assemblages with the concentration of cesium in the soil arising from nuclear testing during the 1950s and early 1960s, this reversal in relative sea-level change occurs in the several years to a decade or two prior to a great earthquake. If this evidence holds up in further testing, it may provide a basis for possible forecasting of great earthquakes in the future.

Initial results of our biostratigraphic studies on the 1964 earthquake were published in the October 2002 issue of *The Holocene*. Current work in FY03 focuses on (1) testing our evidence for pre-seismic subsidence to establish that the observed biostratigraphy not a localized phenomenon or a result of vertical sediment mixing, (2) determining the amount of sudden sea-level rise (land subsidence) associated with the penultimate great earthquake (about 800 years ago) on the basis of diatom assemblages, and (3) investigating numerous sites for evidence of pre-seismic sea-level rise prior to the penultimate event. These results will be published during 2003.

Coastal marsh at Girdwood, Alaska, showing sharp contact between buried pre-earthquake peat and tidal silt that was deposited after the 1964 event.

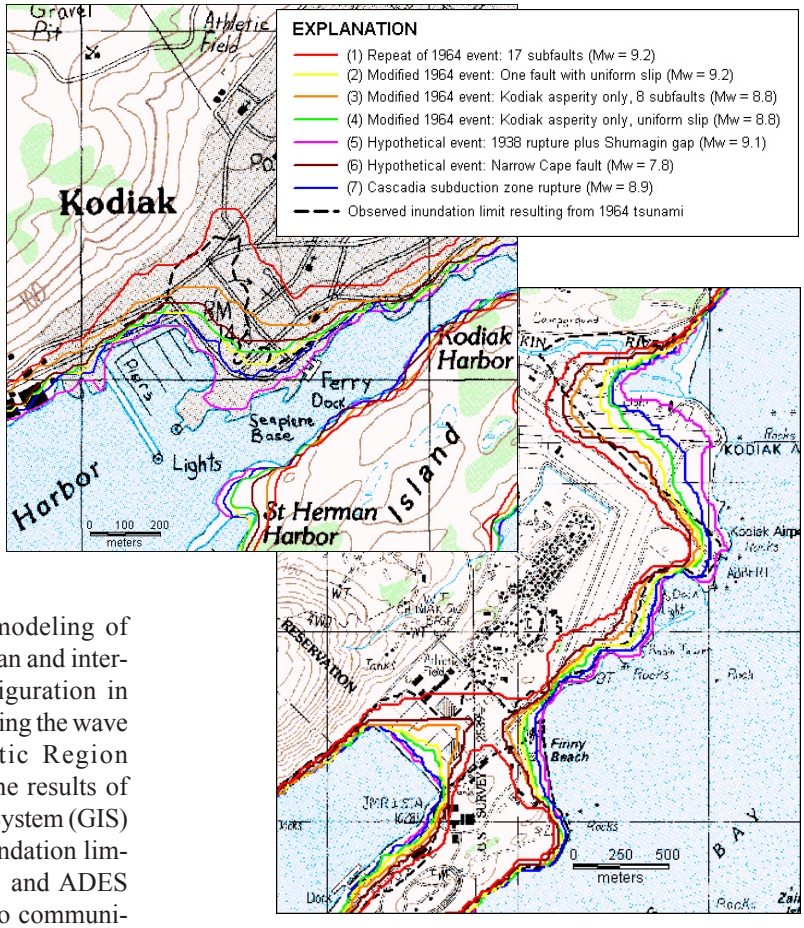
TSUNAMI INUNDATION MAPPING

Contact: Rodney A. Combellick, Engineering Geology Section, 907-451-5007, rod@dnr.state.ak.us

With funding from Congress, the National Oceanic & Atmospheric Administration (NOAA) and Federal Emergency Management Agency (FEMA) 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 Emergency Services (ADES) and the University of Alaska Geophysical Institute (UAGI) to prepare tsunami-inundation maps of selected coastal communities. 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. As a result of a meeting of local, state, and federal representatives in 1999, nine additional communities were selected and prioritized for future inundation mapping based on population, tsunami exposure, community interest, and data availability. Homer and Seldovia are the next communities for which we are currently preparing inundation maps. These will be completed in FY 2003, after which we will begin preparing maps for Seward.

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 ADES meet frequently 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 provides the GIS files of inundation-limit lines to the local communities for use in preparing their own maps.

During preparation of the Kodiak maps, comparison of the modeled 1964 inundation with the observed wave run-up in 1964 showed 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 presented the preliminary results of this project at international tsunami symposia in Istanbul, Turkey, and Seattle, Washington in 2001, and at the Tsunami Society symposium in Honolulu, Hawaii, in 2002. Our project was the subject of recent articles in *Geotimes* and the *TsuInfo Alert Newsletter*.



Excerpts from tsunami-inundation maps for the city of Kodiak (above) and U.S. Coast Guard Reservation (right).

ALASKA VOLCANO OBSERVATORY

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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 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.

Continuing expansion. In 1996 AVO monitored four volcanoes with short-period seismometers. That number has grown to 24 volcanoes monitored with ground-based geophysical instruments and around 100 volcanoes in Alaska and Russia monitored by systematic satellite observations. In 2002 a short period network was added at Okmok, and new "superstations" (below) were installed at Okmok and Akutan. In 2003 AVO will install new networks at Tanaga and Gareloi.

Continued improvement in geophysical monitoring technology provides a much richer data stream. In the past AVO has relied on networks of about a half a dozen short-period seismometers clustered about potentially hazardous volcanoes. Several instruments are needed near each volcano to accurately record and locate the very small earthquakes associated with volcanic eruptions. In 2002 AVO deployed its first "superstations" to augment the short-period network. These stations have broadband seismometers and continuous telemetered GPS instruments in addition to the traditional short-period instruments. The broadband instruments provide a much more complete signal, particularly of the low frequency "gurgling" associated with volcanic fluids. The GPS instruments will allow AVO to precisely track the swelling of volcanoes that accompanies the rise of magma. Networks of these instruments provide information on the size, shape, and location of the magma body. These stations require more power than traditional ones, and also require digital, rather than analog, telemetry. AVO is on the leading edge in developing remotely powered digital broadband and GPS stations.

Satellites extend AVO's capabilities to all Alaska volcanoes as well as the particularly active volcanoes of Kamchatka in the Russian far east, and those in the northern Kurile Islands. These remote, unmonitored, or poorly monitored volcanoes also pose a very real hazard to aviation in American-controlled airspace. Today AVO automatically processes hundreds of detailed subsections of satellite data and scans those data twice daily for thermal anomalies that indicate volcanic unrest, and may precede eruptions by weeks or months. Some eruptions, such as the 1997 eruption of the unmonitored volcano Okmok, were first detected using satellite data. Satellites are also used to track volcanic plumes as they drift downwind. In the spring of 2001, AVO monitored several large eruptions from unmonitored Cleveland Volcano, 150 miles west of Unalaska/Dutch Harbor. The

Construction of a new "superstation" on Cone D inside Okmok Caldera. The gray hut on right can contain all the components of a normal station: Electronics, antenna, batteries, and solar panels. New stations include additional solar panels and a welded tripod holding the GPS antenna.

satellite data stream has been augmented by the launch of the MODIS instrument and the installation of a receiving station at the UAF Geophysical Institute. MODIS is a high spatial resolution multispectral satellite.

Volcano hazards reports and geologic maps provide the "patient history" to complement "vital signs" collected by geophysical networks. These reports and maps document the past history of each volcano, which helps AVO staff anticipate the course and nature of future eruptions. Hazards reports also identify local infrastructure that may be at risk. DGGS plays important roles in field geology, sample analysis, and GIS work. We are presently on the teams working on multi-year projects at Veniaminof and Okmok volcanoes. DGGS has published the Makushin hazard report, will publish the Shishaldin report in calendar 2002, and the Okmok report in 2003 or 2004. Two geologic maps are in preparation. A draft geologic map of Mt. Spurr has been completed.

DGGS plays a vital role in AVO. DGGS is the smallest partner in AVO, contributing less than 10 percent of the personnel. Over 95 percent of DGGS's participation in AVO is funded by two cooperative agreements with the USGS, only one of which has dates that coincide with the state fiscal year. These cooperative agreements describe DGGS's tasks within AVO. Summaries and FY03 progress are below:

Helicopter logistics. DGGS manages $325.0 for helicopter procurement for all major AVO projects. In FY03 this included contracts for fieldwork based out of Fort Glenn (Umnak Island), Cold Bay, Pt. Moller, Pt. Heiden, King Salmon, Homer, and Anchorage. There was a substantial challenge in reacting to the »30 percent increase in charter rates and the reduced number of charter companies. Having all the helicopters contracted by a single agency results in significant budgetary and logistic efficiencies. As part of managing the helicopter budget DGGS is responsible for the final fine-tuning of the schedules. For the calendar year 2003 field season DGGS will also contract the ship that will be required for installation of the western Aleutian networks.

Geologic and Volcanic Hazards studies at Veniaminof and Okmok Volcanoes. DGGS provides mapping and sampling support to interagency teams working on Okmok and Veniaminof volcanoes. At Okmok we have the lead in mapping the caldera walls and the precaldera shield. At Veniaminof we map, as well as providing central management and oversight of samples and the evolving geochemical database. For both projects we provide important office and field GIS support. At Okmok we constructed a new topographic base using merged AirSAR, LandSat, and high-resolution satellite photography. At Veniaminof the challenge is to bring together map and sample information from the unusually large team currently on the project, and merge that with similar information collected over the past few decades. Fieldwork at Okmok will continue into early FY04. Map products will be submitted to the review process shortly thereafter. The final field season is scheduled for early FY04 (July 2003). We have created, and continue to maintain, the sample database—including field notes—and preliminary map data.

AVO World Wide Web site. DGGS was the original creator of the AVO Web site several years 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 HTML coding and graphics manipulation and most of the design. The site is in its fourth version, and is a well-used site for information on active volcanoes in Alaska. In FY03 we began a major push toward greatly increasing the content of the site, and that push will continue and intensify now that we have a full-time geologist/database developer on staff. We also maintain a library of PDF files to facilitate distribution of richly formatted AVO print publications and distribute hundreds of hazards reports on individual volcanoes digitally. DGGS also oversees the AVO internal Web site that displays complex near-real-time seismological and satellite data over the Web, making distributed monitoring possible, instead of monitoring only from within the lab.

Database of geologic information pertaining to Alaska volcanoes. The third, and newest AVO/DGGS staff member has primary oversight of database design, construction, and population for geologic information for all of AVO. This database, when complete, will be a central location for all information (save satellite images and complete seismic data) pertaining to the volcanoes. This database will also serve as the "back end" to the public Web site, making site maintenance easier and allowing more vigorous growth. A preliminary, interim, release is an authoritative and up-to-date bibliographic database, which will be released in FY03. The larger database will be constructed in FY03 and FY04.

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

Contact: De Anne S.P. Stevens, Engineering Geology Section, 907-451-5014, deanne@dnr.state.ak.us

In March 2000, regional and village Native Alaskan leaders met in Kotzebue, northwestern Alaska, to discuss avenues for preserving the indigenous cultures of Alaska and increasing the quality of life for their communities. The Arctic Economic Development Summit determined that new economic development in rural Alaska results in: (1) higher employment, (2) greater access to health care, water, sewer and transportation; and (3) establishment of a tax base or payments that can support schools and needed social services. It concluded that development projects ultimately provide greater future self-sufficiency and determination for Native communities.

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. Most of these jobs were located in rural Alaska and provided well paying seasonal employment to local residents. Part of the reason for the decline in the number of placer miners is that most placer districts are perceived as mined out. Preliminary examination of aerial photographs, however, suggests that untapped placer reserves may be present.

In an effort to help facilitate the economic viability of rural communities through increased placer mining opportunities, DGGS is engaged in 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. As part of their commitment to the rural people of the Seward Peninsula, DGGS project personnel are also presenting a series of educational workshops in Nome (fig. 1) for the purpose of teaching interested members of the communities impacted by this research how to understand, interpret, and apply the geologic map and GIS products generated by the study.

Products from this research will consist of detailed geologic maps of unconsolidated Quaternary sedimentary deposits, appropriate cross-sections, and three-dimensional landform models. The maps and cross-sections will have a scale of 1:63,360 or 1:24,000, and will include the area of approximately four standard 1:63,360-scale (inch-to-mile) quadrangles (roughly 1,000 square miles). 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.

The primary users of the products will be the local residents of the Seward Peninsula, northwestern Alaska. Other interested parties will be found in the broader Alaska mining industry. The products will also be of ongoing importance for future land planning and land-use decisions made by local communities and Native regional and village corporations on the Seward Peninsula.

Due principally to funding constraints, DGGS has not been able to support a placer-geology program for more than a decade. We believe successful completion of the Council district pilot project will provide the impetus needed for the state of Alaska to re-establish a working placer program within DGGS that can then go on to use the new techniques developed on the Seward Peninsula to evaluate the other placer districts throughout the state.

Figure 1. The first DGGS educational workshop held in Nome on August 25, 2002.

SURFICIAL AND ENGINEERING GEOLOGY OF THE SALCHA RIVER–POGO AREA

Contact: Patty Cran, Engineering Geology Section, 907-451-5009, patty_cran@dnr.state.ak.us

DGGS is in the second year of a 3-year field-based program to provide ground truth for airborne geophysical surveys flown in the Salcha River area in 1999. This area has received a great deal of attention from the mining community since the discovery of a potential world-class gold deposit at the Pogo prospect. To evaluate new opportunities for development in the Salcha River–Pogo area, it is critical that the State have an up-to-date inventory of potential geologic resources, hazards, and construction materials to guide planning activities and identify key features of potential interest.

During summer 2002, photogeologic interpretation and field-geologic mapping were conducted by a geologist with the DGGS Engineering Geology Section and a contract geologist to identify surficial deposits, potential geologic hazards, and construction materials resources in the Big Delta C-3, the southwest quarter of the Big Delta C-2, and the northeast quarter of the Big Delta B-3 quadrangles.

Glaciers were present at high elevations of the eastern Big Delta Quadrangle during early Holocene time, about 10,000 years ago (Weber, 1986[1]). We identified glacial deposits in the field area; however, we were unable to confidently determine glacial deposit ages. Based on Weber's (1986) work, we suspect that glacial deposits observed include drift of the Salcha(?), Eagle, and Mt. Harper glaciations, suggesting that the age of glacial drift may range between about 10,000 and 100,000 years.

Deglaciation, 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 meters in diameter. Debris-flow deposits occasionally extend into valley bottoms and are common in glacial cirques.

Avalanche cone at Upper Boulder Creek.

Landslides of varying stability and linear features identifiable on aerial photographs are common throughout the study area. Although prominent linear features are often associated with faults, no unequivocal evidence of active faulting in the area was documented in the field.

DGGS will publish surficial and engineering geologic maps in addition to bedrock and comprehensive maps for the Salcha River–Pogo area by the end of FY03.

[1]Weber, F.R., 1983, Glacial geology of the Yukon-Tanana Upland—a progress report, *in* Thorson, R.M., and Hamilton, T.D., eds., Glaciation in Alaska: Extended abstracts from a workshop: University of Alaska Museum Occasional Paper No. 2, p. 96-100.

Debris flow in Lower Boulder Creek.

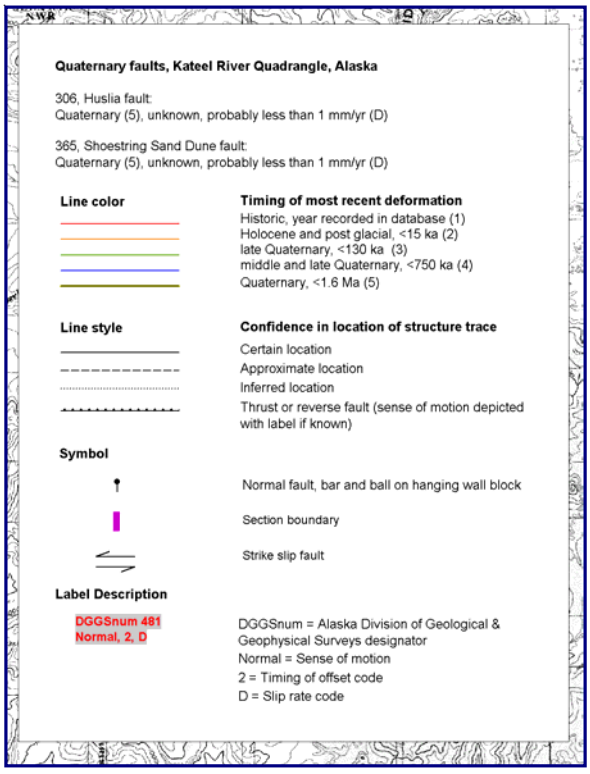
Landslide near the North Fork of the Salcha River.

MAPS AND DATABASE OF QUATERNARY FAULTS AND FOLDS

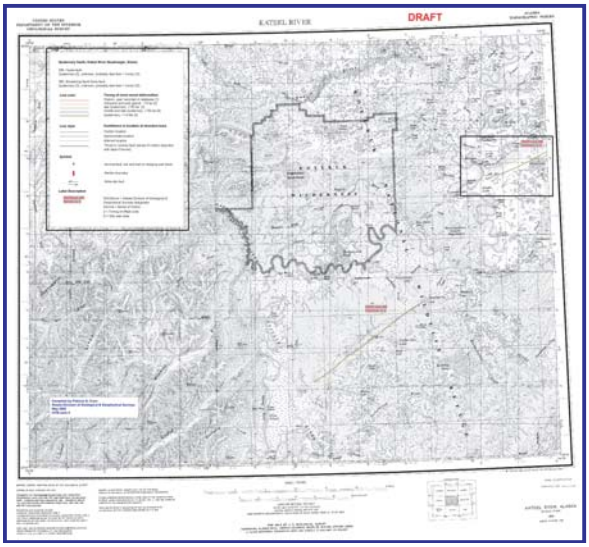
Contact: Patty Cran, Engineering Geology Section, 907-451-5009, patty_cran@dnr.state.ak.us

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.

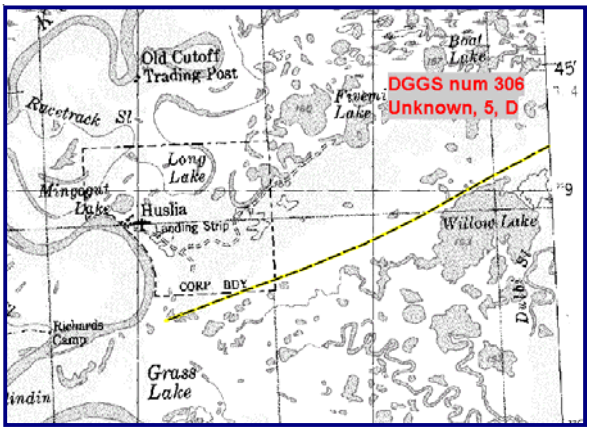
A comprehensive literature search for pertinent published materials on Quaternary faults and folds in Alaska has been completed. Remaining tasks include: completion of text-based descriptions of faults and folds using a nationally established format, compilation of fault traces and fold axes in GIS with associated attributes according to national guidelines, and submission of text files and compiled map data to USGS during State FY03.



Legend for Map of Quaternary faults, Kateel River Quadrangle, Alaska



Draft map of Quaternary faults: Kateel River Quadrangle, Alaska



Huslia fault, Kateel River Quadrangle, Alaska

TRANSPORTATION CORRIDOR MAP CONVERSION

Contact: De Anne S.P. Stevens, Engineering Geology Section, 907-451-5014, deanne@dnr.state.ak.us

Access to Alaska's mineral lands is a strategic issue for the state and federal government, and for the resource industries. During previous campaigns undertaken by the state of Alaska to choose statehood entitlement lands, many potential access corridors were identified and linked in a conceptual long-range transportation grid. This grid is the basis for much of the state's current transportation planning and is consulted when considering access to new mineral discoveries. In 1992, the DGGS Corridor Evaluation Project produced a series of 376 digital geologic, geologic-materials, geologic-hazards, and data-quality maps in 78 quadrangles at 1:250,000 scale for these transportation corridors from compilations of previously published and unpublished reports, and interpretations of aerial photographs and satellite imagery. These maps were important tools in the selection of State lands, and have continued to be requested by companies and agencies in the decade since their compilation even though they were never formally released. By 1999, it became clear that the digital plot files for these maps had become unusable because they were made for plotter technologies and software versions that were no longer supported (fig. 1). Thus, these maps were no longer available to policy makers, mineral explorationists, and engineers who have need of the information that they portray.

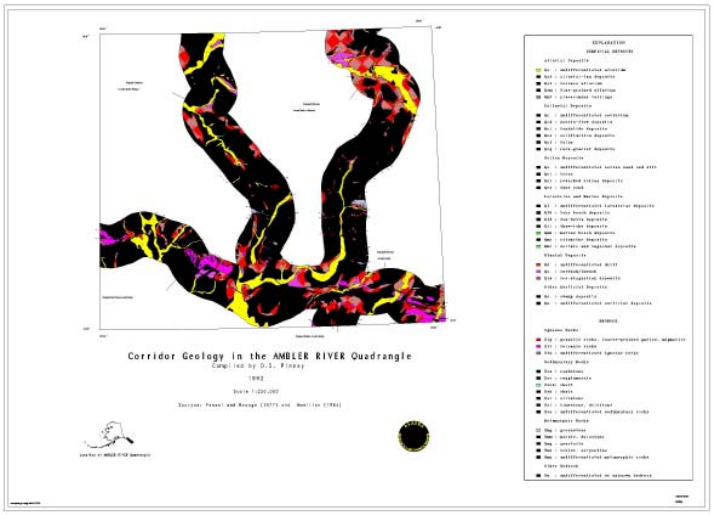


Figure 1. Corridor geologic map generated from old files. Map shows unacceptable colors due to obsolete data coding, very rudimentary cartographic layout, and lack of topographic base.

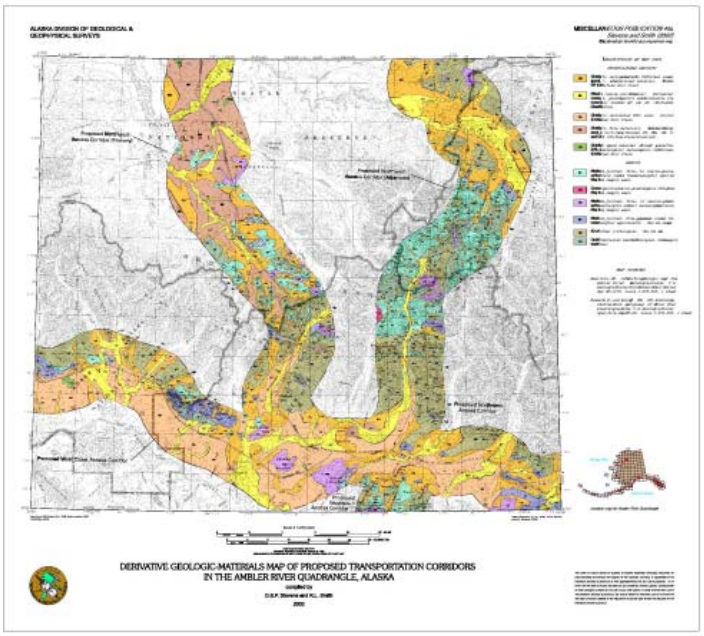


Figure 2. New corridor geologic map for the same quad-rangle. Map shows updated color coding and symbology, and revised cartographic layout with topographic base.

DGGS is converting the data for the 376 sheets of the statewide transportation corridor network map suite from their obsolete digital format to the most current Arc 8.x format in order to formally publish the maps with topographic bases (fig. 2) and an accompanying explanatory report summarizing the Corridor Evaluation Project. The maps and data will be downloadable from the World Wide Web in PDF format and as Arc export files.

As interest in expanding the Alaska transportation network increases, so too will the need for baseline engineering-geologic data of the corridors. This project will give mineral explorationists, transportation engineers, and policy makers valuable tools in order to better assess future transportation issues by providing them with surficial-geologic, geologic-materials, and engineering-geologic information that can affect decisions about transportation options for enterprises ranging from mineral development and land access to siting structures and identifying potential source areas for construction materials.

DIRECTORY OF CONSTRUCTION-MATERIALS PRODUCERS IN ALASKA

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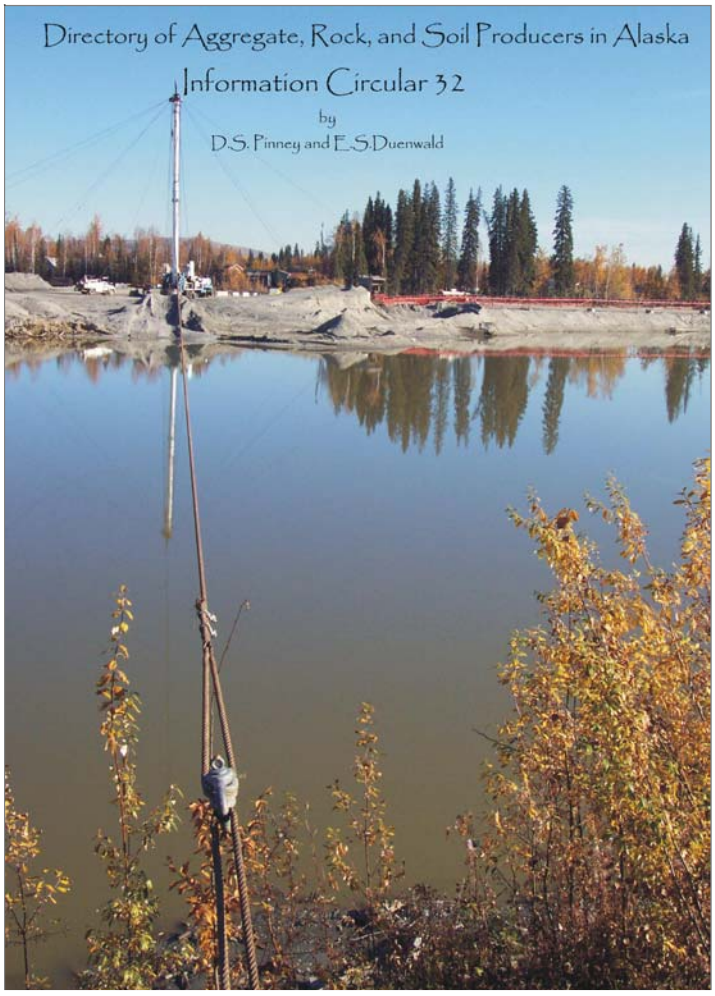
DGGS is developing a cooperative project with the Department of Community & Economic Development (DCED) to update a digital, database-supported directory of current construction-materials producers in Alaska that includes location, commodity, and production data. An important part of this project is to establish a mechanism to maintain and update this data annually so it will remain current.

Information Circular 32, "*Directory of Aggregate, Rock, and Soil Producers in Alaska,*" was originally compiled by DGGS in 1990 and updated in 2001. It is presently our most up-to-date catalog of construction-materials producers in the state. Producers and production typically change radically over short periods of time, and updating this information at regular intervals is a critical necessity if the State of Alaska is to be a responsible manager and caretaker of its natural resources. Increased development and growing population requires concurrent expansion of infrastructure that will generate an ever-greater need for construction materials throughout the state. A significant corollary to this is the necessity of documenting and tracking the distribution and production rates of developed deposits in order to help predict future trends in demand and output. Relative and absolute production can be useful proxy measures of economic development in a region.

The Engineering Geology section of DGGS is working with DCED to jointly produce a directory, using the existing DGGS database in conjunction with additional DCED research. To gather new data for this project, DGGS and DCED will also be soliciting information from the public and private sectors using mailed and online questionnaires. The questionnaire responses will be supplemented by brief field visits to production facilities along the road system. Data will be compiled in a Microsoft Access database and then categorized by commodity and location. We hope this project will elicit a positive and forthcoming response from the production community, although we may need to observe some restrictions on the release of detailed information to protect data confidentiality requests from some private-sector producers. Similar requests have been successfully satisfied by DGGS in the publication of the annual minerals report; we anticipate no problems in following suit for this project.

The planned products of this project are: a georeferenced database of location, commodity, and production data; a formal physical and/or digital catalog of producers including the above data; if feasible, one or more maps depicting the distribution of production sites (separate or as part of the catalog); and a streamlined system whereby the database and derivative products can be updated annually. We will be using the DGGS Geographic Information System (GIS) to generate many of these products, and all data (barring confidentiality stipulations of cooperating producers) will ultimately be served on the World Wide Web upon completion of the project.



GEOLOGIC GROUND-TRUTH INVENTORY OF THE PETERSVILLE (YENTNA) MINING DISTRICT GEOPHYSICAL SURVEY TRACT

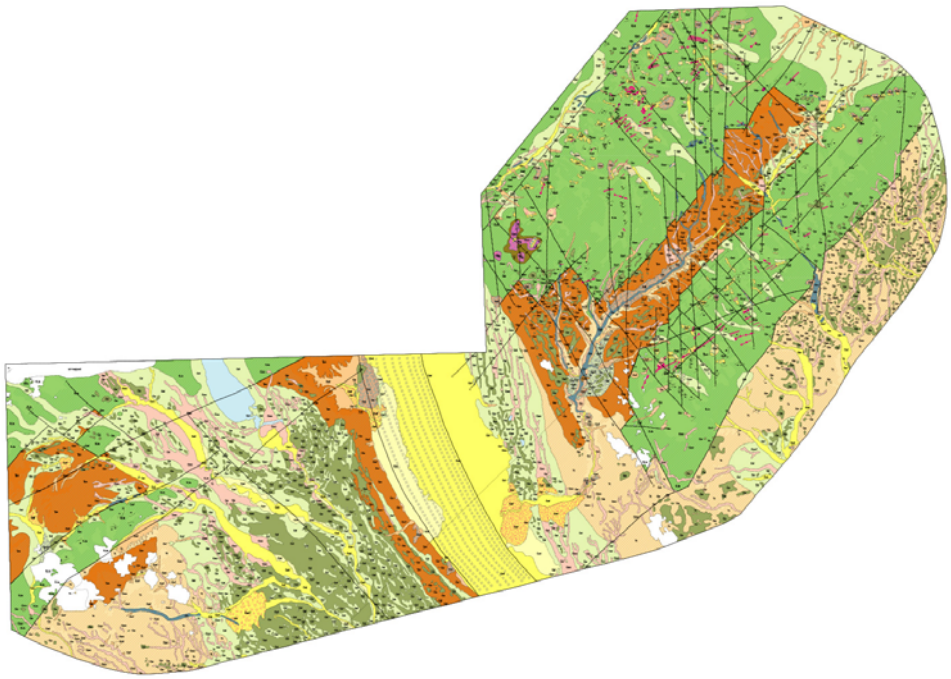
Contact: De Anne S.P. Stevens, Engineering Geology Section, 907-451-5014, deanne@dnr.state.ak.us

DGGS is finishing work on its field-based program to provide ground truth for airborne geophysical surveys flown in the Petersville (Yentna) mining district in 1996. The Petersville district is extensively utilized by a wide spectrum of users, including miners, tourists, snowmachiners, hunters, and fishermen. Legislation signed by former Governor Knowles has established two tracts of land for recreational gold mining by the general public at Petersville, an action that will undoubtedly substantially increase the number of visitors to the area. The proposed Denali Visitors' Center at the Tokositna site in the northeastern part of the district has also made the area the focus of much public interest. In light of the opportunities for development in the Petersville mining district, it is critical that the State have an up-to-date inventory of geologic resources to guide planning activities and identify additional areas of potential interest.

DGGS efforts have focused on determining and understanding the geologic environments of the Petersville mining district, especially with respect to gold mineralization and deposition. The geophysical data were critical to our efforts to extrapolate geologic contacts beneath the cover that dominates the majority of the study area, as well as into areas we were unable to reach on the ground.

To date, the completed products include an interpretive bedrock-geologic map, a surficial-geologic map that was awarded first place in digital cartography at the annual Alaska Surveying and Mapping Conference, a map of glacial ice limits with a discussion of the implications for placer deposits, and maps of sample locations with results of geochemical analyses. All maps are at a scale of 1:63,360. The bedrock and surficial-geologic maps have been digitally combined to generate a comprehensive geologic map of the district (shown below) that will be published in the spring of 2003. We are using the DGGS Geographic Information System (GIS) to generate these maps and will subsequently produce a derivative engineering-geologic map of the district, including prospective construction-materials sites and potential geologic hazards.

All data for the project will ultimately be stored and made available in a geographically referenced relational database. We intend to serve this data on the World Wide Web upon completion of the project.



Comprehensive geologic map of the Petersville mining district, with digitally merged surficial and bedrock geology

LANDSLIDE-INDUCED WAVE HAZARD ASSESSMENT, TIDAL INLET, GLACIER BAY NATIONAL PARK

Contact: Patty Craw, Engineering Geology Section, 907-451-5009, patty_craw@dnr.state.ak.us

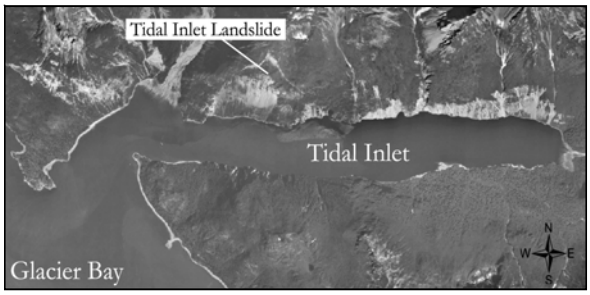
A large detached segment of rock along the northern shore of Tidal Inlet, Glacier Bay National Park, poses a threat similar to the landslide-induced waves that occurred in Lituya Bay, Glacier Bay National Park, when the July 1958 earthquake triggered a rock avalanche that generated a wave. The Lituya Bay wave ran up 524 meters on the slope across from the slide and sent a 30-meter wave through the bay, sinking two of three fishing boats and killing two people.

A landslide-induced wave could pose a significant risk to cruise ships that daily carry several thousand passengers closely past Tidal Inlet during the summer tourist season. In addition, numerous recreational craft in the general area could be at risk. The capability of this landslide to generate a destructive wave depends in large part upon the volume and velocity of the moving mass. The depth of water and topography of the inlet will influence the size and transmittal of waves.

Beginning in 2002, the National Park Service (NPS) supported an investigative field research team headed by the U.S. Geological Survey (USGS) to assess the hazards and risks posed by the Tidal Inlet landslide. Preliminary evaluation of the slide includes installation of high precision GPS monuments and initial GPS measurements to monitor slide movement, geomorphic mapping in the slide vicinity, and collection of dendrochronologic samples.

USGS provided logistical support for the DGGS team member during the 2002 field season. DGGS's contribution to the project to date includes pre-field equipment logistics, field-based GIS support, geologic mapping, and co-authorship of a preliminary report in progress.

Contingent on continued funding, support for DGGS project staff may include travel expenses related to fieldwork and one to two months of salary for up to the next two years.



Tidal Inlet landslide, Glacier Bay National Park, Alaska.

View from Tidal Inlet landslide toward two cruise ships in Glacier Bay. Photo by Gerald Wieczorek, 2002.

Tidal Inlet landslide. Photo by Patty Craw, 2002.

PUBLICATIONS PROJECT

Contact: Paula K. Davis, Geologic Communications Section, 907-451-5053, paula@dnr.state.ak.us

The Publications Team publishes and distributes geologic data collected by staff working in the other sections of DGGS: Minerals Section, Energy Section, and Engineering Geology Section. The Publications Team comprises three members who are involved in many of the division's publication and outreach activities. Some of the functions they perform are:

- Staff DGGS's geologic information counter to provide information and sell geologic products
- Prepare and staff displays at geologic conferences
- Produce an annual report written by the geologic staff that summarizes DGGS activities and communicates plans for its future projects
- Publish three newsletters each year that communicate DGGS progress and advertise the latest releases that are available
- Produce and distribute an annual DGGS calendar.
- Perform design, layout, editing, and final production of printed and digital format technical and educational geologic maps and reports
- Ensure that metadata for each project is complete and sent to the appropriate repository
- Maintain the DGGS library in good order 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 project 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. *Short Notes on Alaska Geology,* a biannual publication that contains short summaries of new research about Alaska's geology, will be published in FY2003.

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).

Future plans include increasing the availability of datasets from which GIS maps are produced, so that customers can manipulate data in any way they choose, and the publishing of 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.

DIGITAL GEOLOGIC DATABASE PROJECT

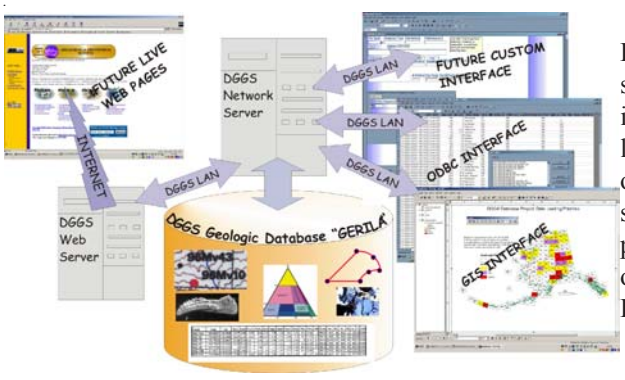
Contact: Larry Freeman, Geologic Communications Section, 907-451-5027, larry_freeman@dnr.state.ak.us

In October 2000, the Division of Geological & Geophysical Surveys (DGGS) began creating a geologic database system that will provide consistent data and information input, organization, and storage architecture. The database system will also provide data identification and retrieval functions that will 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 first objective of the Geologic Database Project is to implement a spatially referenced geologic database system that will maintain a centralized data and information archive. The system will also provide consistent input, organization, and storage infrastructure for new geologic data in a networked environment. The second objective of this project is 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. The user will be able to view and download the data in usable formats to a personal computer.

During the first 2 years, project personnel have identified, gathered, and modeled geologic data for inclusion in the database, and a contractor was hired to design and program the database structure. The basic design and infrastructure of the database system is in place, and project personnel are now loading data into the database and designing forms and interfaces for division and public access to the database.

A spatially referenced geologic database includes geometry and location information about objects in the database. Examples of spatially referenced objects in the DGGS database include a geologic sample location, a fault trace on a geologic map, or a polygon representing the surface extent of Cretaceous granite. Each of these real-world features has a geometry and location; the database relates the geometry to other attributes of the objects. Relationship of object attributes and geometry to geologic concepts allows classification, description, and cartographic expression of the object. Geologic data to be contained in the database include bibliographic information, geologic map features, field observations, sample descriptions and analyses, minerals resource data, information for evaluating geologic hazards, and definitions of terms used to classify objects in the database. Combining spatially referenced features with descriptive and analytic information in a relational database structure will allow members of the community to search more effectively for geologic information specific to their needs.



The database system infrastructure 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. Oracle and ArcSDE data files containing attribute and spatial data, respectively, reside on a data server. DGGS staff access the database using ArcGIS, and other Windows 2000 ODBC (open database connectivity) client applications to retrieve data for use in project-level geologic mapping, analysis, and cartography. This infrastructure allows DGGS to centrally store digital data that are independent of projects, hardware, and software.

Custom applications, data query forms, and data viewing templates are being designed and built using various programming languages to provide staff with interfaces to update and maintain the database and to provide DGGS staff and the public with interfaces to query and retrieve data in familiar formats. The first applications will focus on dataset documentation (metadata), and dataset and publications searches and queries.

Despite the data delivery power of the selected infrastructure, challenges remain in providing public information access. Data security, telecommunications limitations, maintenance costs, personnel training, and other considerations impact the project's success. The solutions to these challenges are being identified and prioritized as DGGS starts to meet the second objective of the Database Project—public Internet delivery of DGGS data and data products.

SCANNING AND DOCUMENT CONVERSION OF USGS BULLETINS AND PROFESSIONAL PAPERS ON ALASKAN GEOLOGY

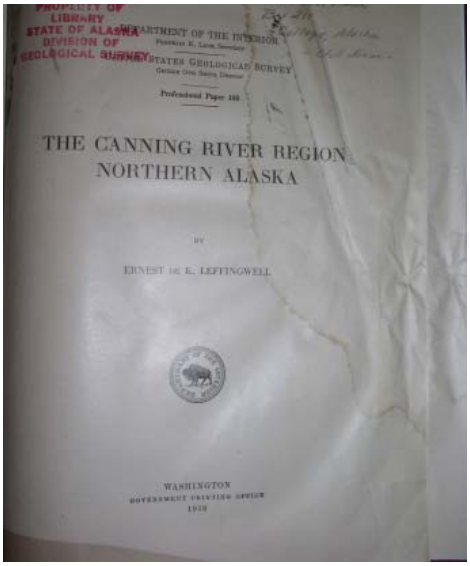
Contact: Simone Montayne, Geologic Communications Section, 907-451-5036, Simone_Montayne@dnr.state.ak.us

Using funding from a U.S. Geological Survey (USGS) grant under the Alaska Minerals Data and Information Rescue in Alaska program (MDIRA), DGGS has converted most of its past publications and maps to electronic files that are available to the public through the DGGS Web site (http://www.dggs.dnr.state.ak.us). The success of this project for both archiving and public accessibility of publications led the MDIRA liaison committee to request a project to make USGS Bulletins and Professional Papers on Alaskan geology accessible in a similar way via the Inter-agency Minerals Coordinating Group Web site (http://imcg.wr.usgs.gov). Except for maps and reports published in the past few years, all of these publications have existed solely on paper. Access to hard-copy publi-cations has been effectively limited to patrons of research libraries.

The USGS Bulletins and Professional Papers include both "text" and oversized sheets such as maps, large data tables, stratigraphic columns, and other large illus-trations. The "text" portions of all available USGS Alaskan publications (pages of text, tables, and illustrations that are 11 inches by 17 inches or less in size) will be scanned and made available in Adobe Acrobat Port-able Document Format (PDF), a file format that can be read on almost all computer platforms using free software downloaded from Adobe Systems, Inc. This body of information comprises approximately 55,000 pages from 1,000 document titles.

More than 1,300 oversized sheets will be made available in a compressed file format accessible from most computer platforms. The compressed format chosen for the maps is MrSID (Multiresolution Seamless Image Database) from Lizardtech. It uses a wavelet compression technique to achieve 20:1 or higher file compression with virtually undetectable image degradation at 1:1 scale. The advantage of this compression is that it will allow users to download high-quality, full-scale images from the Internet. Similar to the Acrobat PDF format, a free viewer is required to read or print the files and to extract the compressed image to an uncompressed raster format (TIFF). A growing number of image processing and GIS software programs are able to read and use the compressed files either as a native format or through free plug-ins. More information about MrSID is available on Lizardtech's Web site at http://www.lizardtech.com.

The addition of USGS Bulletins and Professional Reports to the growing library of Web-accessible information on Alaskan geology will further enhance the prospect for economic development of Alaska's lands.



GIS–IT INFRASTRUCTURE PROJECT

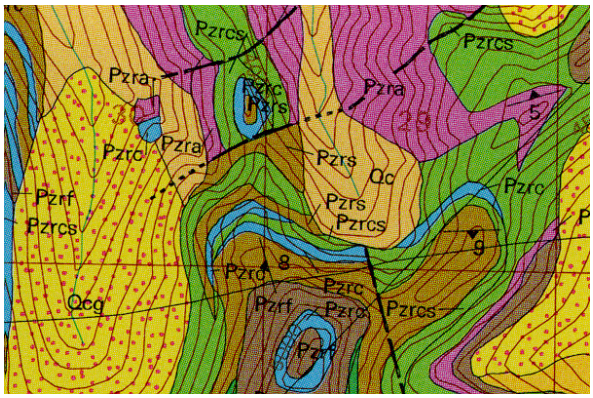
Contact: Gail Davidson, Chief, Geologic Communications Section, 907-451-5006, gail@dnr.state.ak.us

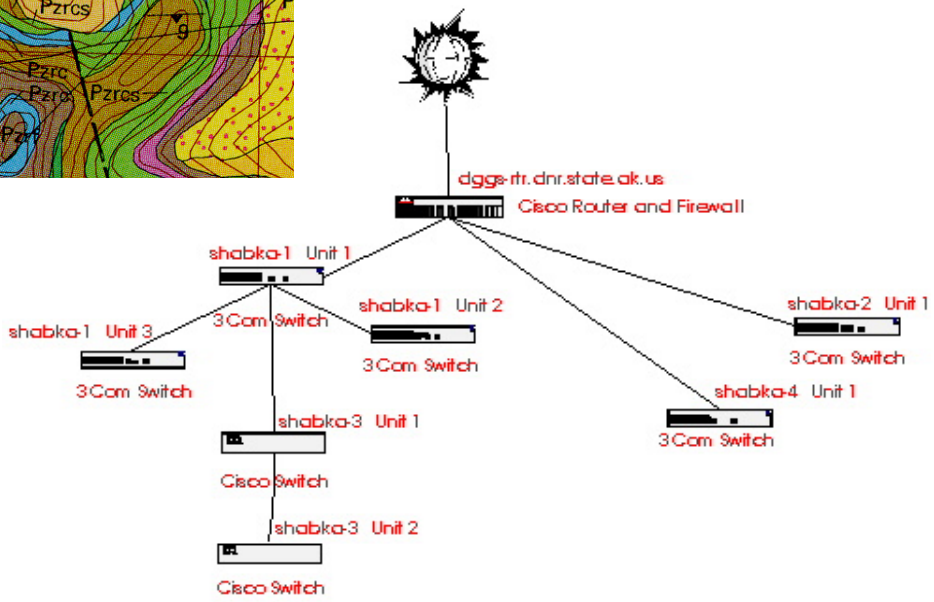
The main focus of the Geographic Information Systems–Information Technology (GIS–IT) team is to provide primary computer and GIS service and support to DGGS staff. The team is made up of a Microcomputer/Network Specialist, a half-time Microcomputer/Network Technician, and a Cartographer.

Each year, DGGS IT staff identify projects that will assist in providing improved computer support to our users. IT service initiatives completed this year include the implementation of an enterprise-wide anti-virus solution and the refinement of IT specifications for an upcoming DGGS building lease agreement that enables DGGS to plan for the future of the network. 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 configuring new hardware and software for the project.

GIS users in the Division have benefited from the GIS staff maintenance, upgrade, and support for ArcInfo licenses. The new 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 on the Chulitna, Big Delta, Sagavanirktok, and Fortymile projects.

While providing DGGS staff with computer, 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 to a particular geologic investigation that is above and beyond the normal scope of support or to improve the stability or efficiency of the support services we provide DGGS. Projects for the coming year include: Implementation of an internal DGGS computer Web page; transferring DGGS IT infrastructure to a new building intact and with as little downtime as possible; installing a new Web server, a new backup device, and a new database server, all in support of the Database Project; implementing an office-wide backup strategy; defining procedures and standards for the process of getting data from Division geologists to the public; and cataloging, quality controlling, and prioritizing GIS data in preparation for entry into the DGGS database.





DGGS WEB PAGE

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

Contact: Gail Davidson, Geologic Communications Section, 907-451-5006, gail@dnr.state.ak.us

During FY02, there were 32,809 visits to the DGGS Web page, a very small increase over last year. Most of these visitors were from industry, with a sizeable portion from educational institutions. The *Generalized Geologic Map of Alaska* remained popular, but the growth of interest in on-line publications was significant, constituting the majority of pages accessed.

Over the last fiscal year, most DGGS publications were made available on the Web site, text as Adobe Acrobat .pdf files, and maps and sheets as LizardTech MrSID (.SID) files. The publications are searchable by series and number, by quadrangle, and by using a site-specific Google Search. Many other files in various formats are available for downloading from the site. In order of popularity, the files downloaded most in 2002 were SR 15, *Geologic Hazards of the Fairbanks Area, Alaska*; LR2, *Analysis of Copper, Lead, and Zinc by Atomic Absorption Spectrophotometry*; the page-sized *Generalized Geologic Map of Alaska*; and IC 44, *Guide to Alaska Geologic and Mineral Information*. Geophysics RFPs have been made available over the Web in the past couple of years; this expedites their dissemination to interested bidders.

Future plans for the site include making newer DGGS publications available through the Web site, then upgrading the site to take advantage of the developing Division-wide database.

Accomplishments—FY02

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 FY02 the Division successfully pursued several funding avenues to finance field teams for geological and geophysical mineral inventory mapping in several areas of the Interior, generating new geologic data for North Slope energy projects, performing rural energy geologic assessments, seismic hazard investigations in the Anchorage and Kodiak areas, and expanded volcano monitoring and hazards studies in the Alaska Peninsula and Aleutian Islands.

In its February 2003 annual report, the Alaska Minerals Commission stressed the importance of baseline geological and geophysical mapping and commended DGGS for its outstanding work on a minimal budget. This mapping helps catalyze mineral exploration and have helped Alaska maintain status quo activity in recent years despite challenging economic conditions. In FY02, DGGS' geological and geophysical mapping of potentially mineral-rich areas of interior Alaska continued with completion of ground-truth geologic mapping of the Fortymile area airborne-geophysical survey tract, initiation of ground-truth geologic mapping in the area of the Pogo geophysical survey, and completion of contract airborne-geophysical surveys in the Broad Pass, Bonnifield, and southeast Pogo areas. New airborne-geophysical surveys were initiated in the Council area of Seward Peninsula (CIP funded) and in the Amphitheater Mountains area near Paxson (Federally funded).

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. The 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 Alaska mineral data rescue efforts through a Federally funded program entitled *Minerals Data and Information Rescue in Alaska (MDIRA)*.

Work on the Alaska mineral data rescue effort has been widely distributed across the private sector as well as through various state and federal agencies. After completing the prototype design and installation of the Oracle-based database early in FY02, DGGS began populating the database and developing application models. Work continues on this third phase of a four-step process to interface DGGS with an Internet-accessible state and federal interagency geologic data delivery system. This state-of-the-art database and Web interface, to be implemented in FY04, will allow the public, as well as agency geologists, to search out and download the majority of all public-sector mineral-related geologic data available for Alaska. These data will include not only published maps and reports but also geochemical data files for rocks, soils, stream sediments, and pan concentrates; airborne geophysical data; land ownership status, mining claim information and plats, and descriptions of mineral occurrences throughout the state.

In FY01, Alaska witnessed a marked increase in interest in North Slope gas and an associated interest in the detailed geology of the Brooks Range North Slope foothills in NPRA. DGGS Energy Section geologists had anticipated this trend with field studies concentrated on Brooks Range North Slope foothills geology. This work continued into FY02 and will be pursued in FY03 and FY04 as well. The outcome of these investigations is a more detailed understanding of the environments in which the oil and gas source and reservoir rocks of the North Slope developed. This information, combined with seismic data, allows petroleum geologists to identify subsurface hydrocarbon reservoirs with greater certainty and success. In spite of the many millions of dollars spent on North Slope oil development each year by the private sector, the publicly available, fundamental framework geologic data generated by DGGS is an important additional contributor to exploration success.

The need to reduce energy costs for rural communities and mining projects prompted DGGS to investigate the potential for shallow gas sources in several promising areas of Alaska. After completing field studies for coalbed methane potential at Wainwright in FY01, DGGS conducted shallow seismic studies of Fort Yukon in FY02. Work is continuing under this federally funded program to assess coalbed methane potential in Chignik as well, with a final evaluation of all three communities to be released in FY03.

The Engineering Geology section initiated the first year of a two-year NASA-funded project to develop advanced remote-sensing technology for ongoing application to challenging engineering-geologic and resource-assessment problems in Alaska. As a result of this effort, a DGGS geologist received one year of graduate training in remote sensing technology and began to apply that knowledge to a placer gold resource-potential evaluation of the Council mining district, where DGGS also completed airborne geophysical surveys. A major goal of the project is to help create local employment opportunities in rural communities by identifying previously unrecognized and untapped placer-mineral deposits.

Through its participation in the Federally funded Alaska Volcano Observatory (with cooperators USGS and University of Alaska Fairbanks-UAF), DGGS expanded its roles in volcano monitoring, hazard evaluation, and information management in FY02. Because of its recognized expertise and efficiencies in helicopter contracting, volcano geochemistry, GIS, database development, and Web-site management, DGGS maintains lead roles in these areas.

DGGS conducted several projects in FY02 to provide the public with information about earthquake and tsunami hazards that will help reduce risks from future events. As part of a Federally funded, multi-year national program to mitigate tsunami hazards, DGGS cooperates with UAF, the state Division of Emergency Services, and coastal communities to develop tsunami-inundation maps for use in identifying evacuation zones and routes. DGGS published the first set of these maps for the Kodiak area in FY02. In cooperation with the UAF Geophysical Institute and with both federal and state funding, DGGS produced draft maps of earthquake site response and soil conditions in the Anchorage area. Finally, with support from USGS, DGGS is developing a GIS database of all available data on active faults statewide and will release a comprehensive catalog and maps of these faults in FY04.

DGGS reached a significant milestone in its distribution of digital georeferenced data and maps when it adopted a policy in FY02 that all publications containing such data be accompanied by metadata that complies with Federal Geographic Data Committee standards. This new policy ensures not only that DGGS maps can be accepted into the National Geologic Map Database, but that all customers receive complete and standardized documentation for georeferenced data published by DGGS. DGGS is at the forefront among state geological surveys and State of Alaska mapping agencies in this endeavor.

Details of DGGS's accomplishments by project appear in the following section.

STATEWIDE MINERAL RESOURCE APPRAISAL

- Completed the third year of a three-year project to acquire ground-truth geologic data of the Fortymile mining district airborne-geophysical survey tract and published the data as an interim geologic map at a scale of 1:63,360. These ground-truth data will provide the geologic control needed to interpret the airborne-geophysical data acquired in FY99. This program also served as the current focus for an ongoing Alaska–Yukon cooperative exchange of geologic and mineral inventory data. This program was supported in part by federal funding.
- Conducted the first year of a three-year geologic ground-truth mineral inventory orientation survey of the Pogo geophysical tract. Released the geochemical data associated with this project. Began the second year of geologic work in the geophysical survey area. This program is supported in part by federal funding.
- Supported by federal funds, compiled mineral deposit data files for four 1:250,000-scale quadrangles that encompass prospective mineral terranes. One of the four quadrangles is completed; two of the others have been reviewed by USGS and will be revised and edited in the fall; the fourth quadrangle has been submitted to USGS for review. The latter three will be completed by DGGS in FY03.
- Prepared and released DGGS's annual report on mineral industry activity in Alaska, *Alaska's Mineral Industry 2001*.
- Acquired and critically reviewed private-sector geologic and geochemical data for the Delta mining area in central Alaska. The map and report are currently undergoing editing and will be released to the public in FY03.

- Conducted airborne geophysical surveys of three prospective mineral tracts: Broad Pass survey, Bonnifield survey, and southeast Pogo survey. Released 55 maps and CD-ROMS containing geophysical data for the three areas.
- Published a second-stage interim geologic map for a portion of the Talkeetna B-5 Quadrangle within the Iron Creek airborne geophysical survey tract.
- Compiled portions of an electronic database of Alaska state agency lithochemical data for access via the Internet. This program concentrates on data that have not been previously published. It is supported by federal funds and was extended through FY03.
- Began compiling an electronic index of all Alaska bedrock and surficial geologic mapping for access via the Internet. This program is supported by federal funds and was extended through FY03.
- Participated in the construction of a DGGS geologic data and information management system that will provide access to minerals-related geological, geophysical, and geochemical data via the Internet. The program is supported by federal funds.
- Initiated an airborne geophysical project to survey Native and state-selected land in the Council area, Seward Peninsula.
- At the request of the federal government, initiated an airborne-geophysical project to survey federal and some State land in the Amphitheater Mountains area in the Mt. Hayes Quadrangle. The project is funded by Federal Receipts.
- Completed and released a paleontologic study of the Amphitheater Mountains in the Mt. Hayes Quadrangle as part of a cooperative project with the Geological Survey of Canada to study ultramafic and mafic rocks that form a discontinuous belt from western Canada to central Alaska. This belt may be of strategic interest in that it hosts platinum-group element minerals.
- Published a full-color aeromagnetic map of t he Yukon Delta area.
- At the request of the federal government, initiated a database project to compile and construct geochemical data for the federal 'Aniak mining district' study. Data will be released to the public. The project is funded by Federal Receipts and will be completed in FY04.
- Provided 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.

STATEWIDE ENERGY RESOURCE ASSESSMENT

- Completed field mapping and published a preliminary 1:63,360-scale geologic map of approximately 600 square miles in the west-central Philip Smith Mountains Quadrangle, *Geologic map of the Dalton Highway (Atigun Gorge to Slope Mountain) area, southern Arctic Foothills, Alaska*. This federally-funded STATEMAP project documents important stratigraphic and structural relationships at the Brooks Range mountain front and in the adjacent northern foothills in proximity to potential Cretaceous reservoir rocks. This mapping also provides stratigraphic control to document the transition from rocks in NPRA to rocks in ANWR and helps correlate rocks in these areas to the Prudhoe Bay oilfield.
- During year four of the NPRA-Brooks Range Foothills project, released a technical report on the petroleum geology of the Brooks Range foothills belt, three posters summarizing the petroleum reservoir potential of sandstones in the Nanushuk Formation and the Tuluvak Formation, and a poster illustrating and discussing the hydrocarbon source rock potential of various rock units in the foothills belt.
- Completed 5 weeks of helicopter-supported field studies of prospective hydrocarbon reservoir rocks in the Brooks Range foothills south of the NPRA. Fieldwork included measuring more than 1,800 meters of Cretaceous sedimentary rocks and 700 meters of Carboniferous carbonate rocks of significance to petroleum exploration and development activities on the North Slope. Fieldwork included 1:63,360-scale geologic mapping of selected areas with petroleum significance in the Chandler Lake Quadrangle.
- Through a cooperative project with the Division of Oil and Gas, conducted a reservoir characterization study on the porosity, permeability, petrography, and facies of the Upper Cretaceous Tuluvak Formation and other Tertiary to Mississippian rocks in the east-central Brooks Range foothills.
- Showed petroleum industry representatives key geologic features of the foothills belt during a two-day tour of the FY02 and FY03 field areas.
- At the request of the federal government, initiated a new cooperative agreement with the U.S. Bureau of Land Management to conduct coalbed methane studies of rural Alaska communities. In cooperation with the U.S. Geological Survey and

the U.S. Bureau of Land Management-Alaska, DGGS continued evaluation of Alaska's remote coal basins for their shallow coalbed gas potential. The project completed field assessments of Wainwright (FY01) and Fort Yukon (shallow seismic program in FY02). Final rural village coalbed methane evaluation will be completed and released in FY03.

- Conducted field examination of shalebed methane prospect at Red Dog Mine and prepared a report, *Significant methane storage capacity in solid bitumen: Implications to gas shale exploration at Red Dog Mine, Alaska* for release in FY03.
- Prepared a final report on the shallow gas potential of the Tertiary Holitna basin for release in August 2002.
- Conducted five days of helicopter-supported fieldwork on Tertiary coal-bearing strata in the southern McGrath Quadrangle to better characterize their petroleum source rock potential for evaluation of the Holitna basin. An addendum to the final report listed above will be released Fall/Winter FY03 summarizing results of this new work.
- In cooperation with the U.S. Geological Survey, DGGS initiated the evaluation of Cretaceous to Tertiary-age coal and associated shale and sandstone strata of the Yukon Flats basin and is providing new scientific data on its coal quality, sedimentary facies, depositional environments, and hydrocarbon reservoir potential. During FY02 DGGS described more than 700 core samples from shallow upland coreholes drilled around the perimeter of the Yukon Flats basin and made preliminary geologic interpretations. Provided overall logistical coordination of reconnaissance geologic fieldwork in FY03 with final report released at end of FY03.
- Implemented a new industry-funded project to evaluate coalbed methane/shallow gas resources of the Delta region with fieldwork commencing in Fall 2002 (FY03).
- In May 2002, DGGS sponsored a gas hydrate short course at the American Association of Petroleum Geologists (AAPG) Pacific Section meeting in Anchorage. This short course was designed to educate Alaskan geologists on the potential and exploration and development issues surrounding gas hydrates.
- Organized and co-chaired a session on Sedimentology and Paleogeography of the Circum-Arctic at the AAPG Regional International Conference in St. Petersburg, Russia. This meeting was attended by petroleum geologists from Alaska, Russia, Norway, Great Britain, and Canada and focused on issues surrounding exploration and development of oil and gas in the Arctic.
- Participated as an advisor on the West Coast Petroleum Technology Transfer Center (PTTC)/U.S Department of Energy Producer Advisory Group (PAG) to assist small independent exploration companies in technology exploration and development of oil, gas, and coalbed methane.
- Represented the Pacific Section of AAPG on an Energy Minerals Division advisory committee. The EMD helps guide the research and discussion of topics such as coal, coalbed methane, nuclear minerals, tar sands, oil shale, geothermal, and remote sensing.
- DGGS staff presented briefings about the status of Alaska's coalbed methane industry, new geologic data, mapping, and stratigraphic interpretations at professional conventions including: North American Coalbed Methane Forum, American Association of Petroleum Geologists annual and Pacific Section meetings, and the annual Alaska Miners Association conference. DGGS also hosted booths at the annual and Pacific Section AAPG meetings.
- Completed development and implementation of a GIS-based sample, geochemical, and borehole database for use in fieldwork and for rapid transfer to DGGS databases for use in analysis, map preparation, and publication.
- Prepared annual summary, *Coal Geology of Alaska*, for the 2002 Keystone Coal Industry Manual.
- Responded to more than 200 requests for technical assistance or information on energy resource issues, sedimentary basin geology, and stratigraphic information throughout Alaska. Approximately one-third of these requests came from the private sector, with the rest from state and federal agencies, academia, and individuals.

STATEWIDE ENGINEERING GEOLOGY

- Published a 1:63,360-scale surficial-geologic map of approximately 600 square miles and accompanying comprehensive text for the west-central Philip Smith Mountains Quadrangle, *Surficial-geologic map of the Dalton Highway (Itkillik–Sagavanirktok River) area, southern Arctic Foothills, Alaska*. This federally-funded STATEMAP project documents depositional relationships and the extent of surficial deposits near the Dalton Highway on the North Slope of Alaska. This publication provides a comprehensive understanding

of northern Alaska glaciation and is integral to creating engineering-geologic maps that identify construction materials needed for maintenance and development of the infrastructure that connects and supports the North Slope oil fields.

- Published *Engineering-geologic map of the Dalton Highway (Galbraith Lake–Slope Mountain), southern Arctic Foothills, Alaska,* as part of a federally-funded STATEMAP project. This map accompanies the general geologic and surficial-geologic maps of the larger surrounding area and will be beneficial for locating construction materials and evaluating engineering constraints for future development in the area as well as providing information useful for the ongoing maintenance of the Dalton Highway.
- Published surficial-geologic and derivative engineering-geologic maps for the Eagle A-1 Quadrangle, an area of approximately 262 square miles, as part of a federally-funded STATEMAP project in the Fortymile mining district. These maps accompany the general geologic map and will be beneficial for locating construction materials and evaluating engineering constraints for future development in the area.
- Published final surficial- and engineering-geologic maps of the Chulitna region, an area of approximately 428 square miles that includes portions of the Healy A-5, A-6, and B-5 quadrangles as well as parts of the Mount McKinley A-1 and Talkeetna Mountains D-6 quadrangles. These maps accompany the general geologic map and will be beneficial for locating construction materials and evaluating engineering constraints for future development in the area.
- Completed a draft *Geologic map of the Big Delta A-4 Quadrangle*. This strategically important area includes the towns of Delta Junction and Big Delta, as well as the intersection of the Alaska and Richardson highways, confluence of the Tanana and Delta rivers, crossing of the TAPS line over the Tanana River, part of Fort Greely, and portions of the proposed routes of the Alaska Railroad extension and Alaska Natural Gas Transportation System. The map has been published as a DGGS Report of Investigations.
- Completed and published an *Engineering-geologic database of the proposed Alaska Natural Gas Transportation System (ANGTS) corridor from Prudhoe Bay to Livengood, Alaska*. The project was funded by special appropriation through a Reimbursible Services Agreement with the State Pipeline Coordinator's Office.
- Published the final GIS-based industrial minerals map, bibliography, and index, *Industrial minerals occurrences in Alaska* (Miscellaneous Publication 43), which was released as a database on CD-ROM as well as a hardcopy map report. DGGS has also compiled an in-house library of all available information sources that are included in the report.
- Completed and released the 2001 version of Information Circular 32, *Directory of Aggregate, Rock, and Soil Producers in Alaska*. This project to compile an annually-updated directory of Alaska construction-materials producers is built upon a relational database that includes location, commodity, and production data. Copies of this free publication were sent to all known Alaska vendors of construction materials, along with an updated questionnaire that will be the basis for the planned 2002 Directory.
- Completed reconnaissance surficial-geologic fieldwork in the Salcha River–Pogo area in support of a STATEMAP project to provide ground-truthing for airborne geophysical surveys in the region. Goals of this reconnaissance survey were to assess the extent of glacial deposits, look for evidence of young faulting, and explain the apparent lack of placer deposits associated with the Pogo mineralized area. DGGS geologists carried out a gravimeter survey consisting of two transects across the Goodpaster River near Pogo to attempt to delineate the bedrock profile of the original valley that is now buried in thick outwash deposits. This may be significant in evaluating the prospects for potential buried placer gold deposits.
- In support of the 2-year NASA-funded project, *Creating Local Employment Opportunities in the Rural Native Communities of Northwest Alaska*, DGGS evaluated the utility of Landsat-7 ETM+ imagery in distinguishing key geomorphic features on a regional scale in the Council mining district by applying remote sensing imagery analysis in conjunction with knowledge of geomorphology, surficial deposits, and bedrock. This project is designed to apply state-of-the-art remote sensing technology and image interpretation techniques to the problem of recognizing and mapping glacial deposits and identifying potential untapped placer reserves in the Council mining district on the Seward Peninsula.
- Provided overall logistical coordination and management for major expansion of Alaska Volcano Observatory (AVO) volcano monitoring capabilities in the eastern Aleutian Islands and on the Alaska Peninsula. Expanded monitoring of active Aleutian volcanoes will ensure accurate and timely

reporting of volcanic activity along this major airline and air cargo route. As a result, air carriers can confidently continue and expand their routes into and over Alaska knowing that they will receive the information they need to avoid damage by airborne volcanic ash. By the end of FY02, twenty-three of Alaska's historically active volcanoes (about half of them) were being monitored, compared to four that were monitored in FY96.

- Co-authored and prepared *Preliminary volcano-hazard assessment for Shishaldin Volcano, Alaska.* This will be published by DGGS in FY03.
- Provided office and field GIS support for Okmok Volcano and Veniaminof Volcano geologic-mapping efforts.
- Continued maintenance and construction of the *public* AVO World Wide Web site. The purpose of these Web pages is to improve public safety by providing access to timely and accurate information for 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. Each month the Web site is accessed about 10,000 times and about 45,000 pages are viewed.
- Continued maintenance and construction of the *internal* AVO World Wide Web pages. These pages display a wide variety of near-real-time seismic and satellite data, most of which is the result of sophisticated, automated, mathematical and computer post-processing. These pages have become instrumental in daily monitoring of volcanoes. Technologically they are at the cutting edge worldwide.
- Continued to oversee and coordinate geochemical data acquisition by all AVO geologists. This effort has, during the lifetime of AVO, resulted in the single largest body of geochemical data on Alaska volcanoes.
- Implemented production and implementation of a comprehensive database of Alaska volcanoes. This database will ultimately drive the AVO Web site and will open the door for the biggest improvement of the site since it was opened 8 years ago. With the new database "back end" we will be able to manage increasing, and changing information such as maps, images, photo indices, references, and volcanic activity.
- Initiated development of an Alaska volcano bibliographic database. When finished this will be fully searchable and updateable and will contain several thousand references. Preliminary release is expected in FY03.
- Began a program to scan and geo-register out-of-print topographic maps of the far western Aleutian Islands. These Army Map Series maps contain the only detailed topographic information for many of these volcanoes. Airphotos that were used decades ago to construct these maps have been lost. These will provide the only mapping bases available until a new program to acquire new imagery and make new maps is initiated. The cost of such a program would be in the million-dollar range.
- Oversaw the production of a series of five papers detailing the 1999 eruption of Shishaldin volcano. These papers appeared in the Bulletin of Volcanology in early FY03. DGGS was the lead author on the summary paper and coauthor on the paper describing geology and petrology.
- Began a new project to convert existing, outdated GIS files of engineering geology maps of statewide transportation corridors into a current file format. These corridors were identified and evaluated in 1990 and 1991 as part of the Department of Natural Resources (DNR) effort to make final recommendations of federal land parcels to be considered for selection by the State of Alaska according to provisions of the Statehood Act. Corridor maps were compiled for a total of 76 quadrangles throughout Alaska, but were never formally released. This project, to be completed in FY03, will allow DGGS to publish the maps and improve the utility of the updated data by combining it with topographic base map information and redesigning the surrounding map layout and content.
- Completed a comprehensive GIS database of existing geologic maps and construction-materials information along the 416-mile-long Dalton Highway to help DOT&PF more easily identify sites that will furnish materials for future highway maintenance and upgrade projects. The project was funded by DOT&PF and was completed in October 2001.
- Represented Alaska on the Western States Seismic Policy Council, which provides a forum for communication between geoscience and emergency management professionals and develops policy recommendations for states and local governments to consider in reducing earthquake risks. These policy recommendations may include public education programs, hazard mapping, zoning regulations, building codes, insurance, or emergency-response planning.
- Assisted in development of the State Hazard Mitigation Plan, being assembled by the Division of

Emergency Services. DGGS provided text and graphics on geologic hazards, and reviewed portions of the draft plan.

- Participated in the advisory committee for the federally funded Advanced National Seismic Network to help guide the emplacement and operation of new seismometers and strong-motion instruments in Alaska. DGGS participation in the advisory committee will continue for the life of the program.
- DGGS geologists attended the biennial meeting of the Canadian Quaternary Association (CANQUA) in Whitehorse, Yukon Territory, Canada, and presented a technical poster, *Late Pleistocene paleoecology of Dalton Gulch, Tofty mining district, central Alaska*. The poster is based on research carried out during the course of a previous STATEMAP project completed in the Tanana A-1 and A-2 quadrangles.
- A DGGS geologist gave a seminar presentation on the Council placer project titled "Applying Remote Sensing Technologies to Landform Analysis: A Pilot Project in Alaska," at the University of Wisconsin–Madison. The presentation was attended by students and faculty of the Institute for Environmental Studies and the Civil Engineering and Geology departments, and served as a forum in which to describe the goals of the project to the academic community with which the DGGS geologist is now working, as well as an opportunity to share ideas that might contribute to the success of the project.
- Participated in the Alaska Emergency Management Conference and presented information on the use of geologic maps in the identification and evaluation of geologic hazards.
- Responded to approximately 360 requests for technical assistance or information on engineering-geology issues and geologic hazards in Alaska. About one-third of these requests came from state agencies. The remainder came from federal agencies, local government, private businesses, academia, and individuals.
- Participated in an interdepartmental working group to consider revisions to the Alaska Coastal Management Program's geophysical hazards regulation (6AAC 80.050). The project was suspended by the Division of Governmental Coordination.

GEOLOGIC MAPS AND REPORTS

- Successfully completed the Federally funded Scanning Project making nearly all DGGS reports viewable and downloadable on the DGGS Web site (www.dggs.dnr.state.ak.us).
- Copied all published reports to CD-ROM for archival purposes and and distributed to multiple locations as backups.
- Integrated pertinent parts of the huge database created from the scanning project with the publications database to allow access to more information on DGGS maps.
- Composed and delivered a PowerPoint presentation and a paper on the DGGS scanning project at the Digital Mapping Techniques 2002 conference in Salt Lake City.
- The DGGS Web site was accessed about 32,000 times for information on Alaska's geology.
- Finalized contract negotiations GeoNorth, the contractor for the Federally funded enterprise database. Contract work began in October 2001 on the initial database design and structure.
- GeoNorth completed the Business Process Model, the basis for the database design. This was followed by the completion of the Conceptual Data Model for geologic map objects, metadata, and publications.
- A DGGS representative met with the National Geologic Map Database Project Technical Advisory Committee to prepare a summary report and recommendations for delivery to the NGMDB director prior to the Geological Society of America meeting in Boston in November 2001. The Technical Advisory Committee then redrafted the summary report at the Digital Mapping Techniques 2002 workshop. The technical report will be drafted into a set of resolutions for the Association of American State Geologists (AASG) to approve at their next meeting. The resolution promotes development, acceptance, and use of digital geologic map content language and data transfer standards, as well as continuing support of the NGMDB project. DGGS is at the forefront among state geological surveys in in this endeavor.
- Drafted a 5-year database project plan, an FY02 project proposal and budget, and a preliminary FY03 project proposal and budget for the Federally funded Minerals Data and Information Rescue in Alaska (MDIRA) program..
- Determined hardware needs for storing and delivering the database, purchased the hardware, and purchased Oracle software
- Participated in devising a work plan with the MDIRA working group for an interagency data sharing system.

- Produced an annual summary delineating progress with previously allocated MDIRA funds.
- Used data from the scanning project and publications databases to assemble information on Alaska geologic maps in the format needed for listing in the National Geologic Map Database. New data will be added as maps are published.
- A Metadata Matrix Committee was created to define DGGS metadata standards. The output of this committee will provide a process model used for the creation of metadata for all Division publications.
- Produced and presented an explanation of metadata and what will be expected for all future DGGS publications at a 'metadata basics' seminar. Interim minimum required metadata guidelines were developed and also presented to the Division, along with a template addressing formatting for metadata.
- Provided a base of IT service necessary for the support of scientific staff. These services included the installation, maintenance, and repair of the DGGS network, servers, office computers, and other network devices used by DGGS. Training and troubleshooting services were also conducted on a continuous basis.
- Initiated the installation and configuration of hardware and software designed for the implementation of the DGGS geologic database.
- Prepared and published three issues of DGGS' newsletter, *Alaska GeoSurvey News* (October, April, June).
- *Distributed* more than 1,000 questionnaires to potential respondents requesting information about Alaska's mineral industry in 2001.
- Reorganized the DGGS library to be more user-friendly and space efficient. Expanded several collections with donations of U.S. Geological Survey publications and the production of new DGGS reports.
- Assisted the public with inquiries, research and information gathering, and publication sales.
- Interacted with the public at various conferences and meetings. DGGS participants provide new information to industries and the general public, gather new contacts, and inform attendees of the types of geological data and information available.
- Staffed a booth with display at the AAPG Conference in Anchorage in May. DGGS employees also put together displays and staffed booths at Alaska Miners Association conventions in Anchorage and in Fairbanks. DGGS geologists helped oorganize and chaired the Exploration 2001 session at the convention.
- Two DGGS geologists received first place awards for mapping projects at the Alaska Conference on Surveying and Mapping in Anchorage.
- A DGGS representative participated in Outdoor Days, an earth science program for 6th graders sponsored by BLM. Working with staff from Ft. Knox, they designed and presented an interactive lesson on drilling and cross-section mapping.
- Several members of the DGGS staff volunteered to visit classrooms in the local public schools throughout the school year. Their visits were very much appreciated and enjoyed by the students and teachers. Staff also assisted with science fair judging for local schools.

PLANNED PROGRAM—FY04

The goals of DGGS are closely aligned with those of the Governor, AS 41.08, and the Department of Natural Resources.

DGGS seeks the following outcomes:

1. Encourage private sector investment in ventures that will develop Alaska's mineral, oil and gas, coal, and construction materials.
2. Help mitigate the adverse effects of naturally occurring geologic hazards on the economy of Alaska and the safety of Alaskans.

DGGS pursues these outcomes through the products and services provided from five major programs. In order to implement these programs, DGGS pools funds from the Division's annual General Fund base-budget, Federal Receipts, Legislatively designated Program Receipts, and Capital Improvement Projects (CIP). Federal Funds and Program Receipts funds are sought only for program activities that are closely aligned with the mission specified in AS 41.08 and the Division's Mission and Measures statement. Likewise, CIP funds address geologic resource problems or goals that DGGS has been specifically asked to pursue. Currently, about 65 percent of Alaska's geological and geophysical program is financed from complimentary non-General Fund sources. Securing the annual complementary funds required to implement the mandates of AS 41.08 and our Mission statement is never assured.

The following tasks within our five major programs constitute the Division's strategy for meeting the goals of the DGGS Mission Statement.

STATEWIDE MINERAL RESOURCE APPRAISAL

- Funded with FY04 CIP receipts, geophysically survey 1000 sq. miles (640,000 acres) of high-potential mineral tracts to provide the geophysical data needed to sustain Alaska's mineral industry investments and create jobs throughout Alaska.
- Funded in part by FY04 annual General Fund base budget and committed airborne geophysical/geological mineral inventory CIP funds, conduct ground-truth geologic mapping and release a geologic map of part of the Livengood C-4 Quadrangle within the Livengood airborne geophysical tract. This map will provide ground-truth geologic data needed to more effectively interpret the geophysical data previously generated for the Livengood mining district. The Geologic Mapping Advisory Board recommended that the Liberty Bell project initially proposed here be replaced by the Livengood geophysical area. Conducting investigations and releasing geologic data about this area will help the mineral industry and policy makers make informed exploration, investment, and policy decisions. A geologic map, sample location map, and tables of analytical data will be produced.
- Funded in part by FY04 annual General Fund base budget and committed airborne geophysical/geological mineral inventory CIP funds, initiate a three year ground-truth geologic mapping and mineral inventory project of the Council airborne geophysical tract. This project will provide ground-truth geologic data needed to more effectively interpret the geophysical data generated in FY03 for the Council mining district. Conducting investigations and releasing geologic data about this area will help the mineral industry and policy makers make informed exploration, investment, and policy decisions, and may help generate new local employment opportunities in this part of rural Alaska.
- Gather, verify, and collate pertinent statistics and summary observations about the status of Alaska's mineral industry during calendar year 2003 to document the industry's annual achievements and encourage others to participate in Alaska's mineral economy. The resulting document, *Alaska's Mineral Industry*, is widely circulated and is recognized as the best source of summary statistical data on the state's mineral industry.
- Publish a geologic map of the Broxson Gulch area near Paxson, as part of a cooperative project with the Geologic Survey of Canada, to better understand and disseminate knowledge about regional metallogeny in a 600-km-long metallogenic terrane that ranges from British Columbia to southcentral Alaska. The terraine is favorable for deposits of platinum-group metals, nickel, copper, and gold. Synthesizing and releasing the data to the public at large will foster a better understanding of the geo-

logic framework of southcentral Alaska and encourage mineral development investments in the region.

- Complete the data release and archiving of the federally funded Sleetmute airborne geophysical survey. The data will be published by DGGS in conjunction with the U.S. Bureau of Land Management (BLM).
- Complete a two-year federally funded project, initiated in FY03, to compile a georeferenced database of geochemical data for the Aniak mining region in southwestern Alaska. Previously unpublished chemical analyses of bedrock samples and geochemical data from stream sediment samples generated by federal agencies, some Alaska Native corporations, and some private-sector corporations will be included with existing DGGS, U.S. Geological Survey (USGS), and U.S. Bureau of Land Management (BLM) data. The data will be published by BLM in conjunction with DGGS.
- Provide authoritative public 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. These presentations are an effective means of bringing the favorable mineral development potential of Alaska to the attention of corporate exploration managers and others who make mineral industry investment decisions.
- DGGS Mineral Appraisal Project geologists will provide timely responses to verbal and written requests for information from other State agencies, local government, and the general public.

STATEWIDE ENERGY RESOURCE ASSESSMENT

- Utilizing federal funding, conduct geologic oil and gas investigations and publish data including a preliminary geologic map of portions of the Chandler Lake B-2 and C-2 quadrangles. This project is a continuation of prior studies conducted by DGGS, USGS, and UAF as part of an overall long-range evaluation of the hydrocarbon resources of the North Slope. This work will help delineate exploration targets in foothills subsurface exploration plays in areas adjacent to the tract of surface investigations.
- Complete year five of a five-year statutory designated program receipts funded project to determine the stratigraphy and hydrocarbon reservoir potential of Cretaceous-age sandstones exposed along 120 miles of the northern Brooks Range foothills and Colville River. The Brooks Range foothills may contain as much as 30 trillion cubic feet of natural gas stored in stratigraphically and structurally complex reservoirs. This work seeks new data to provide a detailed surface and subsurface stratigraphic framework of the rocks that may contain this gas, identify sand-rich stratigraphic intervals with significant reservoir potential, and generate reservoir geometry and quality information.
- Funded by a previous CIP appropriation, complete evaluation of potential hydrocarbon source rocks in Tertiary (66.4–1.6-million-year-old) rocks in the southern McGrath Quadrangle by collecting additional samples for hydrocarbon content analyses. These rocks include thick coal and organic-rich mudstones that serve as surface outcrop analogs for the subsurface stratigraphy of the Holitna basin in the northern Sleetmute Quadrangle. The Holitna basin is being assessed for shallow gas resources that, if present, might be used in nearby communities and the Donlin Creek mine prospect.
- Complete year two of a five-year federally funded program to evaluate the coalbed methane resources of Alaska in collaboration with Federal agencies. This work will involve redrilling a climate test hole originally drilled in 1994 at Fort Yukon and collecting new core samples for canister desorption to determine gas content. If funded, water quality will be evaluated and flow rates will be tested. Previous CIP-supported work at Fort Yukon has indicated that multiple thick coal seams underlie the entire community at depths between 1800 and 2500 feet below the surface.
- Develop coring capability for lightweight coiled-tubing microborehole drilling technology, under a pending federally funded project. This project is the first year of a three-year collaborative project with Los Alamos National Laboratory to test coalbed methane potential and gas producibility for use at three high-priority rural Alaska sites as well as geothermal resources.
- Funded by a Federal contract, acquire new geochemical data for coal for the Angoon and Admiralty coal districts in southeast Alaska in order to classify the resource quality of that coal and support possible future coal and coalbed methane prospecting and leasing in Alaska
- Conduct the second year of a two-year, federally funded basin-wide energy resource assessment of the potential of the Yukon Flats to contribute oil, conventional gas, and coalbed methane to domestic

United States commercial markets through existing and proposed pipelines.

- Initiate the first year of a five-year federally funded program to evaluate the methane hydrate resources of the North Slope. This effort will assess the recoverable resources and potential production characteristics of onshore natural gas hydrate and associated free-gas accumulations on the in the Prudhoe Bay to Kuparuk River locales. Over the course of the five-year project DGGS in collaboration with Federal agencies, will identify and map the distribution of gas-hydrate/free-gas accumulations; characterize their reservoir properties; develop reservoir models from available production data; develop detailed engineering design of proposed gas-hydrate production test well; and prepare initial draft of full-field development plan.
- Complete year two of a Delta Area coalbed methane project to identify stratigraphic targets, potential fracture networks, evaluate fluid flow regime, and model coalbed gas generation-to-production pathways in the middle Tanana Basin. This project will conduct helicopter-based field sampling and geologic mapping from the Wood River coal field west to the Jarvis Creek coal field in a basin under active exploration by industry. The project is funded under statutory designated program receipts and general fund.
- Provide written evaluations of mineable coal potential for lease areas in response to requests from Division of Mining, Land and Water.
- Respond to verbal requests from other State agencies, federal agencies, industry, local government, and the public for information on energy-related geologic framework and oil, gas, and coal resource data (estimated 95 responses).

STATEWIDE ENGINEERING GEOLOGY/CONSTRUCTION MATERIALS

- Utilizing partial Federal funding and in cooperation with the University of Alaska Geophysical Institute, Division of Emergency Services, and coastal communities, publish tsunami-inundation maps for Seward.
- Utilizing partial Federal funding through a cooperative project with the University of Durham, participate in a study of sedimentologic evidence of great earthquakes in the Anchorage region as a basis for identifying possible methods for forecasting similar future events.
- Funded by a Federal grant, implement the second and third phases of a three-year project to apply remote sensing technology to an investigation of the Council mining district. The objective of this investigation is to identify prospective areas that may host previously overlooked placer gold resources, and share the geologic knowledge generated with local rural residents through educational workshops.
- In cooperation with the Department of Community and Economic Development, update and publish the digital, database-supported directory of current construction-materials producers in Alaska. The purpose of this project is to provide contact and product information to prospective users of construction-materials, and to document and track the distribu-tion and production rates of developed deposits in order to help predict future trends in demand and out-put.
- Publish a combined surficial- and bedrock-geologic map of the Petersville (Yentna) mining district. The goal of this map is to provide a geologic framework for future planning and development in the region.
- Using existing data, digitally generate a 1:63,360-scale geologic map of the Fairbanks area on an orthophoto base and drape it over a high-resolution DEM derived from recently acquired AirSAR data. The objective of this project is to present existing geologic data on a user-friendly photographic base and in 3-D view that will facilitate ease of interpretation by planners and land-use analysts.
- Publish a geologic map of Shishaldin Volcano utilizing federal grant funding.
- Incorporate review comments and publish the geologic hazards report on Shishaldin Volcano.
- Participate in the third year of geologic mapping and hazards evaluation of Mt. Veniaminof volcano under a federally funded grant.
- Participate in federally funded geologic mapping and hazards evaluation of Okmok Volcano, taking prime responsibility for mapping the caldera walls and associated precaldera bedrock that will be completed in FY05.
- Maintain GIS databases of map units, samples, and sample data and provide derivative cartographic products for both Veniaminof and Okmok projects utilizing a federal grant.
- Maintain and enhance the Alaska Volcano Observatory (AVO) Web site. With as many as 500 visitors

per day, the AVO Web site is one of our most important information dissemination activities. This is a federally funded grant program.
- In conjunction with UAF/GI librarians, produce a new, complete, and authoritative searchable reference database for Alaska volcanoes.
- Provide final oversight, coordination, and helicopter contracting for multi-team fieldwork to conduct geologic-hazards studies and seismic monitoring of active volcanoes in the Cook Inlet, Alaska Peninsula, and Aleutian Islands regions.
- Participate in volcano eruption response and hazard mitigation as needed to provide timely and accurate warnings and eruption information to emergency-response agencies and air-traffic controllers.
- Contingent on continued Federal funding, continue a program of finding, collecting, scanning, and georeferencing out-of-print detailed topographic maps of those volcanoes for which maps at 1:63,360 or larger scale do not exist. These maps are required as base maps for geological field work and are not forthcoming from the U.S. Geological Survey's topographic mapping program.
- 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).
- As part of the Alaska Coastal Management Program, review Coastal Policy Questionnaires and consistency applications to ensure compliance with the state's geophysical hazards standard (6 AAC 80.050) (estimated 200 reviews, of which approximately 30 will require formal response).
- Conduct post-event hazard evaluations in response to unexpected major geologic events (for example, 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 MATERIALS CENTER

- In accordance with a framework of multiple interagency cooperative agreements, maintain the state's interagency archive of geologic materials (voucher samples of rocks, oil and gas well processed samples, core, rock, thin-sections, ore samples, and hard-rock mineral core) acquired from private companies and State and Federal agencies.
- Systematically record and archive new geologic material pertinent to Alaska's energy and mineral resource development as they are submitted to the Geologic Materials Center.
- Utilizing federal funds, update the GMC sample database on the World Wide Web so that the catalog of the Center's holdings is accessible to mineral and energy explorationists and other interested parties via the Internet.
- With Federal funding, catalog all historical U.S. Bureau of Mines statewide mineral samples stored at the interagency Geologic Materials Center.

GEOLOGIC MAPS AND REPORTS

- Maintain the internal DGGS information management micro-computer network infrastructure to accomplish the work of DGGS.
- Assemble and edit the technical and educational maps and reports of DGGS in both conventional and digital format. These publications record and preserve geologic data such as: definitive statistics for Alaska's mineral industry; geophysical data for areas with promising mineralization, bedrock, surficial, and engineering geology for specific areas in the state; sources of Alaska's geologic information; a record of DGGS programs and accomplishments each year; and educational brochures and pamphlets explaining Alaska's geology or natural-science features.
- Assemble, edit, and publish the *Annual Mineral Industry* report. This report preserves the definitive statistics for Alaska's mineral industry.
- Systematically organized DGGS geologic information will be maintained for access via the DGGS Web site where it will continue to be used by the mineral industry, policy makers, other government agencies, and the general public. New DGGS data, maps, and reports will be added as they are completed. The

World Wide Web (Internet) has become one of the most important avenues for dissemination of information about Alaskan geologic resources.

- Using Federal Receipts, DGGS will complete the construction of the Division's component of the publicly accessible State-Federal interagency Alaska digital geologic database management system so that DGGS and all Alaskans can continue to reduce their cycle time for responding to geologic resource and engineering geology queries and gain access to more comprehensive Alaska geologic data.
- Using Federal Receipts, complete the loading of DGGS archival geologic information into the Division's component of the Alaska interagency geologic database, complete metadata (tracking-files) for existing geographically referenced data, and collaborate on the construction of an interagency Web site for comprehensive Alaska geologic data.
- Provide display materials, knowledgeable staff, data, and summary reports at trade shows, scientific conferences, and other venues in which dissemination of geologic information about Alaska is of strategic value to the state.

PUBLICATIONS RELEASED IN FY02 AND TO DATE IN FY03

Geophysical Reports

GPR 2002_1. Plot files of the airborne geophysical survey data of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 CD-ROM. Contains the 13 maps listed below as GPR2002_1_xy in prn printer file format made with an HP Designjet 2500 HPGL/2 printer driver v4.61. Check for printer compatibility. $10.

GPR 2002_1_1a. Total magnetic field of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_1_1b. Total magnetic field of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Magnetic contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_1_1c. Color shadow magnetic map of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_1_1d. Total magnetic field and electromagnetic anomalies of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Magnetic contours, simplified electromagnetic anomalies, and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_1_2a. Total magnetic field and detailed electromagnetic anomalies of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:31,680 (parts of northern Big Delta B-1 and B-2 quadrangles). Magnetic contours, detailed electro-magnetic anomalies, and topography included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_1_2b. Total magnetic field and detailed electromagnetic anomalies of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:31,680 (parts of southern Big Delta B-1 and B-2 quadrangles). Magnetic contours, detailed electro-magnetic anomalies, and topography included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_1_3a. 7200 Hz coplanar resistivity of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_1_3b. 7200 Hz coplanar resistivity of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_1_3c. 7200 Hz coplanar resistivity of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns,

2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_1_4a. 900 Hz coplanar resistivity of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_1_4b. 900 Hz coplanar resistivity of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_1_4c. 900 Hz coplanar resistivity of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_1_5a. Flight lines of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Blueline. $3.

GPR 2002_2. Line, gridded, and vector data of airborne geophysical survey data for the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 2 CD-ROM set. Line data in ASCII format; gridded data in Geosoft format; vector files in Autocad 14 dxf files. $40.

GPR 2002_3. Gridded and vector data of airborne geophysical survey data for the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 CD-ROM. Gridded data in Geosoft format; vector files in Autocad 14 dxf files. $20.

GPR 2002_4. Project report of the airborne geophysical survey of the Salcha-River–Pogo mining area, central Alaska, by Ruth Pritchard, Fugro Airborne Surveys, 2002, text and interpretation map, 80 p., 1 sheet, scale 1:63,360. $21.

GPR 2002_5. Portfolio of aeromagnetic and resistivity maps of the southeastern extension of Salcha River–Pogo survey, Goodpaster mining district, east-central Alaska, by L.E. Burns, 2002, 17 p. Includes color and shadow maps. Maps fit 8½" x 11" sheet. $15.

GPR 2002_6. Plot files of the airborne geophysical survey data of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 CD-ROM. Contains the 13 maps listed below as GPR2002_6_xy in prn printer file format made with an HP Designjet 2500 HPGL/2 printer driver v4.61. Check for printer compatibility. $10.

GPR 2002_6_1a. Total magnetic field of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_6_1b. Total magnetic field of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Magnetic contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_6_1c. Color shadow magnetic map of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_6_1d. Total magnetic field and electromagnetic anomalies of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens

Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Magnetic contours, simplified electromagnetic anomalies, and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_6_2a. Total magnetic field and detailed electromagnetic anomalies of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1sheet, scale 1:31,680 (part of northern Fairbanks A-4 quadrangle). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_6_2b. Total magnetic field and detailed electromagnetic anomalies of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:31,680 (parts of southern Fairbanks A-4 and A-5 quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_6_3a. 7200 Hz coplanar resistivity of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_6_3b. 7200 Hz coplanar resistivity of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_6_3c. 7200 Hz coplanar resistivity of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_6_4a. 900 Hz coplanar resistivity of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_6_4b. 900 Hz coplanar resistivity of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_6_4c. 900 Hz coplanar resistivity of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_6_5a. Flight lines of the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Blueline. $4.

GPR 2002_7. Line, grid, and vector data of airborne geophysical survey data for the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 CD-ROM. Line data in ASCII format; gridded data in Geosoft format; vector files in Autocad 14 dxf files. $40.

GPR 2002_8. Grid and vector data of airborne geophysical survey data for the Liberty Bell area, western Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 CD-ROM. Gridded data in Geosoft format; vector files in Autocad 14 dxf files. $20.

GPR 2002_9. Project report of the airborne geophysical survey for the Liberty Bell area, western Bonnifield mining district, central Alaska, by Ruth Pritchard, 2002, text and interpretation map, 172 p., 1 sheet, scale 1:63,360. $.30.00

GPR 2002_10. Portfolio of aeromagnetic and resistivity maps of the Liberty Bell area, western

Bonnifield mining district, central Alaska, by L.E. Burns, 2002, 14 p. Includes color and shadow maps. Maps fit 8½" x 11" sheet. $15.

GPR 2002_11. Plot files of the airborne geophysical survey data of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 CD-ROM. Contains the 14 maps listed below as GPR2002_11_xy in prn printer file format made with an HP Designjet 2500 HPGL/2 printer driver v4.61. Check for printer compatibility. $10.

GPR 2002_11_1a. Total magnetic field of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_11_1b. Total magnetic field of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Magnetic contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_11_1c. Color shadow magnetic map of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_11_1d. Total magnetic field and electromagnetic anomalies of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Magnetic contours, simplified electromagnetic anomalies, and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_11_2a. Total magnetic field and detailed electromagnetic anomalies of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:31,680 (parts of Healy B-3, B-4, C-3 and C-4 quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_11_2b. Total magnetic field and detailed electromagnetic anomalies of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:31,680 (parts of Healy B-4 and B-5 quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_11_2c. Total magnetic field and detailed electromagnetic anomalies of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:31,680 (parts of Healy B-3, B-4, and D-3 quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_11_3a. 7200 Hz coplanar resistivity of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_11_3b. 7200 Hz coplanar resistivity of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_11_3c. 7200 Hz coplanar resistivity of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_11_4a. 900 Hz coplanar resistivity of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of

Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Full-color plot from electronic file, 600 dpi. $13.

GPR 2002_11_4b. 900 Hz coplanar resistivity of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Full-color plot from electronic file, 600 dpi. $8.

GPR 2002_11_4c. 900 Hz coplanar resistivity of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Resistivity contours and section lines included. Black and white plot from electronic file, 600 dpi. $8.

GPR 2002_11_5a. Flight lines of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 sheet, scale 1:63,360. Topography included. Blueline. $4.

GPR 2002_12. Line, grid, and vector data of the airborne geophysical survey data for the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 2 CD-ROM set. Line data in ASCII format; gridded data in Geosoft format; vector files in Autocad 14 dxf files. $40.

GPR 2002_13. Grid and vector data of the airborne geophysical survey data for the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, Stevens Exploration Management Corp., and L.E. Burns, 2002, 1 CD-ROM. Gridded data in Geosoft format; vector files in Autocad 14 dxf files. $20.

GPR 2002_14. Project report of the airborne geophysical survey of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by Ruth Pritchard, 2002, text and interpretation map, 203 p., 1 sheet, scale 1:63,360. $33.

GPR 2002_15. Portfolio of aeromagnetic and resistivity maps of the Broad Pass area, southwestern Bonnifield mining district, central Alaska, by L.E. Burns, 2002, 16p. Includes color and shadow maps. Maps fit 8½" x 11" sheet. $15.

GPR 2002_16. Total field magnetics of the lower Yukon Delta, Alaska, by L.E. Burns, 2002, 1 sheet, scale 1:250,000. $13.

GPR 2003_1. Plot files of the airborne geophysical survey data of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., **1 CD-ROM**. Contains the **18 maps** listed below (GPR2003_1_1a through GPR 2003_1_6a) in both HPGL/2 format and postscript printer format. $10.

GPR 2003_1_1a. Total magnetic field of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2003_1_1b. Total magnetic field of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Magnetic contours and section lines included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2003_1_1c. Color shadow magnetic map of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2003_1_1d. Total magnetic field and electromagnetic anomalies of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Magnetic contours, simplified electromagnetic anomalies, and section lines included**. **Black and white plot** from electronic file, 600 dpi. $8.

GPR 2003_1_2a. Total magnetic field and detailed electromagnetic anomalies of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 1 sheet**, scale 1:31,680 (parts**

of Bendeleben A-4 and A-5 and Solomon D-4 and D-5 Quadrangles). **Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot** from electronic file, 600 dpi. $4.

GPR 2003_1_2b. Total magnetic field and detailed electromagnetic anomalies of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 1 sheet, **scale 1:31,680 (parts of Solomon D-5 Quadrangle). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot** from electronic file, 600 dpi. $3.

GPR 2003_1_2c. Total magnetic field and detailed electromagnetic anomalies of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 1 sheet, **scale 1:31,680 (included. Black and white plot** from electronic file, 600 dpi. $4.

GPR 2003_1_3a. 7200 Hz coplanar resistivity of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2003_1_3b. 7200 Hz coplanar resistivity of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi. $26.

GPR 2003_1_3c. 7200 Hz coplanar resistivity of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Resistivity parts of Solomon D-4 and D-5 Quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot** from electronic file, 600 dpi. $4.

GPR 2003_1_2d. Total magnetic field and detailed electromagnetic anomalies of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 1 sheet, **scale 1:31,**680 (parts of Solomon C-5 and D-5 Quadrangles). **Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot** from electronic file, 600 dpi. $4.

GPR 2003_1_2e. Total magnetic field and detailed electromagnetic anomalies of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 1 sheet, **scale 1:31,680 (parts of Solomon C-4, C-5, D-4 and D-5 Quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography included. Black and white plot** from electronic file, 600 dpi. $4.

GPR 2003_1_2f. Total magnetic field and detailed electromagnetic anomalies of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 1 sheet, **scale 1:31,680 (parts of parts of Solomon C-4 and C-5 Quadrangles). Magnetic contours, detailed electromagnetic anomalies, and topography contours and section lines included. Black and white plot** from electronic file, 600 dpi. $8.

GPR 2003_1_4a. 900 Hz coplanar resistivity of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Topography included. Full-color plot** from electronic file, 600 dpi. $26.

GPR 2003_1_4b. 900 Hz coplanar resistivity of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Resistivity contours and section lines included**. **Full-color plot** from electronic file, 600 dpi. $26.

GPR 2003_1_4c. 900 Hz coplanar resistivity of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Resistivity contours and section lines included. Black and white plot** from electronic file, 600 dpi. $8.

GPR 2003_1_5a. Flight lines of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska

Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Topography included. Black and white plot from electronic file, 600 dpi.** $8.

GPR2003_1_6a. Digital elevation model of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., 2 sheets, **scale 1:63,360. Elevation contours and section lines included.** Produced from survey altimetry. **Full-color plot** from electronic file, 600 dpi.

GPR 2003_2. Line, gridded, and vector data of airborne geophysical survey data for the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp., **2 CD-ROM set. Line data in ASCII format; gridded data in Geosoft format; vector files in Autocad 14 dxf files.** $20.

GPR 2003_3. Project report of the airborne geophysical survey of the Salcha-River–Pogo mining area, central Alaska, by Ruth Pritchard, Fugro Airborne Surveys, **text and interpretation map, scale 1:63,360.** To be determined

GPR 2003_4. Portfolio of aeromagnetic and resistivity maps of the Council area, Seward Peninsula, Alaska, by L.E. Burns, Alaska Division of Geological & Geophysical Surveys, Fugro Airborne Surveys, and Stevens Exploration Management Corp. **Includes color and shadow maps. Maps fit 8½" x 11" sheet.** $6.

Information Circulars

IC 32. **Directory of aggregate, rock, and soil producers in Alaska,** by D.S. Pinney and E.S. Duenwald.

IC 48. Alaska's mineral industry 2001: a summary, by R.C. Swainbank and D.J. Szumigala, 2002, 15 p. Free.

Miscellaneous Publications

MP 44. Preliminary bibliographic database of Quaternary faults and folds in Alaska, by P.A. Craw, J.L. Mayer, and R.A. Combellick.

MP 125. Engineering-geologic database of the proposed Alaska Natural Gas Transportation System (ANGTS) corridor from Prudhoe Bay to Delta Junction, Alaska, by C.E. Cameron, E.E. Thoms, and C.A. Galló, 2002, 6 CD-ROMS. $60.

MP 123. Historically active volcanoes of the Aleutian Arc, by J.R. Schaefer and C.J. Nye.

MP 124. Preliminary engineering-geologic database of the proposed Alaska Natural Gas Transportation System (ANGTS) corridor from Prudhoe Bay to Livengood, Alaska, by C.E. Cameron, E.E. Thoms, and C.A. Galló.

MP 126. 400 MHz ground-penetrating radar, Itkillik River, North Slope, Alaska, by P.R. Peapples, A.J. Delaney, D.L. LePain, 2002, 1 sheet. $13.00

Preliminary Interpretive Reports

PIR 2002-1a. Geologic map of the Eagle A-1 Quadrangle, Fortymile mining district, by D.J. Szumigala, R.J. Newberry, M.B. Werdon, J.E. Athey, D.S.P. Stevens, R.L. Flynn, K.H. Clautice, and P.A. Craw, 2002, 1 sheet, scale 1:63,360. $13.

PIR 2002-1b. Bedrock geologic map of the Eagle A-1 Quadrangle, Fortymile mining district, by D.J. Szumigala, R.J. Newberry, M.B. Werdon, J.E. Athey, R.L. Flynn, and K.H. Clautice, 2002, 1 sheet, scale 1:63,360. $13.

PIR 2002-2. Geologic map of the Dalton Highway (Atigun Gorge to Slope Mountain) area, southern Arctic Foothills, Alaska, by E.E. Harris, C.G. Mull, R.R. Reifenstuhl, and Simone Montayne, 2002, 1 sheet, scale 1:63,360. $13.

PIR 2002-4. Geologic map of the Iron Creek area, Talkeetna Mountains B-5 Quadrangle, Alaska, by M.B. Werdon, J.R. Riehle, J.M. Schmidt, R.J. Newberry, and G.H. Pessel, 2002, 1 sheet, scale 1:63,360. $13.

PIR 2002-5. Sedimentology and hydrocarbon source rock potential of Miocene-Oligocene strata, McGrath Quadrangle: An outcrop analog for the Holitna Basin, by D.L. LePain, R. Blodgett, and J.G. Clough, 2003, 76 p. $8.

Raw-Data Files

RDF 1999-2. Chulitna district paleomagnetic study, by David Stone, Howard Scher, and Chad Schopp.

RDF 2002-1. Major oxide, minor oxide, trace element, rare-earth element, trace geochemical, and coal quality data from rocks collected in Eagle and Tanacross quadrangles, Alaska in 1999, 2000, and 2001, by D.J. Szumigala, M.B. Werdon, R.J. Newberry, J.E. Athey, K.H. Clautice, R.L. Flynn, J.C.

Grady, W.C. Munly, and M.R. Johnson, 2002, 35 p., 1 sheet, scale 1:63,360. $17.

RDF 2002-2. High pressure methane absorption isotherms, petrography and vitrinite reflectance analyses, by R.M. Bustin, 2002, 133 p. $13.

RDF 2002-3. Major oxide, minor oxide, trace element, and geochemical data from rocks collected in the Big Delta Quadrangle, Alaska, in 2001, by J.E. Athey, M.B. Werdon, D.J. Szumigala, R.J. Newberry, and M.R. Johnson, 20 p., 2 sheets, scale 1:150,000. $15.

Reports of Investigations

RI 2001-1A. Bedrock geologic map of the Chulitna region, southcentral Alaska, by K.H. Clautice, R.J. Newberry, R.B. Blodgett, T.K. Bundtzen, B.G. Gage, E.E. Harris, S.A. Liss, M.L. Miller, R.R. Reifenstuhl, J.G. Clough, and D.S. Pinney. 31 p., 1 sheet, scale 1:63,360. $16.

RI 2001-1B. Geologic map of the Chulitna region, southcentral Alaska, by K.H. Clautice, R.J. Newberry, D.S. Pinney, R.B. Blodgett, T.K. Bundtzen, B.G. Gage, E.E. Harris, S.A. Liss, M.L. Miller, R.R. Reifenstuhl, and J.G. Clough. 32 p., 1 sheet, scale 1:63,360. $16.

RI 2002-1. Tsunami hazard maps of the Kodiak area, Alaska, by E.N. Suleimani, R.A. Hansen, R.A. Combellick, G.A. Carver, R.A. Kamphaus, J.C. Newman, and A.J. Venturato, 2002, 16 p., 4 sheets, scale 1:12,500. $54. Text and maps may be sold separately. Maps are $13 each; text is $2.

RI 2002-2. Geologic map of the Big Delta A-4 Quadrangle, Alaska, by R.D. Reger and T.L. Péwé, 2003, 1 sheet, scale 1:63,360. $13.

RI 2002-3. Paleontological inventory of the Amphitheater Mountains, Mt. Hayes A-4 and A-5 quadrangles, southcentral Alaska, by R.B. Blodgett, 2002, 11 p. $2.

Special Reports

SR 55. Alaska's mineral industry 2000, by D.J. Szumigala, R.C. Swainbank, M.W. Henning, and F.M. Pillifant, 66 p. Free.

SR 56. Alaska's mineral industry 2001, by R.C. Swainbank, D.J. Szumigala, M.W. Henning, and F.M. Pillifant, 2002, 65 p. Free.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