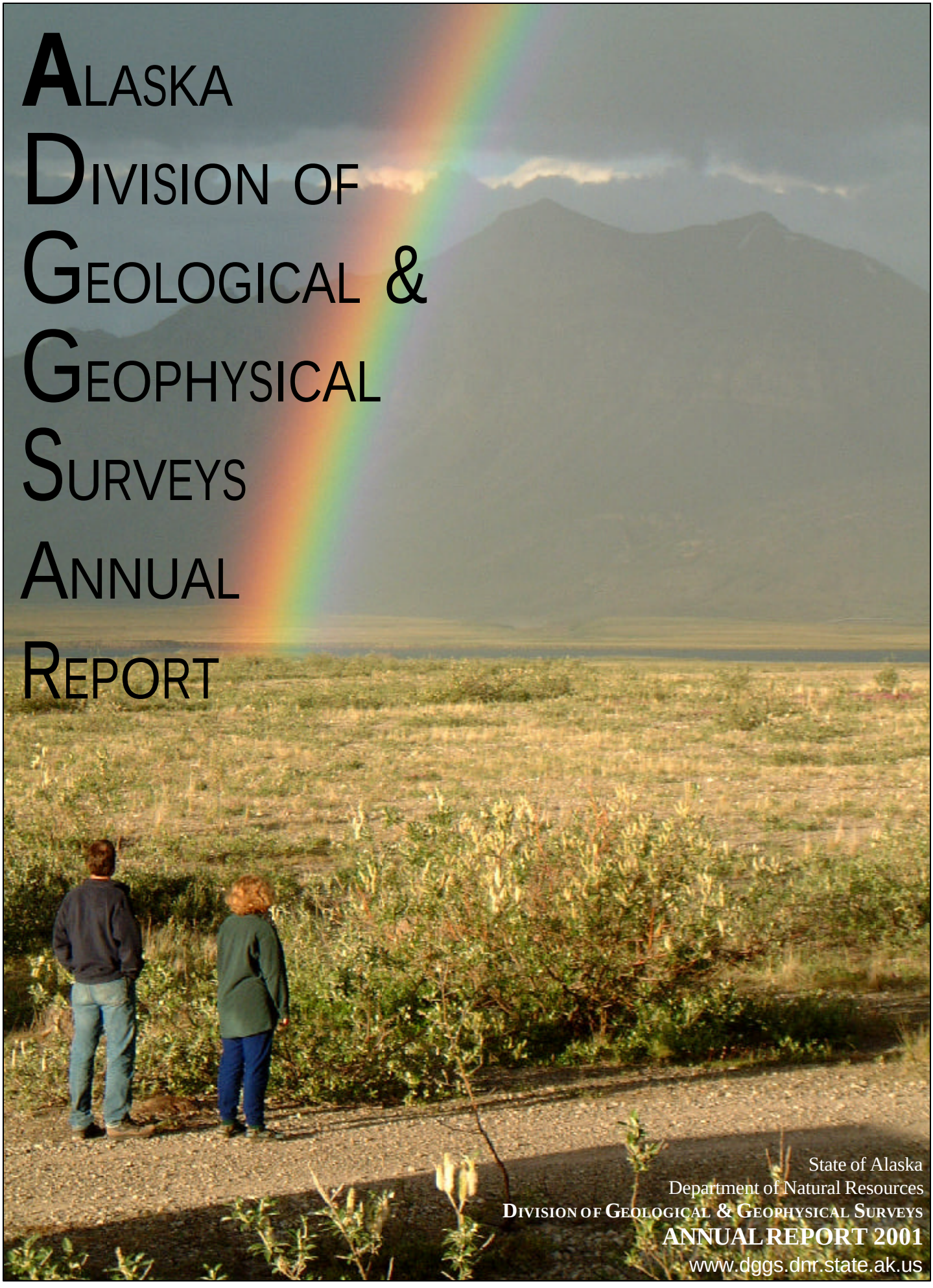
Alaska Division of Geological & Geophysical Surveys Annual Report



State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys
ANNUAL REPORT 2001
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 SLA 1987)

See. 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 eterminations;
(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: *Field geologists Dave LePain (Division of Geological & Geophysical Surveys) and Jennifer Burton (Anadarko Petroleum) look southeast toward the Brooks Range mountain front at Atigun Gorge. Geologists stationed at Galbraith Lake field camp in July 2001 witnessed this breathtaking rainbow late one evening. Photo by C.G. Mull.*

ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS ANNUAL REPORT

State of Alaska
Department of Natural Resources
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
ANNUAL REPORT 2001

State of Alaska
Tony Knowles, Governor

Department of Natural Resources
Pat Pourchot, Commissioner

Division of Geological & Geophysical Surveys
Milton A. Wiltse, State Geologist and 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

Since its formation, the Alaska Division of Geological & Geophysical Surveys (DGGS) has pursued a mission of helping Alaska prepare for the future. The dedication of DGGS scientists to that mission is a large part of the reason that I always have believed that it was a privilege to be associated with our geological survey.

DGGS continually evolves to meet the challenges of the times. Today we find that trustworthy information of all kinds, including geologic information, is required on increasingly shorter notice. The report that is not available in time for a critical decision is not relevant. This poses a particularly challenging problem for geologists in a young state. Pertinent geologic data is often not available, and generating new geologic data requires significant time in the field and real effort. Recasting basic data into objective information that is useful to a wide range of constituents, or the issue at hand, requires careful analysis and synthesis. To be credible, the checks and balances of the scientific method cannot be circumvented. There are, however, many time-sensitive improvements that can be made in the way the Division's applied geological science activities are conducted.

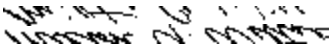
DGGS is continually adopting new technologies and modifying its work practices to gain faster access to data and to achieve more comprehensive inclusion of both new data and data that has been generated in the past. New technology is allowing our scientists to both conduct a more thorough analysis of a larger body of information and more rapidly summarize the results. This annual report includes outlines of new technology and work practices that have been incorporated throughout the Division's projects.

Computer-based geographic information system (GIS) and relational database technologies are being actively adopted and personally used by a rapidly increasing number of our staff. Over half our geologists now have significant facility with one or both of these technologies. The skill to use these new tools is resulting in insights and new ways of interpreting geologic data that we did not imagine even a few years ago.

DGGS, jointly with the U.S. Geological Survey and the U.S. Bureau of Land Management, is developing a distributed geologic data management system that has the goal of making all public-sector Alaska minerals-related geologic information available via the World Wide Web. This project, in particular, will beneficially transform the way DGGS manages its own data and will improve its service to the state.

Geologic resources and conditions will continue to have a major role in the development of Alaska. Our citizens and policy makers will continue to need credible, objective geologic information for all regions of the state. DGGS is instituting the programs and technology that will ensure that they continue to have the geologic information they will need.

Sincerely,



Milton A. Wiltse
State Geologist and Director

Division of Geological & Geophysical Surveys
ANNUAL REPORT 2001

INTRODUCTION

LEGISLATIVE MISSION AND MEASURES STATEMENT

The following mission statement 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, 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-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 strength totals 25 permanent full-time professional and support personnel, three non-permanent professional geologists, a Director, and seven 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

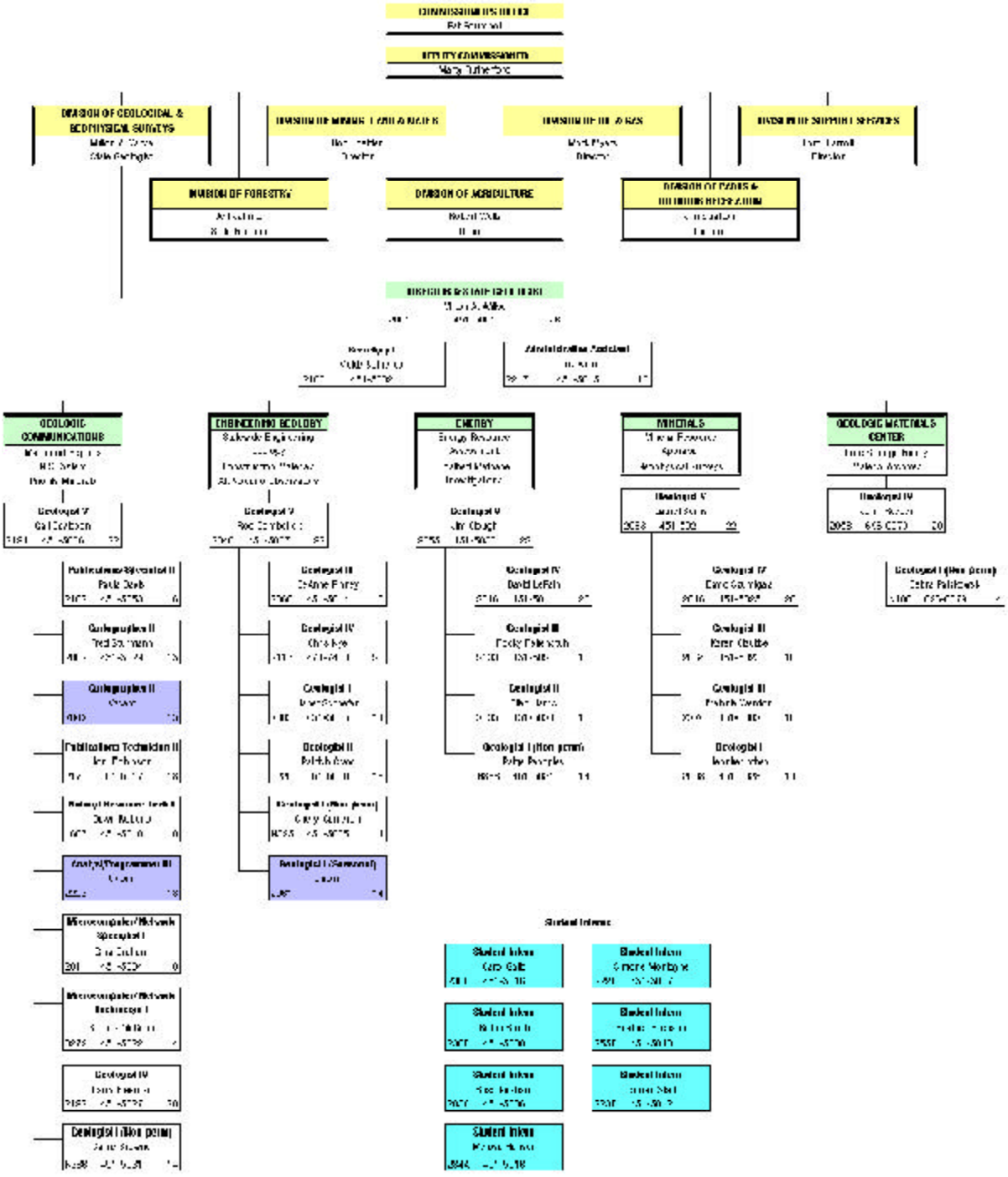
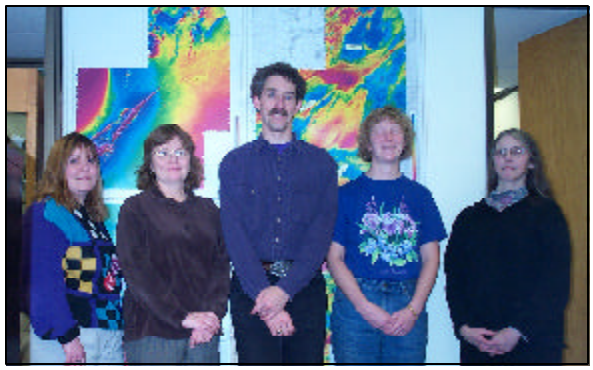


Figure 1

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 geologic hazard mitigation purposes. Surficial-geologic maps portray the distribution of surficial geologic materials and provide information on their, engineering properties, and usefulness as construction materials. Studies of major geologic hazards like earthquakes, volcanoes, and landslides result in reports outlining potential impacts on susceptible areas and expected frequencies of incidence 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 is 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 design response scenarios for earthquake 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, or federal 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.

In summary, DGGS provides an ongoing geologic consulting service 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 GOVERNMENT

Most of the cooperative efforts implemented by DGGS with borough and municipal governments are conducted on a mutually beneficial but informal basis. Notable exceptions are the cooperative efforts with Wrangell and the Ketchikan Gateway Borough. The City of Wrangell transferred $200,000 to DGGS to partially pay for an airborne geophysical survey of high-potential mineral lands near the city. Wrangell's $200,000 was matched by $300,000 from the U.S. Bureau of Land Management and an in-kind contribution of DGGS expertise to oversee the implementation of the geophysical surveys through the use of private-sector contractors. The Ketchikan Gateway Borough cooperative project was funded by contributions from the Borough, Sealaska Native Corporation, the State Mental Health Trust Land Office, the City of Thorne Bay, the community of Coffman Cove, and the U.S. Bureau of Land Management.

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 have recently completed a cooperative

program with BLM to upgrade the Alaska Geologic Materials Center in Eagle River and are now working with BLM to catalog the thousands of mineral-related reference samples stored on site. 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 Cook Inlet 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.

Richard Glenn
Vice President for Land, Arctic Slope Regional Corporation, representing the interests of northern Alaska
Richard Glenn is based in Barrow, Alaska, and has first-hand knowledge of many of the geoscience problems confronting the northern part of Alaska.

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

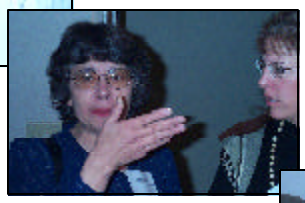
Sitnasuak Native Corporation, representing rural Alaskans in western Alaska

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.



DGGS FY02 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 FY02 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.

PROGRAM OBJECTIVES AND TASKS—FY02

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 FY02 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 2001.

TASKS

Project tasks and products financed by FY02 base budget General Funds, CIP Funds, Program Receipts, and Federal Receipts:

1. Supported in part by Federal Receipts, complete the third year of a three-year project to acquire ground-truth geologic data of the Fortymile mining district airborne-geophysical survey tract and publish the data collected 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 serves as the current focus for an ongoing Alaska–Yukon cooperative exchange of geologic and mineral inventory data.
2. Conduct the first year of a three-year geologic ground-truth mineral inventory orientation survey of the Pogo geophysical tract and summarize findings in an interim status report. This mapping project is designed for completion in 2 years following FY02.
3. Supported by Federal Receipts, compile mineral deposit data files for four 1:250,000-scale quadrangles that encompass prospective mineral terranes.
4. Prepare DGGS's annual report on mineral industry activity in Alaska, *Alaska's Mineral Industry 2001*.
5. Acquire, prepare, and release private-sector geologic and geochemical data for the Delta mining area in central Alaska.
6. Conduct airborne geophysical surveys of three prospective mineral tracts: Broad Pass survey, Bonnifield survey, and southeast Pogo survey.
7. Publish a second stage interim geologic map for a portion of the Talkeetna B-5 Quadrangle within the Iron Creek airborne geophysical survey tract.
8. Compile an electronic database of Alaska state agency lithochemical data for access via the Internet.
9. Compile an electronic index of all Alaska bedrock and surficial geologic mapping for access via the Internet.
10. Supported by Federal Receipts, participate 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.
11. 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 project 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 field reserves, new areas of significant hydrocarbon discovery 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 western North Slope is catalyzing industry interest in the west-central Arctic. Therefore, in FY02 this project 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 project 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 Project are financed from a mixture of funding sources: General Fund, Program Receipts, Federal Receipts, and Capital Improvement Project funding.

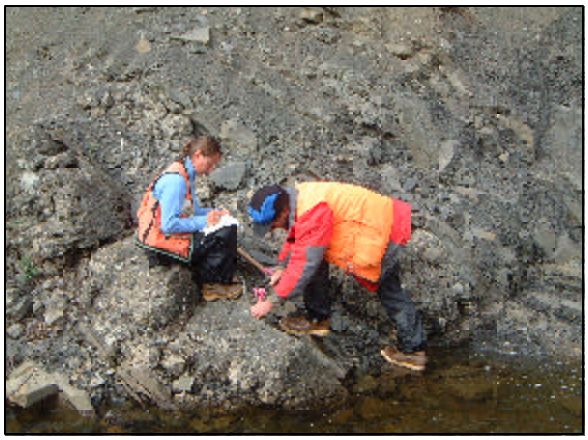
OBJECTIVES

1. Catalyze active private-sector oil and gas exploration on the North Slope beyond the Prudhoe Bay fields.
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, Program Receipts, and Federal Receipts in FY02 are:

1. Determine the oil reservoir characteristics of Nanushuk Group sandstones exposed along 120 miles of the northern Brooks Range foothills to provide key geologic framework elements to catalyze future oil exploration in the central North Slope.
2. Summarize the oil reservoir characteristics of a representative collection of North Slope and Brooks Range foothills strata from Carboniferous to Tertiary in age.
3. Publish a detailed inch-to-the-mile scale geologic map for part of the North Slope (Philip Smith Mountains Quadrangle).
4. Publish the processed data and data interpretation of seismic data acquired in Fort Yukon during FY01 for the purpose of evaluating the feasibility of a coalbed methane test drilling program.
5. Compile existing geologic, seismic, and geochemical data in preparation for and evaluation of the hydrocarbon potential of the Yukon Flats Basin.
6. Generate a report summarizing the reinterpretation of 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 that would be necessary to test for the presence of commercially viable gas reserves.
7. Collect coal samples from the Nulato and Kobuk River coal fields for proximate, ultimate, and trace-element analyses and select appropriate samples for gas isotherm studies; enter these data into the National Coal Resource Database System and prepare a final report detailing coal resource data for each coal field.



STATEWIDE ENGINEERING GEOLOGY/CONSTRUCTION MATERIALS

The Statewide Engineering Geology project 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 Project are partially or largely financed from Federal Receipts or Program 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 land-use zoning, building-code application, and emergency planning 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 even on a local scale, 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 project 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. During FY02, this project is focusing on mapping materials resources in the Fortymile and Pogo mining districts of east-central Alaska to support the expansion of the state's mineral industry.

The FY02 Statewide Engineering Geology and Construction Materials projects outlined below are supported by General Fund, Federal Receipts, and Program Receipts moneys.

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 the General Fund, Federal Receipts, and Program Receipts monies in FY02 are:

1. Publication of a Report of Investigations that includes user comments for a revised text and set of 1:25,000-scale site-response maps depicting expected variations in ground-motion amplification generated by 5 Hz, 1 Hz, and .35 Hz earthquake shaking frequencies. This report and the accompanying maps will be used in conjunction with local building codes for earthquake-resistant planning, design, and construction.
2. Publication of a 1:25,000-scale seismic soil-type map of the greater Anchorage area that corresponds to provisions of the latest seismic building codes.
3. Partially supported by Federal Receipts, publish tsunami-inundation maps for Kodiak, Alaska and initiate tsunami-inundation modeling for other coastal Alaska communities.
4. Prepare generalized earthquake hazard maps of coastal districts in southern Alaska for the Alaska Coastal Management Program.
5. Partially supported by Federal Receipts secured in FY00, publish a compilation of all available information on active faults in Alaska, including maps on a CD-ROM showing fault traces digitized at 1:250,000 scale or larger and a report that presents all information in a consistent format.
6. Produce written evaluations of potential hazards in areas of oil exploration leases, land disposals, permit applications, coastal management reviews, etc., and respond to verbal requests for information from other state agencies, local government, and the general public.
7. 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.
8. Publish geologic maps of Mt. Spurr and Shishaldin volcanoes for improved assessment of hazards from these active volcanoes.
9. Maintain and enhance the Alaska Volcano Observatory Web site.
10. Provide oversight, coordination, and helicopter contracting for multi-team fieldwork to conduct geologic-hazards studies and seismic network maintenance of active volcanoes in the Cook Inlet, Alaska Peninsula, and Aleutian Islands regions.
11. Contingent on securing funds to fulfill Federal Receipts authorization, 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.
12. In support of the Statewide Mineral Resource Appraisal Program, complete the ground-truth surficial-geologic and engineering-geologic mapping of up to 500 square miles of high-potential mineral tracts

to produce the geologic data needed to assess the placer-mineral resources, construction material resources, and potential geologic hazards that may affect development of Alaska's mineral industry in these areas.

13. Update and expand the existing GIS-based bibliography of industrial mineral sites in Alaska, and publish the data digitally via the Internet and CD-ROM in order to document and inventory Alaska's potential economic commodities and make the information available to the public.
14. Generate a geographically referenced compilation of all publicly available data pertinent to engineering geology, geologic hazards, and construction materials resources along the proposed natural gas pipeline route from Prudhoe Bay to the Yukon border.
15. Supported by funds secured through a competitive NASA grant process, apply remote-sensing imaging and high-resolution digital elevation models to evaluate the potential for bypassed placer gold resources in the Council mining district on the Seward Peninsula.

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 information and to provide state and worldwide access to the Division's geologic information base. These efforts have developed into a major project to establish a state-federal 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, Program Receipts, and Federal Receipts are:

1. Publish and distribute the DGGS annual report on Alaska's mineral industry.
2. Assemble and edit the technical and educational maps and reports of DGGS in both conventional and digital format.
3. Supported by Federal Receipts, deploy all of the existing DGGS geologic and geophysical maps and reports on the World Wide Web so that they are accessible to mineral and energy explorationists, engineering geologists, planners, engineers, and other interested parties via the DGGS Web page on the Internet.
4. Supported by Federal Receipts, convert the Division's many kinds of fundamental geologic data into an interagency relational digital database system to facilitate its more

effective use by DGGS, private-sector geologists, and other agencies.
5. Supported by Federal Receipts funding, create National Geologic Map Database metadata files required to make DGGS geologic map data available through the federal national geologic database Web site.
6. Publish a tri-annual newsletter of the Alaska Division of Geological & Geophysical Surveys to keep the public informed about DGGS projects and products.

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 FY02 base-budget General Funds, CIP Funds, Program Receipts, and Federal Receipts:

1. 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 deposit core) acquired from private companies and state and federal agencies.
2. Acquire and archive new geologic material pertinent to Alaska's energy and mineral resource development as they are donated to the GMC.
3. Supported by Federal Receipts, inventory and catalog all U.S. Bureau of Land Management mineral samples archived at the GMC.
4. Establish and maintain 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.

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.

FEDERAL RECEIPTS

Federal Receipts authorizations allocate grant or contract funds received from federal agencies for cooperative or matching fund projects such as investigations of mineral and materials resources, energy resource investigations, and geologic hazard assessments. All these projects increase information on Alaska's geologic resource base or the geologic engineering parameters of natural conditions affecting development activities and public safety. Most projects are unique single- or multi-year projects that are implemented as funds are available from cooperating federal agencies.

OBJECTIVES

1. Maximize the return on Alaska General Fund moneys expended to meet the mandate of AS 41.08.020 through federal grant and cooperative project funding in support of Alaska's geologic survey priorities.
2. Conduct geological and geophysical surveys to determine the potential of Alaskan land for the production of metals, minerals, and fuels.
3. Determine the potential geologic hazards to buildings, roads, bridges, and commerce from earthquakes and volcanic eruptions.

4. Conduct other surveys and investigations that will advance the knowledge of the geology of Alaska.

TASKS

Tasks that will be financed in part by Federal Receipts in FY02 are:

1. Completion of an airborne-geophysical survey of the prospective platinum-group metal (PGM) terrane located on the south flank of the Alaska Range west of Paxson, Alaska.
2. Complete the third year of a three-year project to acquire ground-truth geologic data for the Fortymile mining district airborne-geophysical survey tract and publish the data collected as a geologic map at a scale of 1:63,360.
3. Compile mineral-deposit data files for four 1:250,000-scale quadrangles that encompass prospective mineral terranes.
4. Construct a geologic data and information database system providing relational organization for DGGS minerals-related geological, geophysical, and geochemical data.
5. Extend the ongoing DGGS tsunami-inundation hazards evaluation program to other southern Alaska coastal communities.
6. In cooperation with the Division of Emergency Services, University of Alaska Geophysical Institute, and coastal communities, publish the Kodiak area tsunami-inundation maps that were generated in FY01.
7. Partially supported by Federal Receipts, publish a compilation of all available information on active faults in Alaska, including maps on a CD-ROM showing fault traces digitized at 1:250,000 scale or larger and a report that presents all information in a consistent format.
8. Publish geologic maps of Mt. Spurr and Shishaldin volcanoes for improved assessment of hazards from these active volcanoes.
9. Maintain and enhance the Alaska Volcano Observatory Web site.
10. Design and construct the first of three core components of a geologic database as part of a state–federal Alaska geologic database management system.
11. Publish the pre-drilling seismic evaluation site assessments of the Fort Yukon, Alaska coalbed methane prospect.
12. Conduct field examinations of coal outcrops within the Nulato and Kobuk coal fields to collect new coal quality and quantity data for inclusion in the Alaska coal database of the U.S. Geological Survey's National Coal Resource Data System.
13. Conduct field examinations of oil-related units in the Yukon Flats basin to help assess the commercial oil potential of that area.
14. Add information on DGGS maps to the National Geologic Map Database maintained by USGS.

PROGRAM RECEIPTS

This project allocates funds received from governments, private industry, academic institutions, and the general public from the sale of publications. The sale of these publications increases information on Alaska's geologic resource base, or the geologic engineering parameters of natural conditions affecting development activities.

OBJECTIVES

1. Maximize results from Alaska General Fund and CIP moneys through Program Receipts to meet the mandate of Alaska Statute AS 41.08.020.
2. Provide for the timely release of mineral, energy, and geologic construction materials-related geologic data that will focus attention on the most promising Alaska lands having the potential to sustain or diversify Alaska's economy, or on those lands having a critical impact on Alaska citizens.

TASKS

1. Reproduce DGGS publications, Public-Data Files, and selected maps and reports on an as-needed basis for the public, state, and federal agencies.

DESIGNATED PROGRAM RECEIPTS

This project allocates funds received from local governments, private industry, and the general public. All of these projects increase information on Alaska's geologic resource base, or the geologic engineering parameters of natural conditions affecting development activities. Most elements are one-time single- or multi-year tasks that are undertaken as funds are available from cooperating agencies. We do not normally know in advance which projects, if any, will be funded during the forthcoming budget year.

OBJECTIVES

1. Maximize results from Alaska General Fund and CIP moneys through Program Receipts to meet the mandate of Alaska Statute 41.08.020.
2. Provide for the timely release of mineral, energy, and geologic construction materials-related geologic data that will focus attention on the most promising Alaska lands having the potential to sustain or diversify Alaska's economy, or on those lands having a critical impact on Alaska citizens.

TASKS

In FY02, the Division received funding through the state's Designated Program Receipts process from private industry to be used for the projects described below. Without Designated Program Receipts funding, these projects would not be implemented.

1. The NPRA–Foothills project: This is the third year component of the five-year NPRA–Brooks Range Foothills program designed to understand the detailed stratigraphy of Cretaceous-age sedimentary rocks in the Brooks Range foldbelt and their reservoir and source-rock potential in frontier areas. The objective of this work is to generate industry exploration interest in frontier regions of the North Slope. The preliminary results from the first year of this program resulted in significant industry interest for DGGS's FY01 studies and increased exploration activity in eastern NPRA and adjoining state lands to the south.

FY02 FINANCIAL RESOURCES SPENDING PLAN

	General Fund	Federal Receipts	Designated Program Receipts	Statutory Program Receipts	Inter-Agency Receipts	Direct Charge CIP	CIPs	Total by Section
Director/State Geologist								0.0
Mineral Resource Appraisal	419.2	481.0				30.0	250.0	1,180.2
Energy Resource Appraisal	525.0	322.1		175.9	21.2	31.0	280.0	1,355.2
Engineering Geology	238.4	742.9			155.6			1,136.9
Geologic Maps and Reports	568.0	295.7	30.0		25.2			918.9
Geologic Materials Center	130.2	43.4						173.6
Technical Support	192.3				38.2			230.5
Total by Funding Source	**2,073.1**	**1,885.1**	**30.0**	**175.9**	**240.2**	**61.0**	**530.0**	**4,995.3**

PROJECT SUMMARIES—FY02

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 29 projects that are being pursued by DGGS in FY02 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.

GEOLOGIC GROUND-TRUTH INVENTORY OF FORTYMILE MINING DISTRICT GEOPHYSICAL SURVEY TRACT

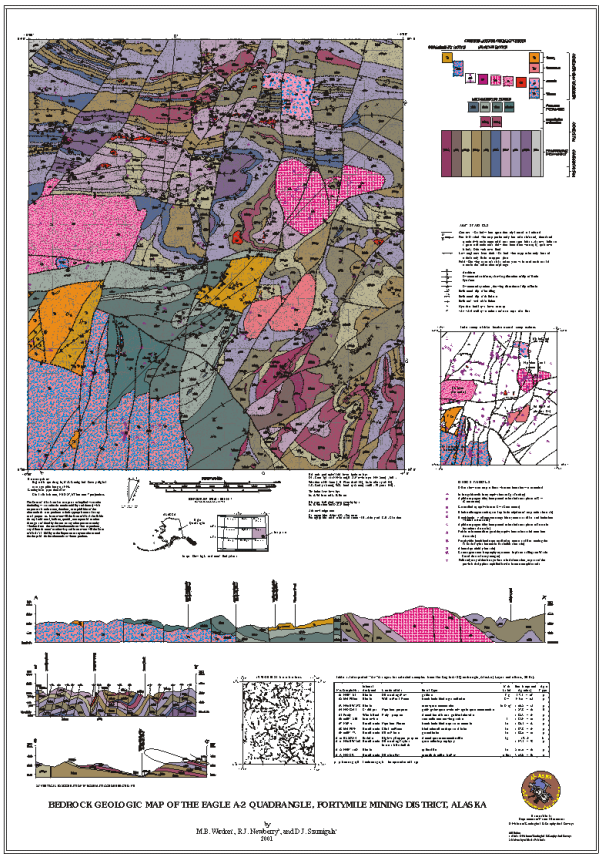
Contact: David J. Szumigala, Mineral Resources Section, 907-451-5025, zoom@dnr.state.ak.us

In 2001, DGGS completed year three of a three-year mapping program to provide geologic ground truth for airborne geophysical surveys flown in the Fortymile mining district in 1998. The Fortymile project is part of DGGS's airborne geophysical/geological mineral inventory project, a special multi-year investment by the state of Alaska to expand the knowledge base of Alaska's geologic and mineral resources to catalyze future private-sector mineral exploration and development and to guide state planning. Major funding for FY01 and FY02 fieldwork in the Eagle A-2 (see inset) and A-1 quadrangles is through the federal STATEMAP program. The study area, in eastern Alaska near the Alaska–Yukon border, is drained by the Fortymile River system and is accessible from the Taylor Highway. In order to produce maps with cross-border, geologically continuous units, DGGS communicated with Canadian and USGS geologists participating in the Canadian NATMAP program.

DGGS efforts are focused on determining and understanding the geologic framework of the Fortymile mining district, especially with respect to placer gold and lode mineral deposits. The district is the oldest placer gold camp in Alaska; alluvial gold was first discovered on Franklin Gulch along the Fortymile River in 1886. More than 535,000 ounces of gold have been produced from the district, but less than 300 ounces of this production were from lode mining. Although no large-scale source(s) for the district's abundant placer gold resources have been located, the historic Purdy lode gold deposit and the recently discovered Napoleon lode gold prospect occur within the study area. A Jurassic(?) platinum-bearing ultramafic intrusion, and several small skarn occurrences were identified and sampled by DGGS within the Fortymile mining district, and the district also has the potential to contain plutonic-related gold, metamorphic gold, copper–molybdenum porphyry, and volcanogenic massive sulfide deposits.

DGGS geologic work has delineated mappable units and defined stratigraphy within three separate major metamorphic suites within the Yukon–Tanana terrane: (1) upper Paleozoic greenschist-facies rocks of the Chicken Metamorphic Complex, (2) pre-Mississippian amphibolite-facies rocks of the Fortymile River Assemblage, and (3) a mixed suite of greenschist-facies rocks including ultramafic rocks and the Upper Paleozoic Nasina and Klondike Assemblages. DGGS's preliminary $^{40}Ar/^{39}Ar$ data, and previously published dates, indicate these metamorphic rocks have been variably intruded by Triassic, Jurassic, and Cretaceous plutons and dikes, all of volcanic-arc affinity, which decrease in abundance eastward. Bimodal Tertiary felsic and mafic rocks of within-plate affinity occur throughout the study area, and trace-element geochemistry suggests some basalt in the area may correlate with Quaternary basalt in Yukon. Extensive high-angle faulting (with relatively young uplift) suggested by geophysical data was corroborated in the field and is part of a complex structural history in the area.

A series of geologic-framework and geophysical maps at 1:63,360 scale, and reports containing geological, geochemical, and geophysical data compilations have been produced by this project during FY00 and FY01. Results of DGGS's FY02 work will be published by June 2002, and all project maps and reports will be made available on the World Wide Web at the DGGS Web site (http://wwwdggs.dnr.state.ak.us).



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

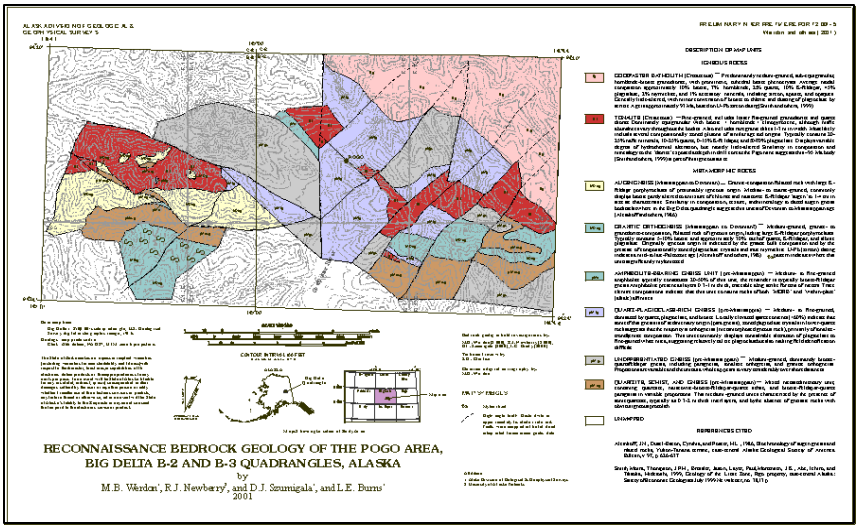
Contact: Melanie B. Werdon, Mineral Resources Section, 907-451-5082, melanie@dnr.state.ak.us

During the summer of 2001 DGGS conducted a 21-day field-based geologic mapping project within the boundaries of the Salcha River-Pogo airborne geophysical survey. This is the first year of a planned three-year study. The geophysical survey covers 1,032 square miles in the Big Delta Quadrangle, and includes portions of the Salcha and Goodpaster River drainages. The objective is to produce a 1:63,360-scale bedrock geologic map of the geophysical tract, and to evaluate the mineral resource potential of the area. Currently the southern portion of the map area is of intense interest to the mineral exploration industry since it includes the Pogo property (a high-grade, plutonic-related, 5.1-million-ounce gold deposit). Many 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 is being actively explored for metasediment-hosted base-metal occurrences.

Several greenschist- to amphibolite-facies metamorphic rock suites were delineated within the boundaries of the Salcha River–Pogo airborne geophysical survey by previous mapping (1:250,000 scale). Contact relationships between these suites are poorly known, and there are conflicting interpretations in the literature. DGGS is carefully locating these boundaries and determining the types of contact relationships. DGGS has delineated many high- and low-angle faults, and we are attempting to determine 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 (e.g., Pogo, True North, Rhyolite prospects). We are also testing a 75-kilometer displacement model for the prominent high-angle, northeast-striking Shaw Creek fault, which has important implications for offset of lithologic units and mineralization in the Pogo and Richardson areas.

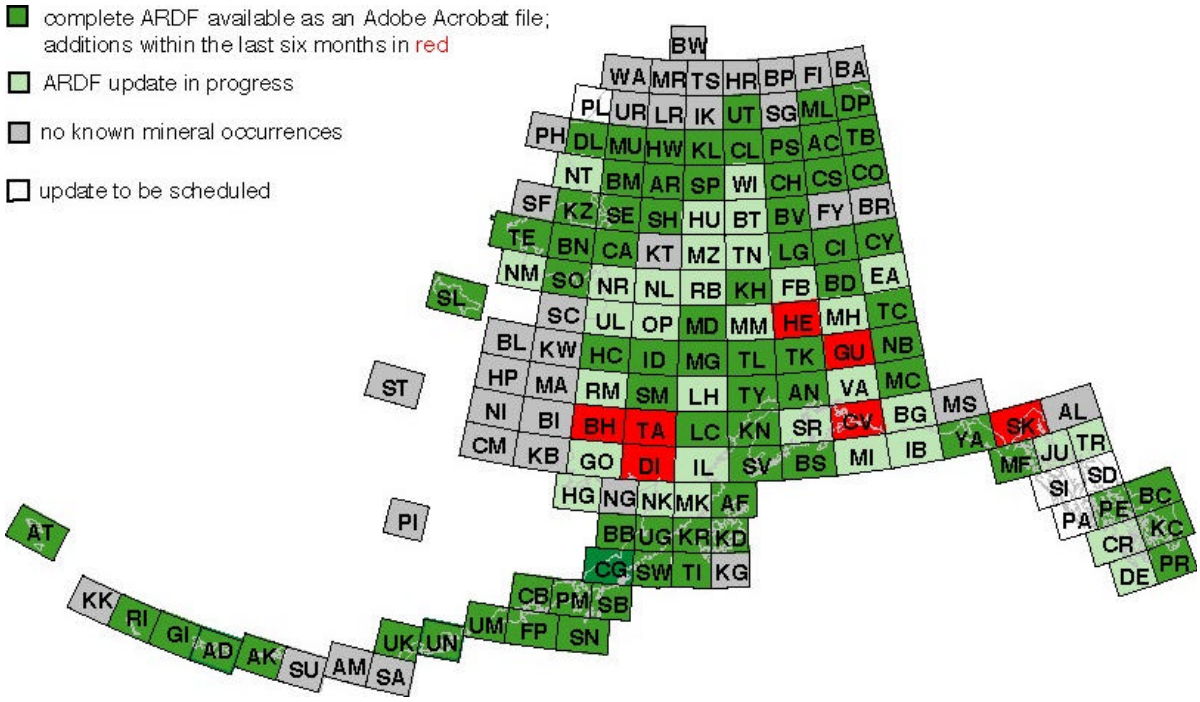
Our detailed mapping documents a complex polydeformational structural history within the metamorphic suites, and we have begun subdividing the suites into metamorphic stratigraphic units. The metamorphic rocks have been intruded by numerous igneous/metaigneous suites of varying ages (Devonian to Tertiary) and compositions (felsic to ultramafic). DGGS efforts have focused on classifying the many types of plutonic, volcanic, 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 will facilitate comparison of these rocks and evaluation of their mineral favorability.

A reconnaissance geologic map (see inset) and results of geochemical analyses from DGGS's summer 2000 reconnaissance fieldwork in the study area were published in June 2001. Reports on DGGS's summer 2001 field mapping and analytical work will be published by June 2002. DGGS plans to conduct additional fieldwork within the Salcha River–Pogo geophysical survey boundary in the summer of 2002.



ALASKA RESOURCE DATA FILE PROJECT
(ALASKA MINERAL DEPOSIT DATABASE)

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



last updated 08/09/01

DGGS has a cooperative agreement with the U.S. Geological Survey (USGS) as part of the federal (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 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.

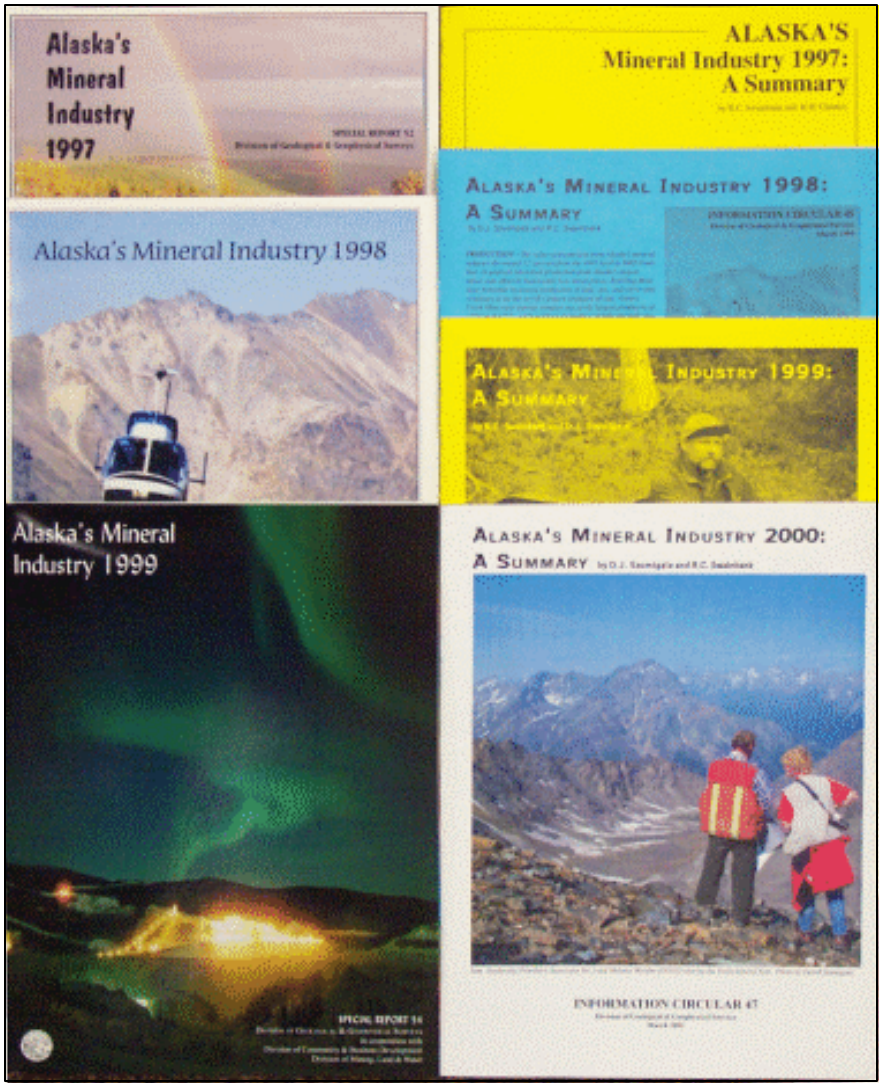
Descriptions in the ARDF database are derived from published literature, state mining claim files, state land status information, personal interviews, and unpublished reports and data from various sources including DGGS, the U.S. Bureau of Land Management, the USGS, Alaska Native corporations, and the mineral industry.

DGGS will complete 9 to 15 quadrangle mineral deposit record-sets that meet peer review and USGS ARDF staff review criteria. DGGS minerals section geologists and interns have completed ARDF files for the Big Delta, Tanacross, Kantishna River, Charley River, and Ruby quadrangles. In FY02, final review comments will be addressed for the Tanana and Melozitna quadrangles, and DGGS staff will be completing the Eagle and Black River quadrangles.

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 mineral industry in Alaska. The report has been published for 20 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 2000 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

Our objective is to supply information on 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. Statewide and international circulation of the annual mineral industry report 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 release knowledge into the public domain that was previously available to only 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 given NAI permission to use and disseminate the data.

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 about $8 million more in the area. During these six years, 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 a detailed stratigraphy of the area. The stratigraphy suggests that massive sulfide mineralization occurs in at least four stratigraphic levels.

The geologic map will be produced in FY02 by NAI and DGGS and will be based on the geologic mapping, lithochemistry, airborne geophysics, and core drilling that was carried out under the supervision of NAI personnel between 1994 and 1999 for American Copper & Nickel Company and Grayd. More than 800 major oxide and trace element analyses and sample locations for the Delta Mineral belt were released as part of this project in FY01.

AIRBORNE GEOPHYSICAL/GEOLOGICAL MINERAL INVENTORY

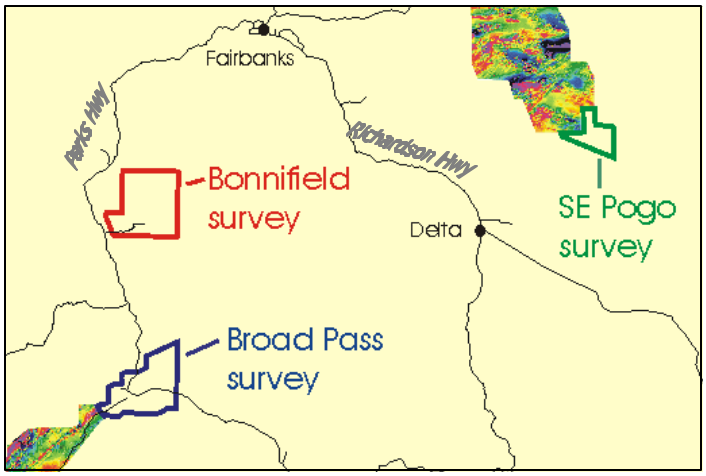
The Airborne-Geophysical/Geological Mineral Inventory project is a special multi-year investment to expand the knowledge base of Alaska's mineral resources and catalyze private-sector mineral development. The project seeks to delineate mineral zones on Alaska state lands that have major economic value, can be developed in the short term to provide high-quality jobs for Alaska, and 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.

For FY02, the Division of Geological & Geophysical Surveys (DGGS) initiated airborne geophysical surveys in the western part of the Bonnifield district, the Broad Pass area, and the area southeast of the Pogo deposit. The Broad Pass and southeast Pogo surveys will connect additional highly prospective terranes with DGGS's previously acquired geophysical data. DGGS believes that geophysical data that leads to a better understanding of the geologic framework hosting identified and potential ore deposits in all these districts will stimulate increased mineral exploration investment within these belts of rocks and the surrounding areas. Data acquisition was completed by September 1, 2001. The data will be released in early 2002.

The Bonnifield district is about 80 miles south of Fairbanks, Alaska. The district extends across the north flank of the Alaska Range for approximately 40 miles and is part of a larger mineral belt that extends into Canada. Approximately 80,000 ounces of placer gold has been mined from the region since 1903; most of the placer gold has come from the western part of the district. A major lode prospect in the area surveyed is the Liberty Bell gold deposit. Gold and base-metal (copper–lead–zinc) anomalies and mineral alteration zones are known within the proposed survey tract.

The Broad Pass area, located near Cantwell on the southern flank of the Alaska Range, contains plutonic rock with unevaluated potential for porphyry copper–molybdenum, tin greisen, base-metal and precious metal hydrothermal veins, plutonic gold deposits, and platinum-group elements and is similar to the Chulitna district immediately to the south. The area is crossed by the Denali Fault and has extensive surficial cover. Existing infrastructure makes this area unique compared to most of Alaska and attractive for mineral development if mineable deposits are found.

The southeast Pogo area is approximately 50 miles northeast of Delta Junction in the Goodpaster mining district. Very little historical gold production is known in the area; however, structural data interpreted from the previous Pogo geophysical survey suggests this area has high mineral potential. Regional geology of the area consists of highly deformed, high-grade metamorphic rocks that were intruded by Cretaceous granodiorites about 92 million years ago.



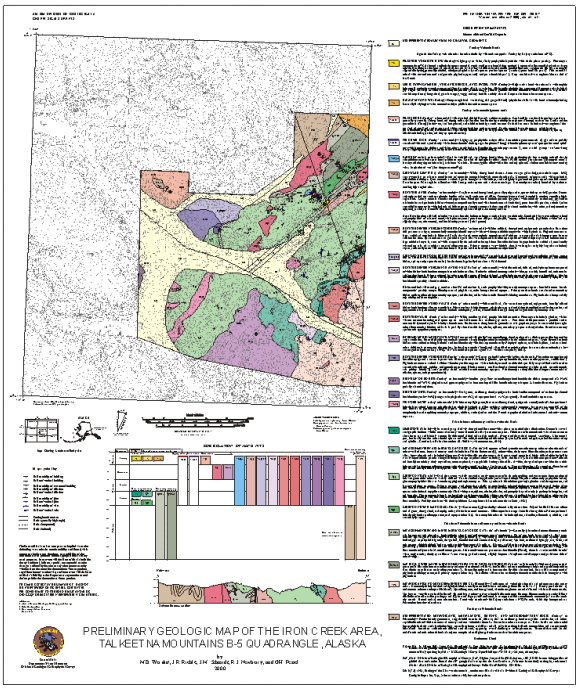
GEOLOGIC GROUND-TRUTH INVENTORY OF THE IRON CREEK GEOPHYSICAL SURVEY AREA

In 1999 DGGS participated in a 15-day geologic field mapping project in the Iron Creek airborne geophysical survey tract. Geologists from the mineral research program of the USGS cooperated with DGGS to benefit from shared personnel and field expenses. The objective is to produce joint publications of interpreted geological and geophysical data, and to evaluate the mineral resource potential of the area to catalyze and guide future mineral investment. In FY02 we will be releasing the final geologic map of the Iron Creek area.

A preliminary 1:63,360-scale geologic map (see inset) was produced in 2000. It covers approximately 100 square miles of the southeastern quarter of the Talkeetna Mountains B-5 Quadrangle, and is centered around known copper prospects. Previously the Iron Creek area was mapped at 1:250,000 scale as predominantly Paleozoic volcanic rocks with minor limestone lenses, intruded by two plutons. Our new mapping identified numerous other, previously unrecognized plutonic and volcanic rocks, of many different compositions, with probable ages ranging from Jurassic(?) to Tertiary. Tertiary-aged, quartz-rich granitic plutons, rhyodacite dikes, volcanic breccias, and basalt dikes were discovered in the northern half of the map area. Other significant plutonic bodies mapped include tonalite/trondhjemite, granodiorite, monzonite, diorite/gabbro, and hornblendite.

A large portion of the central map area contains amygdaloidal basalt, amygdaloidal gabbro, epidotized volcanic breccias, and fine-grained mafic rocks. These mafic units have many features characteristic of the Nikolai greenstone including (1) variable, but generally high magnetic susceptibility, (2) bimodal TiO_2 values, (3) amygdules, (4) association with Late Triassic limestone, and (5) scattered quartz + hematite + epidote +/- chalcopyrite +/- bornite +/- pyrite veins and alteration. This suggests that these rocks can be correlated with the Wrangellia terrane. We also identified a separate unit consisting of mixed metasedimentary and metavolcanic rocks that have been intruded by mafic sills with a low magnetic susceptibility, which tentatively may be correlative with Paleozoic rocks to the east. In the southeastern corner of the map area, another package of metavolcanic rocks may be part of the Peninsular terrane.

The map pattern of the mixed metasedimentary–metavolcanic–mafic sill package indicates large-scale folding of these units in the map area. A sub-parallel set



of younger, northeast-trending, high-angle faults was identified, one of which has a component of strike-slip motion based on horizontal slickenslides along the fault surface. There also appears to be a major northwest-trending, high-angle fault with north-side-down displacement along the main fork of Iron Creek.

The recognition of numerous new plutonic rocks of varying compositions increases the potential of the Iron Creek area for epithermal and pluton-hosted mineralization. Numerous fracture- and shear-controlled copper–iron prospects and small skarn bodies were located and sampled. Quartz–sericite–pyrite alteration in felsic metavolcanic rocks with a white mica $^{40}Ar/^{39}Ar$ plateau age of 145.7 Ma indicates Jurassic, plutonic-related hydrothermal activity.

DGGS and USGS released analytical data and sample locations from the Iron Creek area in fall 1999. Ages for igneous and sulfide-bearing rock samples were determined by $^{40}Ar/^{39}Ar$ laser step-heating in 2000. For FY02, a geologic report on conodont analyses is in preparation for publication in DGGS's series. Conodont and argon age information was incorporated into the final map of the Iron Creek area, which is currently undergoing USGS review. This map will be released in FY02.

COMPILATION OF ALASKA STATE AGENCY LITHOCHEMICAL DATA

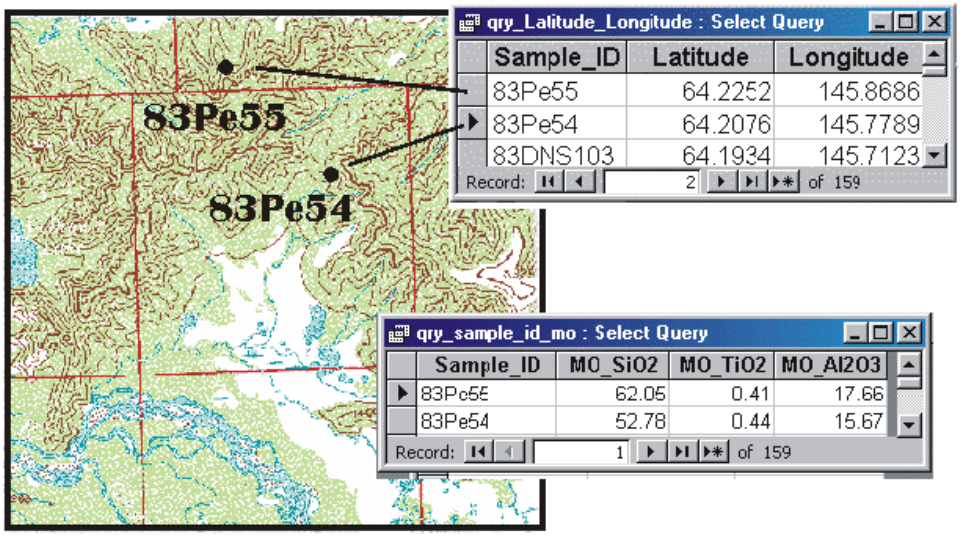
Contact: Laurel E. Burns, Mineral Resources Section, 907-451-5021, laurel@dnr.state.ak.us

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 data sets will 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 3 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. The Alaska Division of Geological & Geophysical Surveys (DGGS) possesses a significant amount of Alaska minerals-related geochemical data that have not yet been gathered into organized data sets. Some of the data have not been published; other sets are not in digital format and are in danger of being lost. The vast majority of the data have not been digitally linked with geographic locations.

DGGS is assembling the various at-risk lithochemical data that has been generated by DGGS, or in some cases generated by the University of Alaska, organizing these data into rational data sets 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 being conducted 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 data sets, and 500 or 600 mineral compositions data sets. An additional 1,000 major oxide or trace-element data sets from unpublished Master of Science thesis research done at the University of Alaska Fairbanks (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.



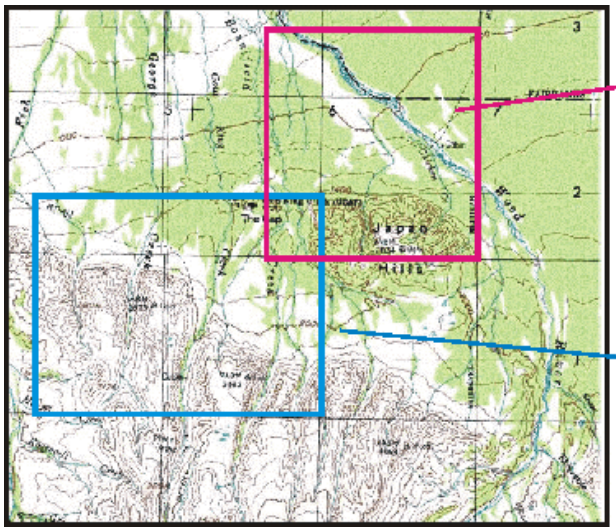
COMPILATION OF ALASKAN BEDROCK AND SURFICIAL GEOLOGIC MAPS INDEX PROJECT

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

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, BLM, and USBM bedrock and surficial geologic maps exists. The most complete bedrock and surficial listing, Galloway and Laney (1995), lacks DGGS and USGS data published after about 1994 and completely omits any BLM and Bureau of Mines mapping. Additionally, 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 Alaska Map Index Project will collate, expand, and update these indexes into a single, multi-agency database of Alaska geologic mapping.

This project will generate a computer database index of published bedrock and surficial geologic mapping in Alaska. The database will contain geographically referenced data in both map and table format for maps published by the State of Alaska, Division of Geological & Geophysical Surveys (DGGS), U.S. Geological Survey (USGS), U.S. Bureau of Land Management (BLM), and U.S. Bureau of Mines (USBM). A link to the database will be placed on the Interagency Minerals Coordinating Group (IMCG) Web site. The database will contain metadata for the geologic maps, and index maps showing map boundaries. Map boundaries and metadata citations for DGGS maps will be linked to digital files of the appropriate scanned maps that are accessible on the web as .PDF files. Hardcopy versions of the index maps and metadata will be published.



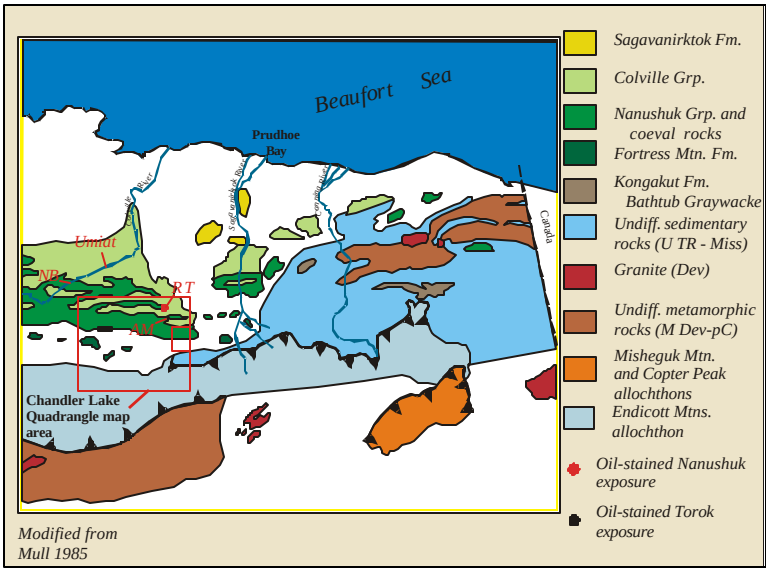
Grover, M.B., Miller, R.J., and Smith, D., 1979, Bedrock geologic map of the Fairbanks A-3 quadrangle, DGGS, scale 1:63,360, 2 sheets.

Gilbert, T.K., and Jones, G.W., 1963, Surficial geologic map of part of the southwestern Fairbanks quadrangle, USGS, scale 1:250,000, 2 sheets.

NPRA–BROOKS RANGE FOOTHILLS PROGRAM

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

The goal of this five-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 east 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 FY01 field season was the Chandler Lake Quadrangle, shown in the inset map below. DGGS will complete work in the Chandler Lake Quadrangle during FY03. The study will shift westward toward the DeLong Mountains Quadrangle in FY04.



Modified from Mull 1985

During the FY02 field season, three detailed stratigraphic sections were measured through portions of the Nanushuk Group along the Kanayut River south of Umiat, at the confluence of the Lupine and Sagavanirktok rivers, at Slope Mountain along the Dalton Highway, and along a small tributary to May Creek in the Chandler Lake Quadrangle. In addition, stratigraphic sections at Arc Mountain (AM) and Rooftop Ridge (RT), begun during previous field seasons, were reexamined for high-frequency sequence bounding unconformities. Of particular economic significance, several sandstone beds in the Nanushuk Group at Arc Mountain exhibited strong hydrocarbon odors. Over the past four field seasons, oil-stained sandstones have been observed in the Torok Formation and Nanushuk Group over a large geographic area in the Chandler Lake, Umiat, and Sagavanirktok quadrangles, including Alaska state-owned lands. The Arc Mountain–Rooftop Ridge–Ninuluk Bluff (NB) sections represent an important north–south (non-marine to marine) transect through Torok and Nanushuk depositional systems that helps constrain paleogeographic reconstructions of the Lower Cretaceous shoreline. Significant intraformational unconformities have been identified in the Nanushuk at Ninuluk Bluff, Arc Mountain, Rooftop Ridge, and Slope Mountain. Of particular significance, unconformities identified at Ninuluk Bluff are important in understanding the distribution of potential hydrocarbon reservoirs in coeval deepwater strata to the north in the northeastern NPRA.

In addition, DGGS continued facies studies of sandstones and conglomerates of the Upper Cretaceous Tuluvak sandstone during FY02. In outcrop this unit contains rocks with excellent porosity and permeability that suggest the horizon might be an excellent hydrocarbon objective in the subsurface. Oil-stained possible deepwater equivalents of the Tuluvak Formation were examined east of the Dalton Highway along an unnamed tributary to the Sagavanirktok River. Additional sampling for organic geochemical analyses was also conducted along the fold belt. The field data suggest the presence of more oil-prone source rocks than indicated by previous mapping in the area.

In conjunction with stratigraphic studies during the FY02 field season, DGGS completed field checking digitized copies of older 1:125,000-scale geologic maps of the Chandler Lake and Umiat quadrangles. These maps are part of a series of maps being digitized by the U.S. Geological Survey in a collaborative project. The quadrangles will be released in FY02–03.

Products will include: a 1:63,360-scale geologic map of the Chandler Lake C-2, D-2, and part of D-1 quadrangles (see inset rectangle on map above; released fall FY02); measured sections (released during the winter following each field season); summary of the petrology and reservoir quality of selected sandstone bodies (released winter FY03); and a report summarizing the sequence stratigraphy and reservoir quality of Cretaceous rocks (released winter FY05).

NORTH SLOPE RESERVOIR CHARACTERIZATION STUDY

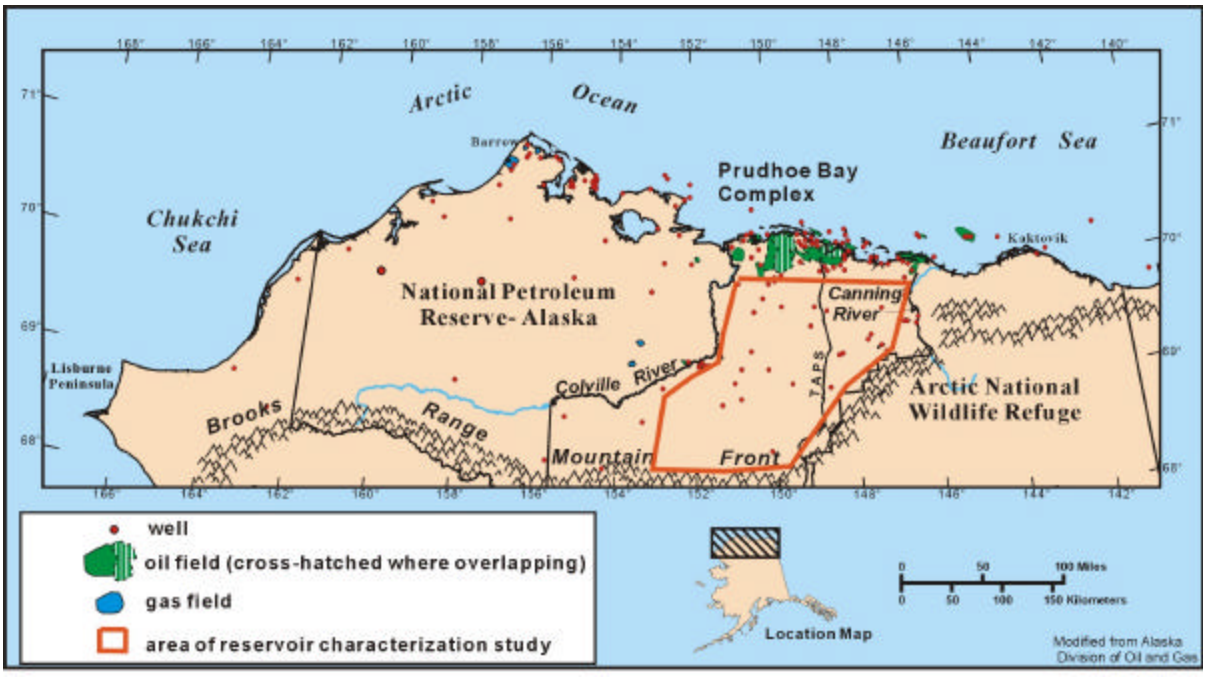
Contact: Rocky R. Reifenstuhl, Energy Resources Section, 907-451-5026, rocky@dnr.state.ak.us

The North Slope Reservoir Characterization project is a joint DGGS/Division of Oil & Gas project funded through a $21,000 Reimbursable Services Agreement (RSA) from the Division of Oil and Gas. The goal of this project is to summarize the reservoir characteristics of a representative collection of North Slope and Brooks Range foothills strata, from Carboniferous to Tertiary in age. The primary formations addressed are: Tuluvak sandstone (Prince Creek Formation), Schrader Bluff Formation, Nanushuk Group, Torok Formation, Fortress Mountain Formation, Cobblestone sandstone, and Lisburne Group.

The area of study is from the Canning River on the east to the Colville River on the west. The reservoir quality of selected rocks will be evaluated by considering the detailed components of the rocks, depositional environment, regional geologic framework, and structural framework. A total of 60 samples will be collected and analyzed for porosity and permeability. Additionally, the samples will be studied petrographically. Ten of the 60 samples will be of the Lisburne Group carbonate. The remaining 50 samples will be sandstone.

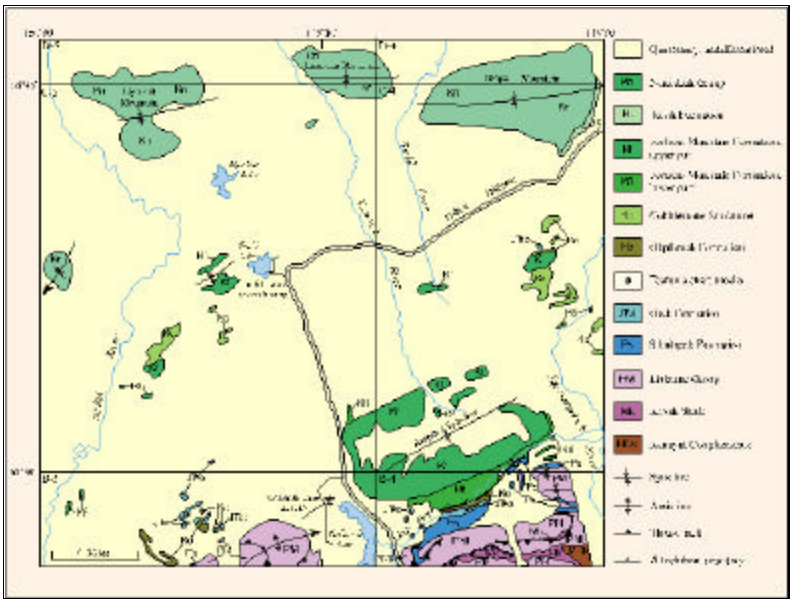
Summer 2000 fieldwork indicates that sandstones and conglomerates of the Upper Cretaceous age Tuluvak sandstone contain rocks with excellent porosity and permeability and also suggests that the Tuluvak is an outstanding hydrocarbon reservoir objective in the subsurface. Oil-stained, possible deepwater equivalents of the Tuluvak sandstone were examined east of the Dalton Highway along an unnamed tributary to the Sagavanirktok River.

A DGGS report is scheduled for release in March 2002 in paper copy and in electronic format on the DGGS Web site. Upon completion of this study, all rock samples, with field locations and report, will be archived at the DGGS Geologic Materials Center in Eagle River, Alaska.



PHILIP SMITH MOUNTAINS STATEMAP PROJECT

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



Geologic mapping in the northwestern Philip Smith Mountains Quadrangle 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 increase the production of these geologic maps. This 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 east-central Brooks Range foothills and the North Slope of Alaska. These surface exposures can then be correlated to the subsurface deposits of the Prudhoe Bay–Kuparuk oil fields as well as units mapped in ANWR and NPRA. Renewed attention by the oil companies on plays outside of the Prudhoe Bay–Kuparuk area is evident in recent lease sales in the National Petroleum Reserve–Alaska and new oil discoveries in northern Alaska. In addition, shrinking supplies and increased prices for natural gas have resulted in exploration for natural gas in areas of northern Alaska previously thought to be uneconomic. Many petroleum explorationists, in particular those in smaller companies, rely on DGGS for the continuity of mapping and stratigraphic studies to improve understanding of the geologic framework of the North Slope and advance their search for frontier plays.

During the summer of 2001 DGGS conducted 21 days of geologic field mapping and support investigations in the Philip Smith Mountains entire C-5, and portions of the D-5, D-4, C-4, B-5, and B-4 quadrangles. Objectives included: completing sequence stratigraphic studies of the Torok Formation and the Nanushuk Group to develop detailed facies interpretations and evaluate these units for reservoir potential; sampling for organic geochemical analysis to evaluate hydrocarbon potential in upper Triassic to Lower Cretaceous rocks; correlating units in the Ellesmerian and Lower Brookian sequences to understand the structural transition from parautochthonous rocks of ANWR to allochthonous rocks of the central Brooks Range and foothills and constraining the timing of what must have been polyphase and syndepositional deformation of some of these units; and petrographic studies to differentiate units and define provenance for Lower Brookian rocks. Support investigations included sampling for organic geochemistry, porosity and permeability, micropaleontology, invertebrate paleontology, paleobotany, thin section petrographic studies, and gamma-ray spectrometer surveys. This information will be used to evaluate petroleum source rock and reservoir potential and to establish stratigraphic relationships and facies changes, the necessary components of a petroleum system.

Detailed surficial mapping, as well as engineering material studies, is another component important to this project. The Dalton Highway, the Trans-Alaska Pipeline System, and one of the proposed routes for the new natural gas line bisect this map area. This project will provide assessments of material sites and potential hazards along these routes.

Products resulting from this project by June 2002 will include:

1. Comprehensive geologic map at 1:63,360 scale with supporting text.
2. Surficial geologic 1:63,360-scale map.
3. Construction material resources and geologic hazards strip map along the Dalton Highway/ TAPS corridor.
4. All samples will be compiled and available in a geographically referenced relational database.

COALBED METHANE FOR RURAL ALASKA ENERGY

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

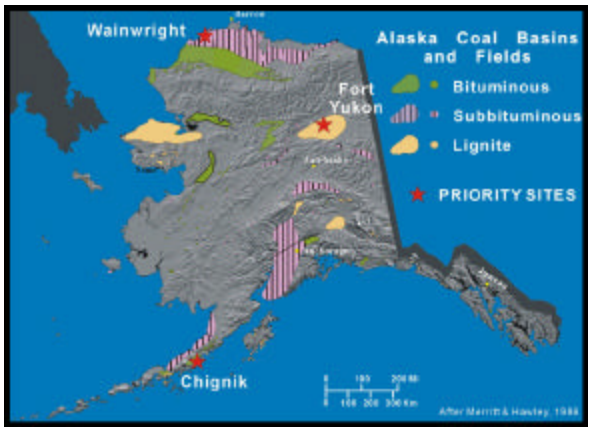
The Division of Geological & Geophysical Surveys (DGGS) is evaluating the potential for local sources of coalbed methane to meet Alaska's rural energy needs in communities situated on or near coal basins. The presence and quantity of producible coalbed gas in these basins remains unknown and untested 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. The field portion of the project,

mini-vibrator

cable laying



funded by State CIP and U.S. Department of Energy (DOE) funds, was completed between March 31 and April 14 when approximately 8.5 line miles of seismic reflection study was conducted using the Kansas Geological Survey's IVI mini-vibrator that was flown from Fairbanks to Fort Yukon on an L-382 Hercules aircraft. Initial processing of the acquired data shows excellent vibration transmission through the permafrost zone to subsurface layers. There are a number of significant reflectors present, including the top of the lignite (~1,200 feet) and indications are that the coal-bearing zone may be up to 200 feet thick.

Following the completion of site assessment by DGGS, USGS, and BLM, the next step is to drill a minimum of two wells per site. The first well is used to determine the stratigraphic position of coals for subsequent coring in the nearby second well. Coals in the second well are then cored and measured for gas content by canister desorption. The two wells are then used for hydrologic testing by pumping one well and monitoring water table response in the other well. Environmental concerns are assessed by chemical analysis of the coalbed water produced during these tests. The data gathered by this project will quantitatively estimate the gas in place, pumping requirements for production, and the disposal requirements for the produced water.

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.

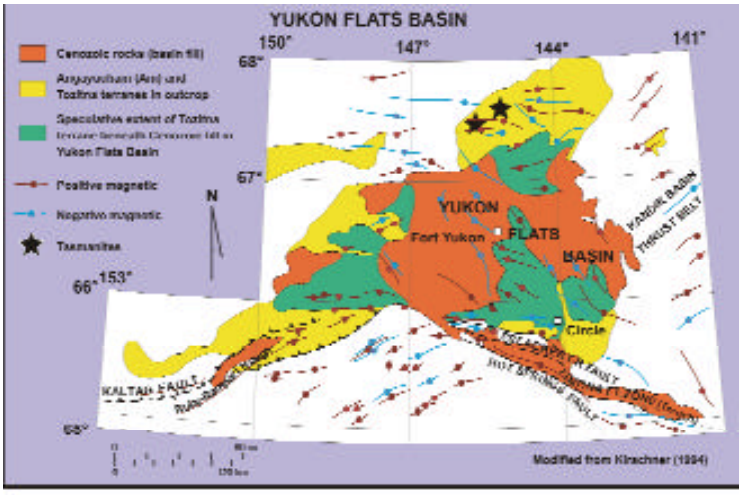
YUKON FLATS BASIN HYDROCARBON POTENTIAL STUDY

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

The Division of Geological & Geophysical Surveys (DGGS) together with the U.S. Geological Survey (USGS) will evaluate the coal and associated shale and sandstone strata of the Yukon Flats basin and provide new scientific data on coal quality, sedimentary facies, depositional environments, and hydrocarbon reservoir potential.

Background: Several aspects of the Yukon Flats basin 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 west, 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, indicate the basin is filled with at least 15,000 feet of nonmarine sediments. Seismic stratigraphic observations indicate the basin-fill is comprised of three stratigraphic cycles, each including 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 the Nenana basin, temperatures conducive to petroleum maturation and expulsion occur below 7,000 to 10,000 feet. These attributes, combined with 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 it with new site-specific fieldwork around the perimeter of the basin to develop an up-to-date interpretation. 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.

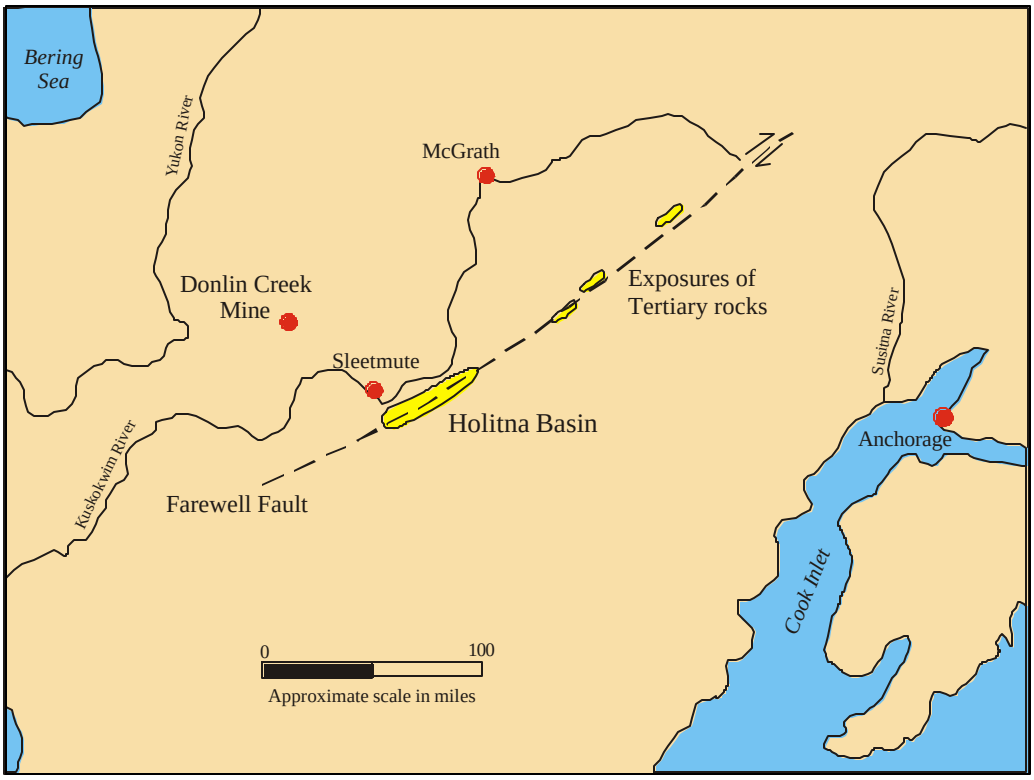
HOLITNA BASIN ENERGY RESOURCE STUDY

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 one-year 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 neighboring communities and promote development of nearby mineral resources, such as the Donlin Creek Mine. Little detailed information is available regarding the geology of the basin, which discourages future exploration of the basin's energy resources.

The Holitna basin is a subsurface strike-slipbasin 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 field season 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. In addition to doing fieldwork, DGGS is reinterpreting high-resolution aeromagnetic data of the region and is pursuing the purchase of a detailed gravity survey of the region. Both of these geophysical datasets will result in a better understanding of the origin, deep structure, and sedimentary fill of the Holitna basin. DGGS is also evaluating shallow seismic techniques to evaluate the subsurface structure. The dataset resulting from this project will allow DGGS to make meaningful general conclusions regarding the gas potential of the Holitna basin. The dataset and DGGS's summary report might help lower the risk associated with exploring this remote frontier 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 Spring 2002.



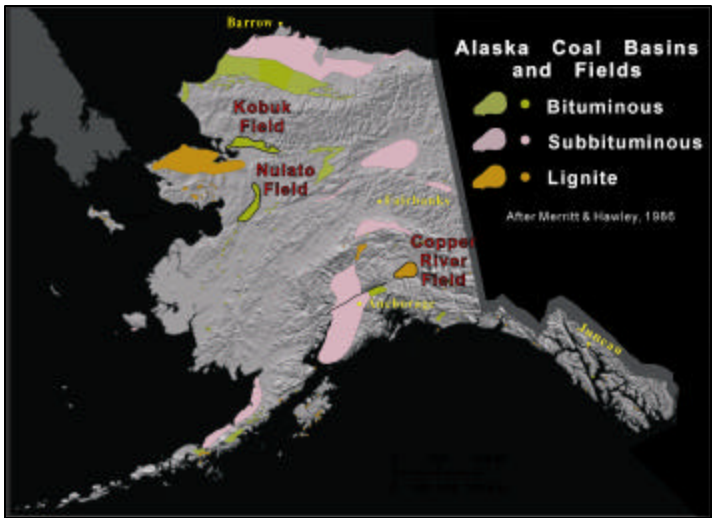
ALASKA COAL DATABASE
NATIONAL COAL RESOURCE DATA SYSTEM

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, archived in a single, readily accessible database. Encoded and formatted data for northwestern, northern, interior, southcentral Alaska, Alaska Peninsula, and small coal fields of Alaska has 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. This was particularly evident in (1) the Copper River Field and associated Summit and Wrangell districts, (2) the Nulato Coal Field, and (3) the West and East Kobuk coal fields of the Kobuk Basin. These areas are relatively unexplored and their coal quality and stratigraphic context are poorly known, yet they contain a number of communities that currently import costly diesel fuel to provide home heating and electrical power generation. The communities are Glennallen, Copper Center, and Gakona (Copper River Field); Nulato, Galena, Kaltag, and Koyukuk (Nulato Field); and Ambler, Kiana, Kobuk, and Shungnak (Kobuk Field). A solid fuel or coalbed gas alternative for these communities would help avoid costly and environmentally damaging fuel spills while also providing a potentially cost-effective fuel alternative to meet energy needs. The "New Coal Resource Data for Copper River, Nulato, and Kobuk Coal Fields" NCRDS project will help alleviate the lack of data for these coal fields by providing significant new coal quality data and accurate stratigraphic information. This information is essential for meaningful evaluations of the coal resources in these areas.

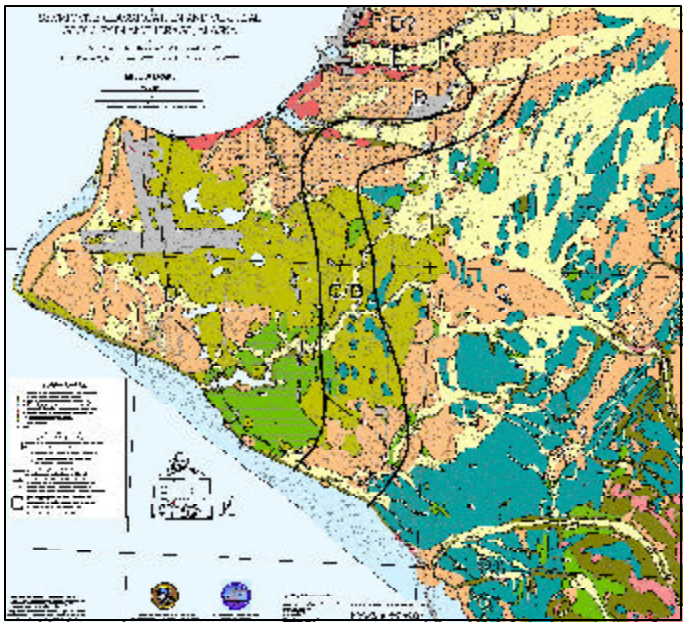
In June 2000, DGGS staff conducted field examinations of coal outcrops within and along the perimeter of the Copper River Basin. In June and July 2002, coal samples will be collected from the Nulato and Kobuk River coal fields to be submitted for proximate, ultimate, and trace-element analyses, and selected 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.



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).



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.

In conjunction with this project, we are collaborating with the University of Alaska Geophysical Institute (UAGI) in 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. The draft site-response maps were developed in FY00; an example appeared in last year's briefing paper. During FY01, several dozen copies of these maps were distributed to potential users in the Anchorage geotechnical community. We are now incorporating comments from these users 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, we developed collaboratively with UAGI a seismic soil-type map, which also corresponds to provisions of the latest seismic building code and will be published by DGGS during FY02. The draft of this map appears here. According to the building code, seismic soil types are ideally assigned according to seismic shear-wave velocities in the upper 30 m (100 ft) 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 m.

DGGS's participation in the seismic microzonation project is supported by USGS/NEHRP. DGGS has also received support from this program to develop a liquefaction-susceptibility map of Anchorage using data in the borehole database. This map will be completed in FY02.

TSUNAMI INUNDATION MAPPING

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

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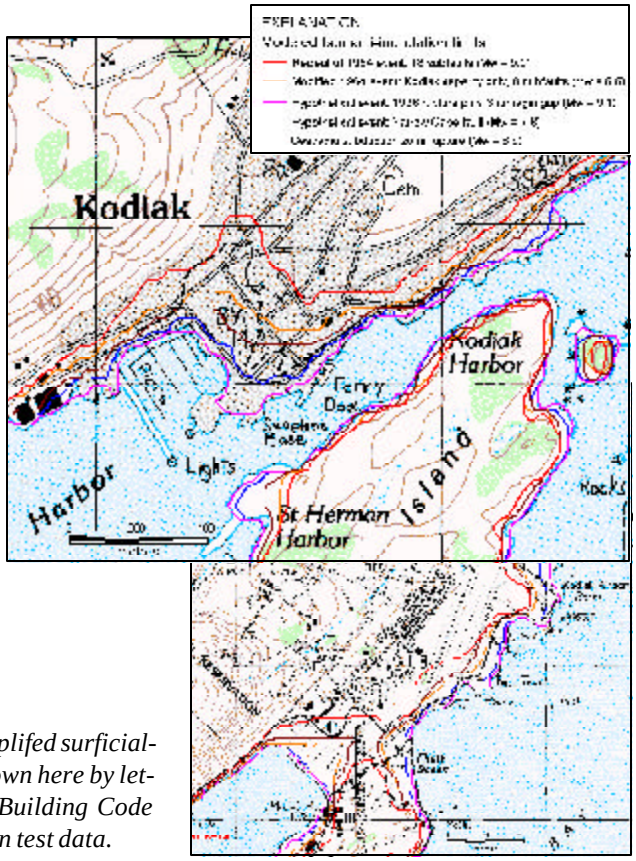


Seismic soil-type classifications superimposed on a simplifed surficial-geologic map of Anchorage. Seismic soil types, shown here by letters C-E, are defined by criteria in the Uniform Building Code based on seismic-velocity and standard penetration test data.

GENERALIZED EARTHQUAKE HAZARD MAPPING FOR SOUTHERN ALASKA COASTAL DISTRICTS

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

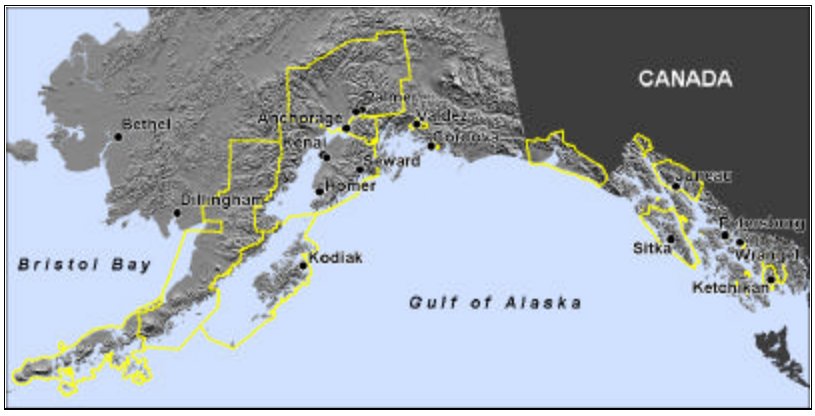
As part of the Enhancement Grants component of the Alaska Coastal Management Program, DGGS has obtained funding from the Division of Governmental Coordination to prepare generalized earthquake hazard maps of coastal districts in southern Alaska. This two-year project will provide geohazards information to help coastal districts implement the geophysical hazard standard (6AAC 80.050) and to update the resource inventory section of district plans. Products of the work will be maps of Quaternary faults and earthquake ground-shaking hazards for coastal districts in southwestern, southcentral, and southeastern Alaska at scales appropriate for area planning and preliminary project evaluation.

A significant difficulty for Alaska coastal districts in implementing the geophysical hazard standard is that there are very few reliable maps showing the location and severity of hazards. Detailed hazard maps of large areas are slow in coming because the field efforts necessary to collect the required data are time-consuming and expensive. However, there is now sufficient available regional information on active faults, earthquake frequencies, and ground-shaking potential, as well as GIS-based modeling methodology (HAZUS) to prepare generalized maps of these hazards for the coastal districts in which the hazards are significant. Preparation of these earthquake-hazard maps, based on existing information, is the overall objective of this project. No fieldwork is planned.

The results of this project will improve the ability of districts and permit applicants to address the geophysical hazard standard in southwestern, southcentral, and southeastern Alaska. The intent is to make the best use of available geohazards information in a reasonable time without conducting costly additional fieldwork. Consequently, the maps will be necessarily generalized. By having earthquake-hazard information at the permit-application and planning stages, applicants and districts will be better equipped to make wise development decisions and thereby reduce future losses and casualties from earthquakes. The information can be used to update coastal district resource inventories and may lead to more specific enforceable policies for mitigating geophysical hazards.

The earthquake-hazard maps will be made available as registered GIS images as well as on paper. The format, scale, and types of information to be portrayed will be determined in consultation with the districts. Because detailed geologic and subsurface data are still lacking in many areas, the maps will not portray hazards from earthquake-induced landsliding. The maps will also not address tsunami inundation or volcanic hazards, nor will they replace existing, more detailed earthquake-hazard maps that are currently available or in preparation for parts of the Municipality of Anchorage.

During the first six months of this project (January–June 2001), most of the effort was devoted to compiling existing geologic maps, scanning and registering them for quick reference in GIS, and digitizing those for which digital GIS versions are not yet available. An overview of the project, including a summary of earthquake hazards in the southern coastal regions of Alaska, was presented at the state coastal management conference in Juneau. Earthquake hazard maps of the southcentral and southwestern coastal districts will be completed during FY02.



Coastal districts in southwestern, southcentral, and southeastern Alaska for which DGGS will develop generalized earthquake-hazard maps

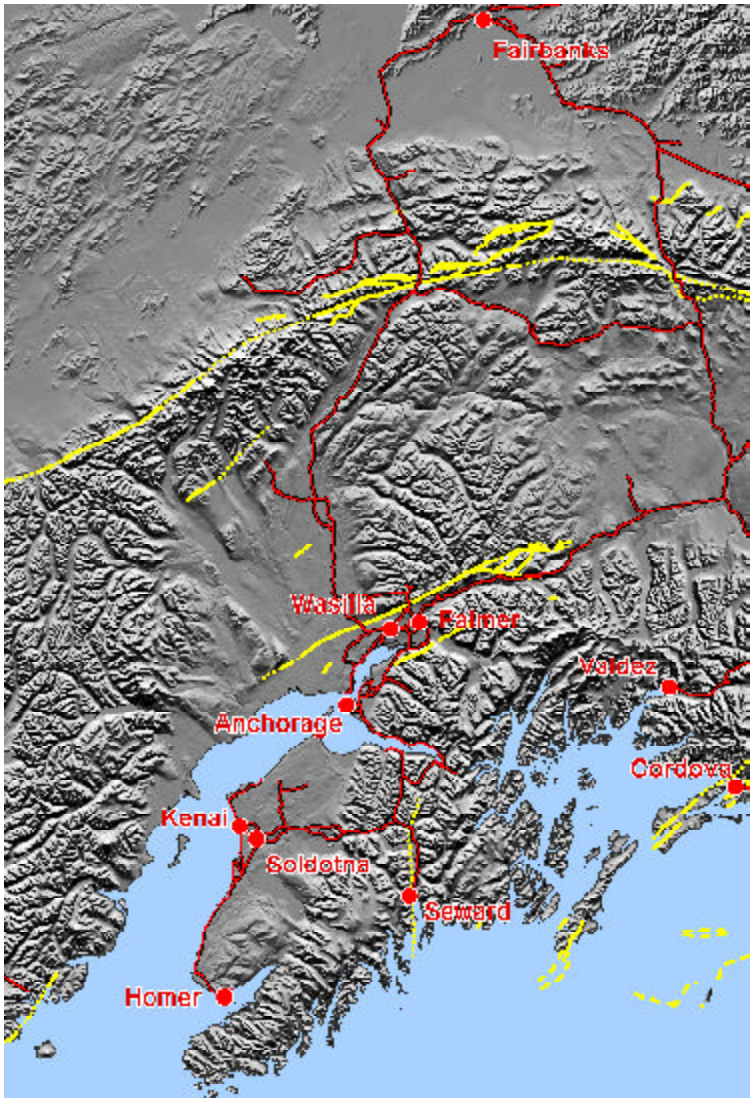
MAPS AND DATABASE OF QUATERNARY FAULTS AND FOLDS

Contact: Patricia A. Craw, Engineering Geology Section, 907-451-5009, patty@dnr.state.ak.us

Geologic maps show that there are thousands of faults in Alaska. However, only a fraction of these have been active in the recent geologic past; most have not undergone displacement for millions of years. Faults that are of concern as possible sources of earthquakes are those that show evidence of activity during the Quaternary period, roughly the past 2 million years. Active faults are those that have had historic seismicity or show geologic evidence of displacement during the Holocene epoch, approximately the past 10,000 years. A recent neotectonic map of Alaska shows that there are at least 140 surface faults with evidence of activity during the Quaternary period. Although this excellent map provides an invaluable reference on active faulting in the state, it was compiled at a scale of 1:2,500,000, which is not meant for use in project planning at the local level. Additionally, the map does not provide some important information available for many faults, such as orientation, slip rate, or earthquake recurrence interval.

The U.S. Geological Survey has initiated a cooperative project with DGGS to compile data on active faults and folds in Alaska in a standard GIS format. With funding provided by USGS, DGGS has conducted an extensive literature survey to record all published information on faults and folds that show geologic or seismic evidence of activity during the Quaternary period. DGGS will digitize the fault traces and fold axes at 1:250,000 scale and record 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.

This project comprises four tasks. The first task, to conduct a comprehensive literature search for pertinent published materials on Quaternary faults and folds in Alaska, has been completed. DGGS has published this preliminary bibliography of 753 references as a menu-driven Microsoft Access database, searchable by structure name, fault section, senior author, and quadrangle. The second task, to complete text-based descriptions of these structures using a nationally established format and building on USGS-supplied preliminary data, is in progress. The two remaining tasks are: (1) compile fault traces and fold axes in GIS with associated attributes according to national guidelines, and (2) revise text files and compiled map data following technical review comments. The project will be completed by the end of FY02.



Quaternary faults in southcentral Alaska

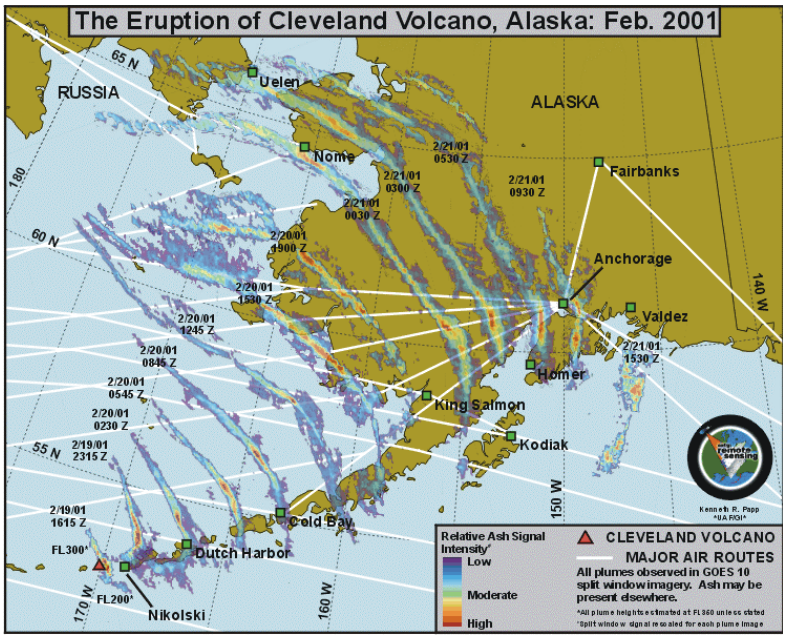
ALASKA VOLCANO OBSERVATORY

Contact: Christopher J. Nye, Engineering Geology Section, 907-474-7430, cnye@giseis.alaska.edu

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.

Networks of seismometers are the heart of AVO's volcano monitoring. These networks consist of about a half a dozen instruments clustered about potentially hazardous volcanoes. Several instruments are needed close to each volcano to accurately record and locate the very small earthquakes associated with volcanic eruptions. Changes in the locations of earthquake hypocenters over months and weeks provide very important information about impending eruptions. Since 1996 AVO has rapidly expanded the number of monitored volcanoes using $2 million in new annual funding provided by the Federal Aviation Administration. The new funding is a direct response to increasing air traffic in the north Pacific and the hazards that volcanoes present to that traffic. During this time the number of monitored volcanoes has risen from 4 to 22 of the 40+ active Alaska volcanoes. During FY01 the monitoring system on Great Sitkin Volcano, near Adak, was completed and sites throughout the arc were maintained. In July 2001 a seismic network was installed on Veniaminof Volcano, which last erupted in 1994. During the 2002 field season a new seismic network will be added at Okmok, and permanent GPS networks at Akutan and Okmok.

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



This composite image shows the relative movement of the February 19, 2001 eruption cloud from Mt. Cleveland as observed by the GOES 10 satellite. The first image at 1615 UTC on 2/19/01 is approximately 2 hours after the initial eruption start time. Over time, this first plume split, and sent ash to the southeast up to 20,000 ft. asl and to the northwest up to 30,000 ft. asl. After this time, the plume rose to 35,000 ft.. Times are listed in UTC (or Z). Note: This image shows areas of detected ash only and ash may have been present elsewhere.

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. During FY02 data from the new MODIS satellite will be added. 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 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 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 FY01 progress are below:

Helicopter logistics. DGGS manages $325,000 for helicopter procurement for all major AVO projects. In FY01 this included contracts for fieldwork based out of Adak, Fort Glenn (Umnak Island), False Pass, Cold Bay, Pt. Heiden, King Salmon, Homer, Anchorage, and Glennallen. 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.

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 provide central management and oversight of samples and the evolving geochemical database. For both projects we provide important office and field GIS support. At Okmok the challenge is to construct a map base. There are no current detailed topographical maps of Okmok, so we are constructing a new 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 assigned to the project, and merge that with similar information collected over the past few decades.

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. In FY99 we launched the third version of the public page, with more intuitive organization, and much more content. A major new addition was individual pages for each active volcano, based on text and figures, a new USGS catalog with photographs, newly generated color maps, additional eruption narratives, and expanded bibliographies. This created what are essentially atlas pages for at least the historically active volcanoes. We are also beginning to create a library of PDF files to facilitate distribution of richly formatted AVO print publications. This now makes the AVO Web site the best place for one-stop-shopping for information on Alaska volcanoes. 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. During FY02 the site will undergo a major overhaul aimed at simplifying navigation through the site and satisfying requirements of the Americans with Disabilities Act.

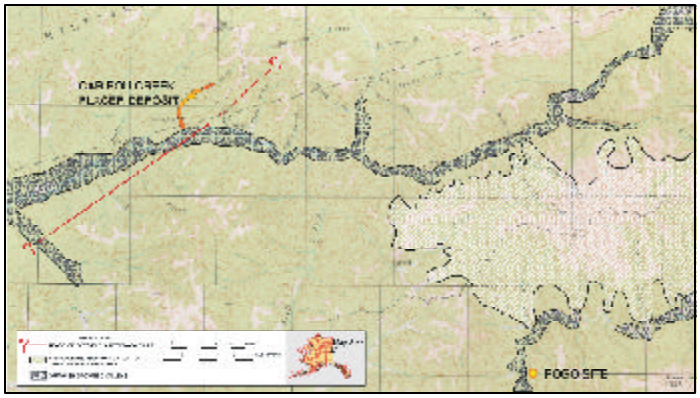
Presentation and Distribution of Geospatial Data. AVO is producing a folio of GIS (ArcInfo) geologic maps and map-based hazard reports on individual volcanoes. The projects that produce these products also usually have many kinds of spatially referenced data, including sample descriptions, geochemistry, age data, stratigraphic columns, etc. Traditionally these are distributed as either paper products (map plus text and tables) or as ArcInfo coverages. Paper products severely limit the ability of the end user to manipulate, sort, query, or otherwise interact with all aspects of the data. DGGS members of the AVO will seek new methods for presenting geospatial data that will allow a high level of interactivity for relatively unsophisticated computer users. This is an ongoing task.

Geochemical Database: DGGS provides oversight and coordination of contracting for whole-rock geochemical data for all of AVO. This oversight ensures that an internally consistent database continues to evolve among all AVO sub-projects.

SURFICIAL AND ENGINEERING GEOLOGY OF THE SALCHA RIVER–POGO AREA

Contact: DeAnne S. Pinney, Engineering Geology Section, 907-451-5014, deanne@dnr.state.ak.us

DGGS is in the first year of a three-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 (see map). In order to explore 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 to guide planning activities and identify key features of potential interest.



DGGS efforts are focusing on determining and understanding the geologic environments of the Salcha River–Pogo area, especially with respect to gold mineralization. As a corollary to this, the Engineering Geology section of DGGS is mapping the surficial deposits in order to understand the genesis of the landscape in which the mineralized rocks are found, to assess the cover deposits and other rock units for their potential as construction materials sources in the event of further economic development or infrastructure needs in the region, and to identify possible geologic hazards that could pose a danger to human life and property should there be increased development in the area. The figure shown above illustrates the approximate maximum extent of Pleistocene glaciation in the mountains immediately north of the Pogo site. We believe the valleys of the Goodpaster and Salcha rivers were carved by ancient, pre-Pleistocene glaciers and subsequently filled by large influxes of Pleistocene outwash sediments to form the broad, flat-bottomed valley floors we see today.

To determine the bedrock profile of the Goodpaster valley, DGGS carried out gravimeter surveys along two transects across the valley near the Pogo gold deposit during the summer of 2001 (see photos). Data gathered by this survey will allow us to model the bedrock surface of the valley bottom under the outwash and determine thickness of gravel cover, which will be significant in evaluating the economics of any potential future placer mining operations.

Also shown on the map is a possible Quaternary fault that appears to offset loess deposits south of Butte Creek. This is significant in that no faults of such young age have been documented previously in the area. Summer field surveys were unable to locate any exposures that could confirm the presence of the fault, but geomorphic features clearly indicate a break in the surface along the trace. The implication of such recent tectonic activity has yet to be explored, but will necessarily change our picture of the geologic environment of the Salcha River–Pogo area.

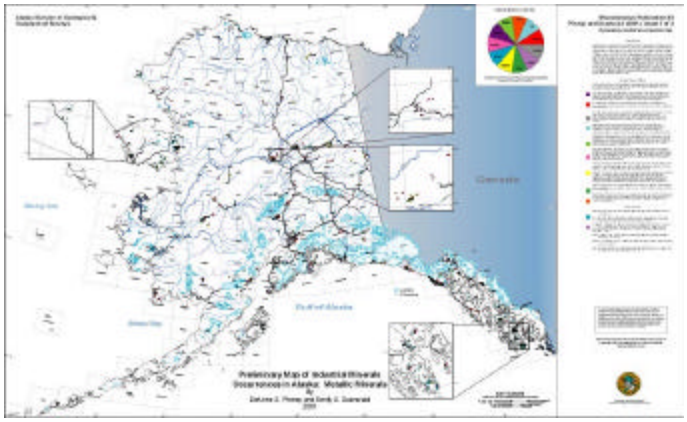
The anticipated products of this project are a series of geologic-framework maps at 1:63,360 scale describing the surficial geology, construction materials resources, and potential geologic hazards of the area. We will be using the DGGS Geographic Information System (GIS) to generate these maps, and all data for the project will ultimately be stored and made available in a geographically referenced relational database. We hope to be able to serve this data on the World Wide Web upon completion of the project.

GIS-BASED BIBLIOGRAPHY OF INDUSTRIAL MINERALS SITES IN ALASKA

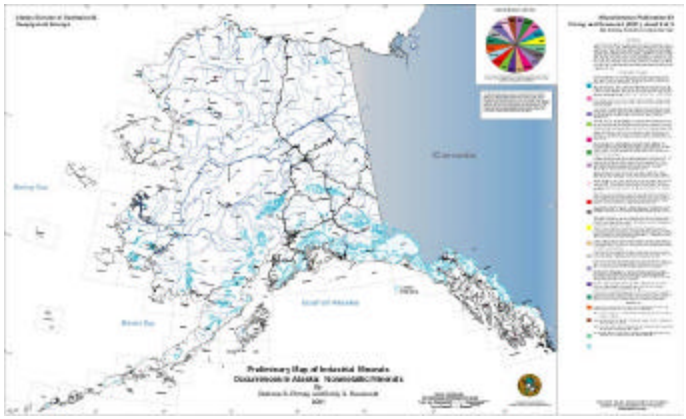
Contact: DeAnne S. Pinney, Engineering Geology Section, 907-451-5014, deanne@dnr.state.ak.us

DGGS is updating and expanding the existing GIS-based bibliography of industrial minerals sites in Alaska in order to document and inventory the state's potential economic commodities and make the information available to the public digitally via the Internet and on CD-ROM.

A broad and simple definition of industrial minerals is that they are principally non-metallic (that is, they are not utilized as metals even though the material in question is, strictly speaking, a metallic mineral), non-fuel rocks and minerals. They include a broad range of minerals that are consumed for a wide variety of industrial uses. Industrial minerals are generally regarded as common, simple products that are sold cheaply into local markets, but many are actually quite rare, most are extremely complex, some far exceed the price of the more glamorous metals, and a significant proportion are shipped to markets around the world.



Map 1: Metallic and rare-earth minerals



Map 2: Nonmetallic minerals

The maps shown above were released by DGGS in 2001 and were generated using the updated database structure that DGGS has applied to existing data compiled from the literature on industrial materials resources in Alaska. The GIS database used to generate these maps contains 1,608 records of industrial minerals occurrences documented from 1911 to 1988. The 31 commodities are subdivided into two groups in order to be represented on map sheets: metallic and rare-earth (map 1), including magnesium, titanium, iron, chromium, columbium, vanadium, thorium, uranium, manganese, aluminum, and the rare-earth elements; and nonmetallic minerals (map 2), including graphite, wollastonite, gemstones, fluorite, barite, asbestos, mica, zeolites, kyanite, pumice, diatomite, perlite, quartz, clay, gypsum, zirconium, sulfur, silica, phosphate, and calcium. Construction materials, including sand and gravel and stone, were included in a very general way in the original data search but were ultimately eliminated because occurrences are so numerous and widespread that the documentation of their distribution was deemed beyond the scope of this project.

The Engineering Geology section of DGGS will be focusing on updating this GIS database in FY02 to reflect more recently documented occurrences of industrial minerals in the state and to put it into a format that can be readily accessed on the World Wide Web or downloaded from CD-ROM. As part of this project, DGGS is also compiling an in-house library of all the information sources that will be included in the final GIS-based Industrial Minerals Bibliography and Index.

Industrial minerals in Alaska represent a resource of potentially significant value that is currently under-exploited, in large part because of access and transportation barriers. Renewed interest in railway expansions to link Alaska with new markets may act as a catalyst for exploration for these commodities, and could open a new chapter in natural resources development in the state.

GEOLOGIC DATA COMPILATION ALONG THE PROPOSED NATURAL GAS PIPELINE ROUTE FROM PRUDHOE BAY TO THE YUKON BORDER

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

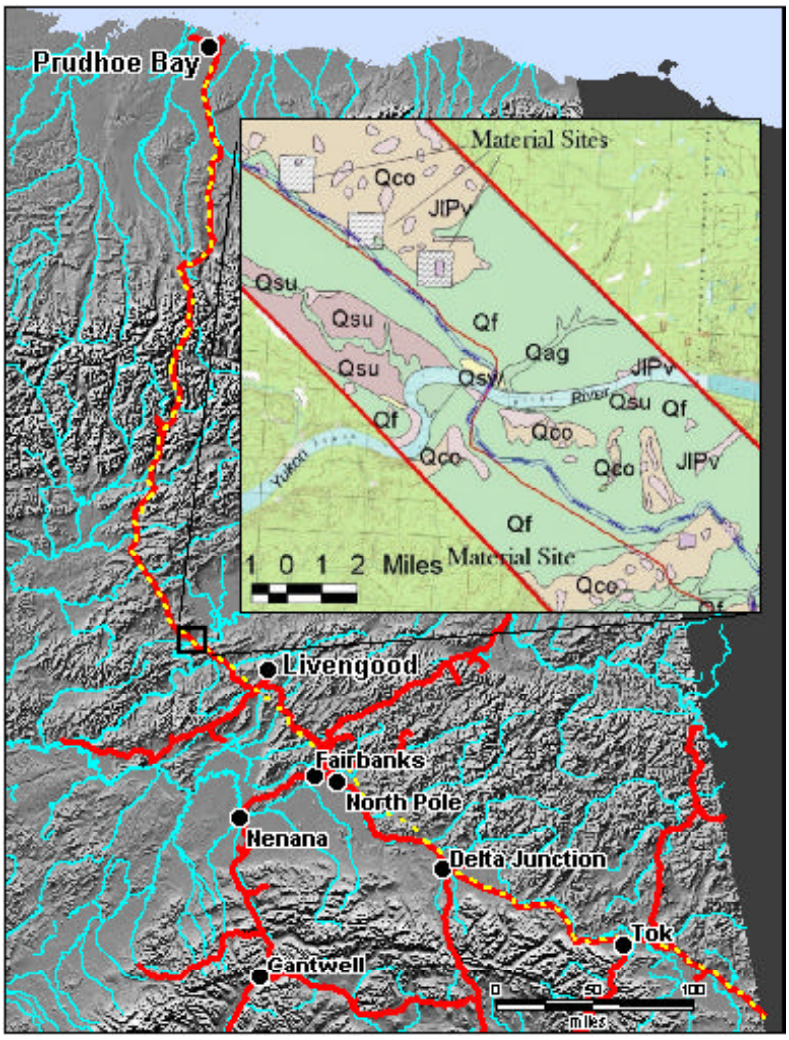
Through special appropriation by the Legislature, DGGS has initiated a project to compile all data pertinent to engineering geology, geologic hazards, and construction materials resources along the proposed natural gas pipeline route from Prudhoe Bay to the Yukon border. The objective of this work is to determine the current level of knowledge about geologic hazards and construction materials within the proposed natural gas pipeline corridor that could affect future gas pipeline design, construction, or safety.

DGGS will compile all text reports in the public domain that discuss any aspect of the engineering geology of the ANGTS corridor, and all geologic maps that intersect the proposed pipeline centerline or extend within 1 mile of it. Because DGGS will be storing images of the maps, the entire map will be stored. Compiling all data within 1 mile of the centerline will allow for possible reroutes, and ensure inclusion of information on all geologic features that may affect pipeline integrity, such as faults.

Current funding for this project supports data compilation from Prudhoe Bay to Delta Junction with a completion date of June 30, 2002. DGGS will propose continuation of the project in FY03 to complete the compilation along the remainder of the route from Delta Junction to the Yukon border.

DGGS will undertake the following tasks as part of the currently funded project:

1. Locate and assemble all available and pertinent geologic data on the proposed natural gas pipeline corridor from Prudhoe Bay to Delta Junction, Alaska.
2. Create a computer-accessible georeferenced database of all geologic maps and reports for the area within the corridor.
3. Create a digital geologic map-file archive for the corridor in georeferenced MrSid format and a digital document-file archive in PDF format.
4. Create a GIS application that will allow a broad spectrum of users to access and display the currently available data.



Portion of the proposed natural gas pipeline corridor in the vicinity of the Yukon River, showing compiled geologic mapping and construction materials sites. Dotted yellow line indicates the route of the proposed natural gas pipeline.

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

Contact: DeAnne S. Pinney, 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: higher employment; greater access to health care, water, sewer, and transportation; provision of a tax base or payments that can support schools and needed social services; and ultimately, development projects that provide greater self-sufficiency and determination for the future of the Native communities.

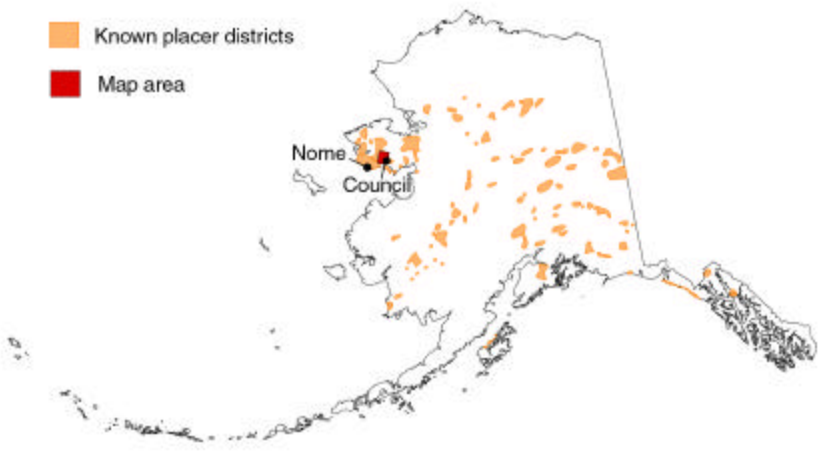
Historically, small-scale placer gold mines have been highly accessible as a means of generating income in rural areas. Since 1992, however, 780 of a total 1,251 placer mining jobs have been lost statewide. Most of these jobs were located in rural Alaska and provided well paying seasonal employment to local residents. A large part of the reason for the decline in the number of placer miners is that most known placer districts are perceived as mined out. Casual review of aerial photographs and topographic maps of historic mining districts suggests that untapped placer reserves may be located by applying remote sensing technologies to analyze landforms and reconstruct Quaternary geologic history.

DGGS has initiated a NASA-funded project to apply remote sensing imagery, high-resolution Digital Elevation Models (DEMs), and high-altitude color-infrared (IR) photography in conjunction with expert 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. DGGS project personnel will also present a series of educational workshops in Nome for the purpose of teaching interested members of the rural communities impacted by this research how to understand and interpret the map and GIS products generated by the study.

Products from this research will consist of detailed geologic maps of unconsolidated Quaternary sedimentary deposits and 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 approximately four standard 1:63,360-scale (inch-to-mile) quadrangles (Bendeleben A-4, A-5; Solomon D-4, D-5). 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 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, for more than a decade DGGS has not been able to support a placer geology program. 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 in order to evaluate the other placer districts throughout the state (see figure).



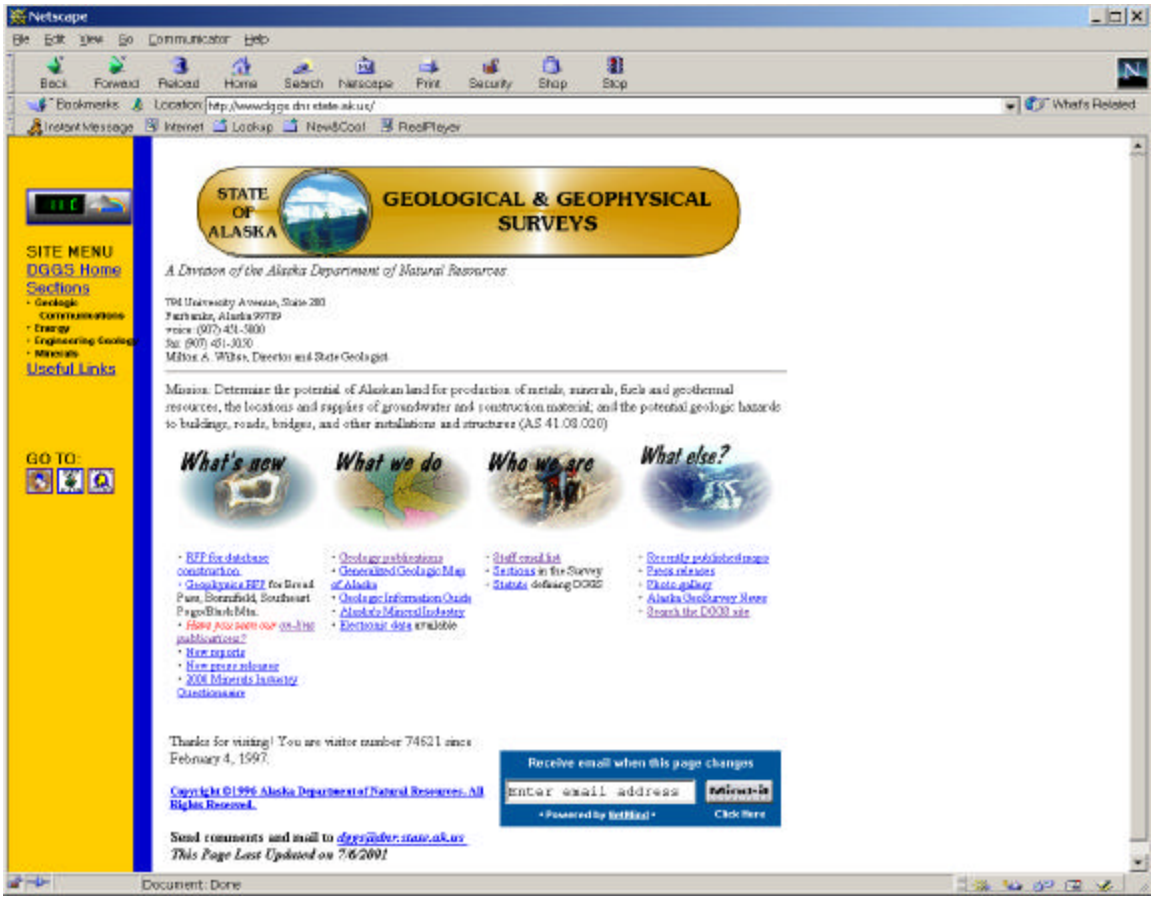
DGGS WEB SITE

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

The DGGS Web site maintained its growth in FY01, with 30,429 visits to our page. Most of these visitors were from industry, with a sizeable portion from government agencies. The most popular parts of the site this year were the *Generalized Geologic Map of Alaska,* the *Guide to Alaska Geologic and Mineral Information,* and our newly completed on-line scanned publications, including both text and maps of DGGS published reports.

Many files are available for downloading from the site. In order of popularity, the files downloaded most in 2001 were AR2000, *DGGS Annual Report* for 2000; PDF 98-37a, *Preliminary Geologic Map of the Tanana A-1 and A-2 Quadrangles, Central Alaska*; and IC 44, *Guide to Alaska Geologic and Mineral Information*.

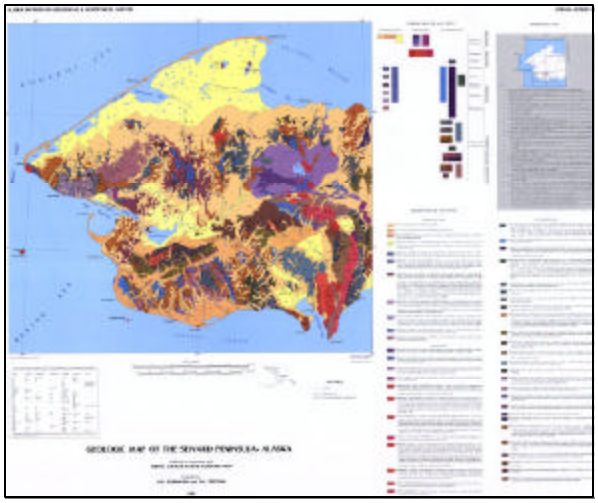
Future plans for the site include rearranging pages to make data easier to find, including information from each section in DGGS, and making the DGGS publications that are now on line accessible through database search functions that access the Division-wide geologic database now being created.



SCANNING AND DOCUMENT CONVERSION PROJECT

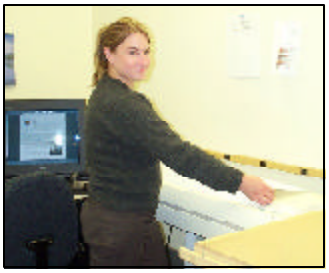
Contact: Lauren Staft, Geologic Communications Section, 907-451-5052, Lauren_Staft@dnr.state.ak.us

In the 40 years since statehood, DGGS and its predecessors have published a wealth of geologic research and information about the geology, natural resources, and geologic hazards of Alaska. DGGS also is custodian of the most complete set of research reports from the Alaska Territorial Department of Mines. Except for maps and reports published in the past few years, all of these publications have existed solely on paper. Access to hard-copy publications effectively was limited to patrons of research libraries in Fairbanks, Anchorage, and Juneau and to persons who purchased publications through the DGGS office in Fairbanks.



Courtesy of a grant from the USGS under the Alaska Minerals Data and Information Rescue Program, DGGS was able to carry out a project to convert most past publications and maps to electronic files. Almost all DGGS archived publications are now available through DGGS's Web site (http://wwwdggs.dnr.state.ak.us). These publications include both "text" and oversized sheets such as maps, large data tables, stratigraphic columns, and other large illustrations. The "text" portions of all available DGGS publications (pages of text, tables, and illustrations that are 11 inches by 17 inches or less in size) have been scanned. This body of information comprises 67,000 pages from 1,900 document titles. These publications are in Adobe Acrobat Portable Document Format (PDF), a file format that can be read on almost all computer platforms using free software downloaded from Adobe Systems, Inc.

More than 3,000 oversized sheets are also 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/.



Publications are currently listed using the DGGS publication series identification number (for example, PDF 88-02). These files are indexed in DGGS's catalog of publications, IC-11 and addenda to IC-11 which are available on the Web site. The publications are also searchable by quadrangle. Through a graphic map interface, users can simply click on a map of Alaska to access links to publications in their quadrangle of interest. DGGS publications are also searchable by indexed-term and full text through Google's SiteSearch service. This search engine scans all text on the Web site, including reports in PDF format, by user-defined keywords.

For the future, DGGS is exploring options for further enhancing the users' ability to query all of the files and retrieve multiple documents on the Web site. When this search capability is implemented, it will make DGGS's "virtual library" a truly powerful resource for the 21st century!

DIGITAL GEOLOGIC DATABASE PROJECT

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

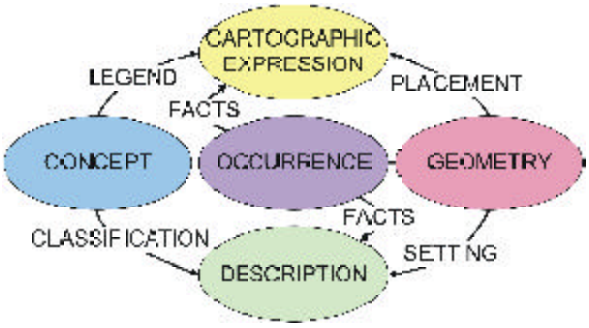
In October 2000, the Division of Geological & Geophysical Surveys (DGGS) began creating a geologic database system that will provide consistent data and information input, organization, and storage architecture. The database system will also provide data identification and retrieval functions that will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

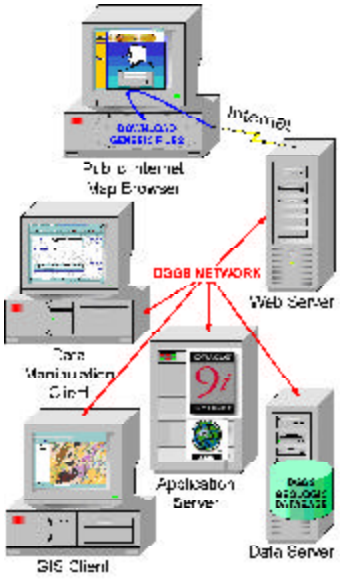
During the first year, project personnel have identified, gathered, and modeled geologic data for inclusion in the database. A data model was created to guide development of the architecture of the database system. DGGS is implementing that database system through a contractor that will design, program, and install the system hardware, software, and data loading utilities. By early 2002, when this phase of the project is complete, DGGS will have the database infrastructure in place and will load data into the system.

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 the community to search more effectively for geologic information specific to their needs.

The database system infrastructure will consist of a data server, relational database management software, and utilities to interface with the DGGS LAN and GIS. The database will be available to DGGS staff through the DGGS LAN. Oracle 9i and Oracle Spatial data files will



be stored on a Sun or Windows NT data server. DGGS will add ArcSDE to facilitate transfer of spatial data between project files and the database. DGGS intends to continue to use ArcGIS as a project-level geologic mapping, analysis, and cartographic tool. This infrastructure will allow DGGS to deliver digital data that are independent of projects, hardware, and software.



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

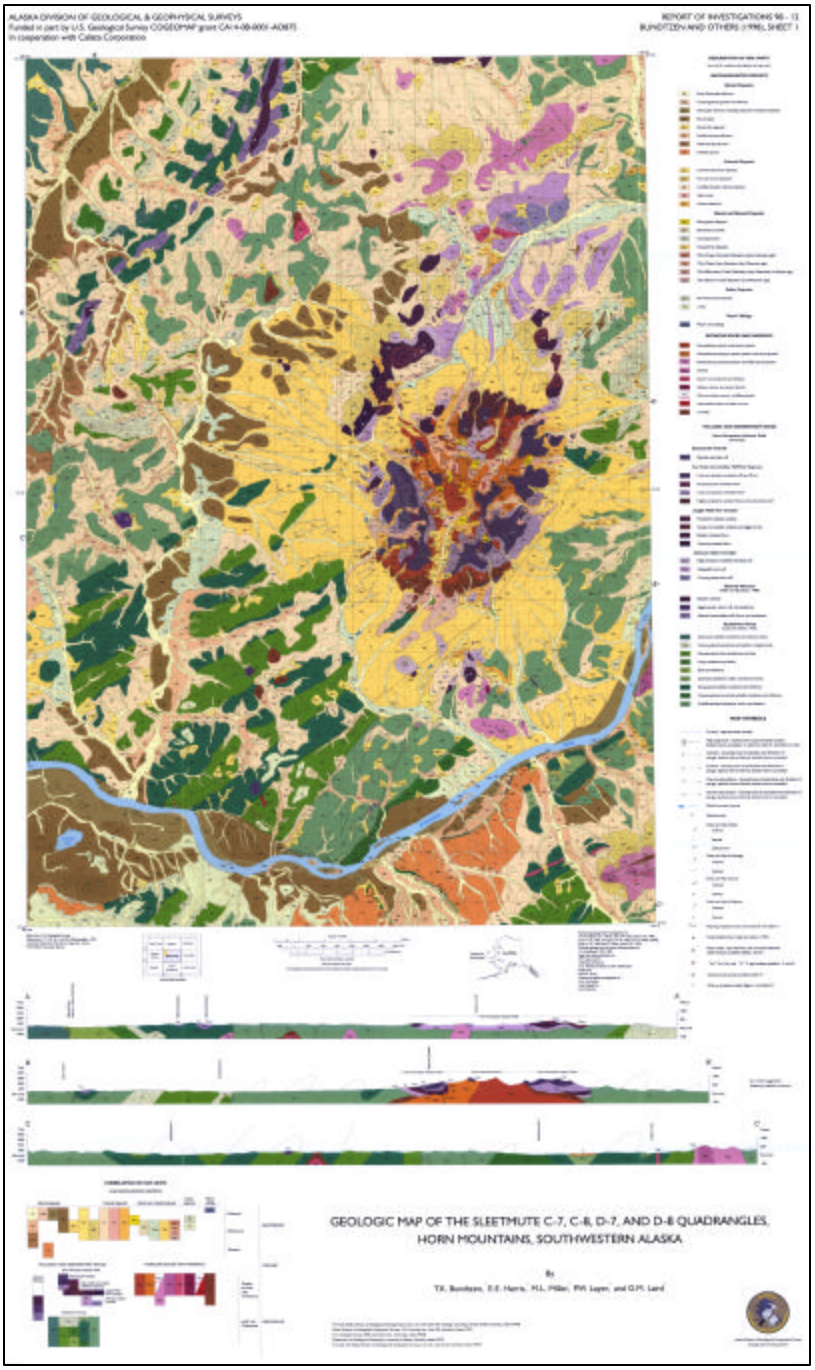
NATIONAL GEOLOGIC MAP DATABASE

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

Under the auspices of the USGS-funded STATEMAP program, DGGS will provide the information necessary to make DGGS map information available through the National Geologic Map Database (NGMD) at http://ngmdb.usgs.gov. Map information covering all 50 states, from several different mapping agencies including federal and state geological surveys, is available on this site.

DGGS has about 4,300 published geologic, sample location, geophysical, and other related maps that are larger than page size, associated with 2,700 publications. The majority of these maps exist in paper format and also have been converted to TIFF and compressed to MrSID digital format. A few hundred maps were created electronically and are stored at DGGS as Arc/Info coverages. Under this program DGGS will enter the descriptive data that the U.S. Geological Survey has requested for all state survey maps into National Geologic Mapping Database (NGMD)-compatible files. To do this, we will modify and supplement existing database files so that they conform to NGMD standards. Under the auspices of this and several other DGGS projects, we will complete Federal Geographic Data Committee (FGDC)-compliant metadata files for all GIS datasets used to create final DGGS publications that are included in the NGMD files above.

Included in the database for each state is information about available maps including title, authors, publishing organization, date of publication, location data, and how to acquire the map.



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ACCOMPLISHMENTS—FY01

DGGS has a mandate to generate new, objective, peer-reviewed information about the geology of Alaska and inventory its resources and geologic hazards. As in past years, in FY01 the Division successfully pursued several funding avenues to finance field teams to generate new geologic data for North Slope energy projects, geophysical and geological mineral inventory mapping, seismic hazard investigations, and rural energy geologic assessments.

By the end of FY01 all of the Division's maps and reports were converted to digital files accessible for viewing or downloading via the Internet. This milestone marked the first step in the creation of a Division-wide geologic data management system that will interface with a comprehensive interagency state and federal Internet-accessible geologic database for Alaska. By accessing the publications "keyword search" capability of the DGGS Web site (http://wwwdggs.dnr.state.ak.us/), one can now find any DGGS map or report that contains the search word(s) entered. This feature makes published DGGS data available to anyone who has access to the Internet. There is no charge to the public for this service.

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 has been established to guide the implementation of Alaska mineral data rescue efforts.

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. In FY01, DGGS conducted a detailed analysis of all types of data and information generated by the Division and initiated a contract for the design and construction of a data management system prototype that will be completed in FY02. The delivery of this initial system constitutes the second milestone in a four-step project to interface DGGS with an Internet-accessible state and federal interagency geologic data delivery system that 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.

Undiscovered onshore and offshore oil fields in the 500-million- to billion-barrel or larger size range are believed to exist on the North Slope. Strategically, it is important that the remaining oil potential of the North Slope not be ignored. On a state level, the revenues from this oil represent a significant input to the state's long-term economic health. On a national level, the North Slope represents one of few remaining opportunities to maintain a robust, independent, domestic oil industry. If there are not major commitments to exploring frontier areas in Alaska by the international megacorporations, the responsibility for finding this oil and developing it defaults to the country's independent oil companies. Many of these companies do not have the cadres of petroleum geologists, geophysicists, tectonic synthesizers, paleontologists, structural geologists, etc., characteristic of the exploration staffs within major oil companies. Even the larger independent companies have a need for pertinent public-sector geologic information to establish a coherent geologic framework for their more detailed exploration work.

If Alaska is to enjoy the benefits of a sustained petroleum industry and if the country is to preserve the strategic advantage of a sustained domestic petroleum industry, then a place for the country's domestic oil companies must be created in Alaska. One key factor in bringing the nation's domestic independent oil companies to Alaska is lowering the geologic risks of doing business here. A second factor is the reintroduction of a more

level playing field so that many companies have a justified conviction that they can succeed in a vigorous competition for discovery. Both of these objectives were addressed in the Division's FY01 energy program.

In FY01 we 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 geologists had anticipated this trend with field studies concentrated on Brooks Range North Slope foothills geology. This work has been 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 fundamental framework geologic data generated by DGGS is an important additional contributor to exploration success.

Working with colleagues at the University of Alaska Geophysical Institute, our engineering geologist produced a remarkably accurate model for forecasting the extent of tsunami ("tidal wave") inundation of Kodiak that could be expected from 1964-type subduction earthquakes. The modeling process that was developed is applicable to other southern Alaska coastal communities and will be used in FY02 and FY03 to create similar inundation maps for them as well.

The Engineering Geology Section submitted an innovative proposal to NASA (National Aeronautics and Space Administration) to secure funding to develop in-house expertise in the application of remote sensing technology to several kinds of Alaska engineering geology, geologic hazard assessment, and mineral resource problems. As a result of this effort, a DGGS geologist will receive graduate training in remote sensing technology and will receive funds to apply that knowledge to a placer gold resource-potential evaluation of the Council mining district.

During the Legislative session held in the spring of FY01, the DGGS airborne geophysical survey program got back on track with an FY02 CIP appropriation that allowed the Division to conduct airborne geophysical surveys during the summer of 2001. In recent years we have selected high-mineral-potential areas for survey followed by 1:63,360-scale geologic mapping. The geophysical data have allowed us to make greatly improved geologic maps and the combined geologic and geophysical data have contributed significantly to encouraging mineral exploration in Alaska.

The following highlights summarize the results of these and other activities conducted during FY01:

- The DGGS Web site was accessed over 27,000 times for information on Alaska geology.
- Sold 2,651 professional maps and reports and distributed approximately 4,000 free educational publications.
- Responded to about 1,000 significant professional geologic information requests from the general public and other agencies.
- Made 35 public presentations on Alaska geology related to minerals, energy, and engineering geology.
- Generated Special Report 54 (Alaska's Mineral Industry 1999) and Information Circular 47 (Alaska's Mineral Industry 2000, A Summary). These publications provide the state's authoritative statistics and other information about the billion-dollar Alaska mineral industry. The reports are widely circulated and used by many exploration managers as an aid in securing funds for Alaska mineral ventures.
- In July 2000, completed the second of three planned field investigations designed to provide ground-truth geology and evaluate mineral resources in part of the Fortymile airborne geophysical survey tract. New rock geochemistry for the district was published in the fall of 2000 and a bedrock-geologic map summarizing the summer's ground-truth geology, Eagle A-2 Quadrangle (260 square miles), was published in June 2001.
- In June 2001, completed the third of three field investigations designed to provide ground-truth geologic mapping of the Fortymile airborne geophysical survey tract. The data generated will be released in FY02.
- Conducted a reconnaissance geologic ground-truth survey of a portion (120 square miles) of the Salcha–Pogo airborne geophysical survey tract in the Big Delta Quadrangle of east-central Alaska. The reconnaissance ground-truth geologic map and geochemical data were released in the spring of 2001.
- Co-planned and participated in an international Alaska–Yukon field workshop focused on getting Alaska, Yukon, British Columbia, and Canadian Geological Survey geologists together at key field locations on both sides of the border to reconcile rock nomenclature and other geologic, geophysical, and mineral evidence so that the geologic and

geophysical mineral data generated by Alaska and Canadian geologists will have a consistent framework along our common border. The resulting clarity in data representation will help support resource development.

- Released a summary of chemical analyses of 800 major oxide and trace elements for rocks from the Delta mineral belt on the north flank of the Alaska Range in east-central Alaska. These samples were collected from a region that is prospective for copper, lead, and zinc mineralization, as well as for bedrock gold deposits. These analyses were donated to DGGS by private industry and are part of the data generated by multi-million dollar exploration ventures conducted in the area. Placing these data in the public domain makes them available to catalyze new exploration efforts.
- Published radiometric geologic-age determinations for rocks of the Iron Creek area of the Talkeetna Mountains as part of a cooperative project with the U.S. Geological Survey. Previous data releases for this area indicated that some of the igneous rocks are similar in composition to rocks that elsewhere host platinum-group-element mineralization. The new age data indicate that these igneous rocks also are similar in age.
- Acquired funding from the federal government to compile a database of historical state-generated rock and mineral geochemical data for mineral-related projects that are in danger of being lost or otherwise compromised. This project will concentrate on analyses that are in DGGS files but never published, analyses that were released without corresponding map locations, and data that is not in digital format.
- Made 13 oral and poster presentations about Alaska mineral resources and DGGS mineral resource projects at various professional association meetings, mineral exploration conferences, and business forums to focus attention on Alaska's geologic resource potential.
- Monitored data reduction and data compilation and publication for an airborne geophysical survey of 1,240 square miles conducted in southwestern Alaska during FY01. This project was funded by a federal cooperative program with the U.S. Bureau of Land Management. The survey tract encompassed federal, Alaska Native corporation, and state lands.
- As part of a cooperative agreement to share information and potential work in part of the Mt. Hayes Quadrangle, DGGS arranged for the collection of paleontological samples needed for determining the geologic age of mineralization in the Broxson Gulch area. The purpose of the project is to increase public understanding of the geological setting and rock chemistry of nickel–copper–platinum-group-element mineralization in that region. The potential mineral host rocks in the Broxson Gulch area are similar to those in the mineralized rocks of the Kluane ultramafic belt of Yukon Territory and northern British Columbia, Canada.
- Responded to about 310 requests for technical information and assistance on mineral-related issues and maps. These requests were from the private sector, Native corporations, other state agencies, and federal and local government agencies.
- Located and acquired a commercial high-resolution gravity survey of a portion of the Holitna Basin. This survey will enhance the gas potential assessment of the basin as an energy source for regional mineral development.
- FY01 was year three of the five-year NPRA Foothills Program. As part of this program the DGGS Energy Resources Section released one technical report on the reservoir potential of the Nanushuk Formation, a prospective producing horizon that is exposed in the Brooks Range foothills within southeastern NPRA; made a poster presentation on the petroleum reservoir potential of the Nanushuk group; and presented a poster summary of the hydrocarbon source rock potential of various rock units in the Brooks Range foothills belt at the American Association of Petroleum Geologists (AAPG) conference in Denver. This information provides fundamental framework data useful for guiding oil and gas exploration on the North Slope.
- Completed helicopter-supported geologic field mapping and other investigations in the Philip Smith Mountains Quadrangle that will encourage industry exploration for oil and gas on the central North Slope. This project, funded through the U.S. Geological Survey's STATEMAP program, will produce a 1:63,360-scale geologic map of the Philip Smith Mountains C-5 Quadrangle and portions of the adjacent quadrangles, for release in FY02.
- During FY01 DGGS staff completed helicopter-supported fieldwork for a Division of Oil and Gas/DGGS cooperative petroleum reservoir characterization project. This project included examining surface outcrop samples and subsurface core material representing a cross section of North Slope and Brooks Range foothills stratigraphy. Porosity and permeability, detailed petrography, geochemistry, sedimentary facies analysis, and regional geologic mapping will characterize potential subsurface reservoirs in support of oil and gas exploration on both state and federal lands.

- DGGS, in cooperation with the U.S. Geological Survey (USGS) and the U.S. Bureau of Land Management-Alaska (BLM) is evaluating Alaska's remote coal basins for their shallow coalbed gas potential. During FY01, DGGS and the Kansas Geological Survey (KGS), through a cooperative research agreement, conducted a shallow seismic study at Fort Yukon to evaluate the lateral continuity and thickness of coal seams beneath the community. The field portion of the project was completed between March 31 and April 14, 2001, when approximately 8.5 line miles of seismic reflection study was conducted using the KGS's IVI minivibrator. Initial processing of the acquired data indicates a number of significant reflectors present, including the top of the lignite at about 1,200 feet and indications are that the coal-bearing zone may be up to 200 feet thick.
- During FY01, continued an evaluation of coal quality of the Copper River field, Eagle field, and Kobuk River field. Coal samples for the Copper River field have been submitted for proximate, ultimate, and trace-element analyses, and selected samples have been submitted for high pressure gas isotherm studies. The long-term goal of DGGS's participation in the NCRDS program is to record all known coal resources in Alaska in a single, readily accessible database.
- DGGS participated in a field study of the Copper River basin with the Division of Oil and Gas. Reservoir and source rock samples were collected for evaluating the oil and gas potential of this basin that is presently undergoing industry exploration through the state's exploration licensing program.
- Conducted an evaluation of coal lease blocks in the Jumbo Dome area near Healy for the Division of Mining, Land and Water (DMLW) as set forth in regulation 11AAC 85.010. DGGS is mandated to evaluate the potential for commercial development of coal on state lands.
- In September 2000, DGGS participated in a USGS-led shallow seismic refraction survey at Galena, Alaska. The refraction survey was designed to determine the depth to bedrock beneath the city of Galena in order to better assess the potential for local hydrocarbon energy sources. Galena is approximately 5 miles from known potential gas-bearing coal outcrops.
- In FY01, completed development of a customized database to archive data collected during energy resource evaluation and mapping projects. The database front-end includes a point-and-click map data entry interface. Field location, sample, and geochemical data can be queried and exported into text or GIS-compatible formats. 2001 North Slope field projects utilized a laptop version of the software for efficient and on-the-spot data management and analyses.
- Continued to provide coalbed methane information to the Division of Oil and Gas for the state's new shallow gas leasing program. This program has generated considerable interest by lower 48 producers to explore Alaska's coalbed gas resources.
- Organized and co-sponsored a coalbed methane workshop, "Alaska Coalbed and Shallow Gas Resources." The five-day workshop in May 2001 attracted over 100 participants to activities which included a two-day field trip to view Kenai Peninsula geology, coal exposures, and the nation's first commercial liquefied natural gas plant at Nikiski (days 1 and 2); two short courses (days 3 and 4); and a full day of technical papers and discussions (day 5). Attendees included coalbed methane producers from other states interested in exploring for coalbed methane in Alaska.
- DGGS staff organized and participated in the Alaska Geological Society's Technical Conference held during May 2001 in Fairbanks. This annual event brought over 100 geologists together to present current data and discuss geologic concepts that could lead to new energy and mineral development in Alaska.
- DGGS staff represented Alaska on the West Coast Petroleum Technology Transfer Council's Producer Advisory Group (PAG). PAG members from industry, state and federal agencies, and universities meet at least quarterly to discuss energy resource development issues and support innovation in exploration and production techniques through low-cost conferences and short courses.
- DGGS staff presented a poster summarizing the hydrocarbon source rock potential of various rock units in the North Slope foothills belt at the American Association of Petroleum Geologists (AAPG) annual meeting in Denver in June 2001. DGGS shared a booth promoting oil, gas and coalbed methane exploration in Alaska with the Division of Oil and Gas at the annual AAPG meeting in New Orleans.
- DGGS staff prepared a core display and authored a paper, "Potential reservoir facies in the Nanushuk Formation (Albian–Cenomanian), central North Slope, Alaska: examples from outcrop and core," for the SEPM NPRA Core Workshop held June 2001 at the AAPG annual meeting in Denver. That poster was also presented at the May 2001 Alaska Geological Society Technical Conference. These

presentations help to inform a broad spectrum of the petroleum industry about new prospective areas in Alaska.

- DGGS staff presented "Opportunities in Alaska Coalbed Methane," at the June 2001 AAPG annual meeting in Denver and participated in discussions at a gas hydrate conference held in conjunction with the meeting. Participation in these meetings helps to focus interest on Alaska's exploration opportunities.
- DGGS staff presented "Overview of DGGS's Tertiary Holitna Basin Project: Gas for Donlin Creek?" at the annual Alaska Miners Association convention in Anchorage in November 2000. This project is a DGGS effort to evaluate the potential for gas in a nearby remote basin to meet the energy needs for a hardrock gold prospect.
- DGGS staff presented an overview of Alaska's rural energy program, coalbed methane resources, and new drilling technology at the November 3, 2000, meeting of The Energy Council in Anchorage, Alaska. The Energy Council comprises elected legislators from ten energy-producing states as well as two international affiliates.
- A DGGS geologist attended the March 2001 annual meeting of The Energy Council in Washington, DC, and provided information on Alaska's coalbed gas potential.
- Released a biostratigraphic report on outcrop samples from the Sagavanirktok Quadrangle, eastern North Slope as a Preliminary Interpretive Report in FY01, in support of oil and gas exploration.
- A DGGS geologist authored "Evolution of the Neoproterozoic Katakturuk Dolomite ramp complex, northeastern Brooks Range, Alaska," published in a Society for Sedimentary Geology Special Publication, *Carbonate sedimentation and diagenesis in the evolving Precambrian world*. The Katakturuk Dolomite forms the core of the frontal range in ANWR and is considered by some in the petroleum industry to be a potentially viable oil and gas reservoir target on both federal 1002 lands and adjacent state lands.
- Released on CD-ROM, "Coalbed methane prospects of the Upper Cook Inlet—Field trip guidebook," as DGGS Miscellaneous Publication 41; and "Opportunities in Alaska coalbed methane, Anchorage, Alaska, March 1–3, 2000, Proceedings," as DGGS Miscellaneous Publication 42.
- DGGS staff co-authored "Tapping Alaska's Enormous Coalbed Methane Potential," published in the August 2000 "American Association of Petroleum Geologists Explorer," a monthly periodical. This summary article generated new industry interest in Alaska's coalbed gas resources and the new shallow gas leasing program.
- Developed draft ground-motion site-response maps and a draft seismic soil-class map for Anchorage in cooperation with the UAF Geophysical Institute. Planners and engineers will be able to use these maps in conjunction with the building codes to design more earthquake-resistant buildings.
- Developed draft tsunami-inundation maps for the Kodiak area in cooperation with the UAF Geophysical Institute, Alaska Division of Emergency Services, and the Kodiak city and borough governments. These maps depict modeled inundation extents of tsunami waves from several earthquake scenarios to guide emergency managers in planning evacuation areas and routes.
- Developed a database of published information on Quaternary-age faults and folds in Alaska (those active in the past 2 million years). The DGGS Report of Investigations will be a useful tool for geoscientists, engineers, emergency managers, government and industry planners, researchers, and educators.
- As part of Anchorage area earthquake-hazards studies, DGGS participated in a field study with personnel from the University of Durham (England) to obtain detailed sedimentologic data on land-level changes during the 1964 earthquake and several similar prehistoric earthquakes. The study has revealed evidence of small pre-earthquake land adjustments that could become a basis for forecasting major subduction-zone events in some areas several years in advance.
- 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.
- 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 on the advisory committee will continue for the life of the program.
- 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.

- DGGS staff co-authored and produced DGGS Report of Investigations 2000-4, "Preliminary volcano-hazard assessment for Makushin Volcano, Alaska." This is one of series of volcano-hazard assessments being produced for volcanoes monitored by AVO and published by either DGGS or USGS.
- Maintained and updated the *public* AVO World Wide Web pages. 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 improvements to 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 automated, mathematical, and computer post-processing. These pages have become instrumental in daily monitoring of volcanoes.
- Maintained and expanded the whole-rock geochemical database used by all AVO geologists. This effort has, during the lifetime of AVO, resulted in the single largest body of geochemical data on Alaska volcanoes. The database is larger than the collection of all previous Aleutian arc geochemical analyses that have been published in the last 50 years by the scientific community and is used to model Aleutian volcano eruptive events and other volcano phenomena.
- DGGS geologists participated in two major NASA workshops to assess needs for satellite and airborne remote-sensing data for scientific work in Alaska to address specific regional problems. In conjunction with this, they established a formal working relationship with the Alaska SAR Facility at UAF.
- A DGGS geologist submitted a successful proposal to NASA for a two-year pilot project that will develop internal DGGS remote-sensing expertise to augment traditional field methods in geomorphology, surficial geology, engineering geology, and bedrock geology. These techniques will be used to evaluate the placer gold potential of part of the Council placer mining district on the Seward Peninsula. Determining the potential for buried placer deposits may help catalyze economic development in rural communities and benefit the people of Alaska by expanding opportunities for both small- and large-scale mine operations.
- DGGS provided recommendations to NASA for candidate areas of Alaska to obtain airborne tandem-mission synthetic aperture radar (SAR) data as part of NASA's 2000 PacRim mission. NASA successfully flew the mission recommended by DGGS, obtaining more than 8,000 square miles of high-resolution topographic data along the proposed Alaska Highway gas pipeline and railroad corridors and over Augustine and Okmok volcanoes.
- Published "Interpretive bedrock-geologic map of the Petersville (Yentna) mining district, Alaska" (Report of Investigations 2000-3). This bedrock-geologic map covers an area of approximately 428 square miles and includes portions of the Talkeetna B-2, B-3, B-4, C-2, and C-3 quadrangles.
- Published surficial-geologic and derivative engineering-geologic maps for the Eagle A-2 Quadrangle, an area of approximately 262 square miles, as part of a federally funded STATEMAP project. These maps accompany the general geologic map of the area and will be beneficial for locating construction materials and evaluating engineering constraints for future development in the area.
- Completed final drafts of surficial- and engineering-geologic maps of the Chulitna mining district, to be published as DGGS Reports of Investigations. These maps cover an area of approximately 428 square miles and include 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. They accompany the general geologic map of the area and will be beneficial for locating construction materials and evaluating engineering constraints for future development in the area.
- Updated and expanded the existing GIS-based bibliography of industrial minerals sites in Alaska and made it available to the public digitally, via the Internet, and on CD-ROM.
- Compiled a digital, GIS-based directory of current construction-materials producers in Alaska that includes location, commodity, and production data. Approximately 100 questionnaires were

mailed or faxed to confirmed vendors who stated a willingness to take part in this survey.

- Completed reconnaissance surficial-geologic fieldwork in the Salcha River–Pogo area in support of a three-year 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.
- Developed a comprehensive GIS database for existing construction-materials information along the 416-mile-long Dalton Highway that will help DOT&PF more easily identify sites that will furnish materials for future highway maintenance and upgrade projects.
- A DGGS geologist participated in an international cooperative workshop, The Role of Mineral Aerosols in Quaternary Climate Cycles: Models and Data, sponsored by the INQUA (International Quaternary Association) Commission on Loess. The workshop was held in Jena, Germany. This meeting of scientists from the fields of geology, climate modeling, and computer databases was by invitation only and was convened in order to initiate the synthesis of loess (windblown dust deposited on land) data and to facilitate interactions between the dust modeling and data collection communities. The Spring 2001 DGGS newsletter article, "Atmospheric dust: Impacts on climate and the critical need for geologic data," discusses the background of and issues raised in the workshop.
- Responded to approximately 365 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.
- Completed a needs assessment and conceptual database design for a centralized relational geologic database management system to integrate with and complement the DGGS GIS system and prepared an RFP for a contract to implement the DGGS database. The objective of this project is to allow DGGS geologists to more quickly respond to information requests and shorten the cycle time for generating maps and reports.
- Converted 370 archive data tables from older DGGS publications to electronic format; the data will be used to begin populating the division-wide database that is being planned and created and will eventually be accessible by the public.
- Recovered data from archived publications and identified data for the pending DGGS geologic database system.
- Completed scanning all DGGS reports and maps published before 2000 and made them available through the DGGS Web site. New maps and reports will be added in this format as they become available.
- A DGGS geologist conducted a workshop on Internet resources for prospectors at the computer lab facilities at the Delta Mine Training Center. The presentation could serve as a basis for other similar presentations in other venues.
- Added a new, easy-to-use search feature to the DGGS Web site. In addition to the "Publications by Quadrangle" and "Publications by Series" searches, there is now a keyword search. The search engine will look through the DGGS web pages and report any occurrences of specified keywords or phrases.
- DGGS staff participated in numerous public school classroom science and science-fair programs, and made presentations in University of Alaska seminars and geology courses.

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PROGRAM—FY03

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

The Legislature has directed DGGS to seek the following outcomes:

1. Encourage private-sector investment in ventures that will develop Alaska's mineral, oil and gas, coal, and construction materials.
2. 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 by five major programs. 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. Federal Receipts and Program Receipts 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, one-half to three-fifths of Alaska's geophysical and geological program is financed from non base level budget funding sources. Securing the complementary funds required to implement the mandates of AS 41.08 and our Mission Statement on an annual basis 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 in FY03.

STATEWIDE MINERAL RESOURCE APPRAISAL

- Contingent on FY03 CIP funds, geophysically survey 1,000 square miles (640,000 acres) 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.
- Funded by FY03 General Fund base budget and committed airborne geophysical/geological mineral inventory CIP funds, conduct ground-truth geologic mapping and release an interim geologic map of the Big Delta C-3 and portions of the Big Delta C-2 and B-3 quadrangles within the Salcha River–Pogo airborne geophysical tract. This map will provide ground-truth geologic data needed to more effectively interpret the geophysical data previously generated for the Salcha River–Pogo mining district. The mapping area is a key to understanding regional geology near the Pogo mineral deposit and newly discovered Caribou prospect. Conducting investigations and releasing geologic data about this area will help the mineral industry and policy makers make informed decisions. A preliminary geologic map, sample location map, and tables of analytical data will be produced.
- Gather, verify, and collate pertinent statistics and summary observations about the status of Alaska's mineral industry during calendar year 2002 to document the industry's annual achievements and encourage others to participate. This document is widely circulated and is recognized as the best source of summary statistical data on Alaska's mineral industry.
- 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. 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.
- Produce a ground-truth geologic map of the Delta mining belt from data contributed to us by the private sector. Several different companies collected geologic and geochemical data over many years of investigation. Synthesizing and releasing the data to the public at large will add to a better understanding of the geologic framework of Interior Alaska and will encourage mineral investment in the region.
- Produce a ground-truth 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 terrane is favorable for deposits of platinum-group metals, nickel, copper,

and gold. DGGS will publish the paleontologic information and a preliminary geologic map in FY03. Synthesizing and releasing the data to the public at large will add to a better understanding of the geologic framework of southcentral Alaska and encourage mineral investment in the region.

- Contingent on federal funding, complete a georeferenced database of geochemical data from past DGGS projects and make this information accessible on the Internet. Analyses of major oxide and trace-element geochemical analyses from bedrock voucher samples will be screened for quality data. The resulting database will include the sample's analytical history, laboratory, vintage, degree of reliability, and associated project information. These data can provide fundamental new insights regarding the state's geologic framework relative to mineral deposits.
- Contingent on federal funding, complete 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. This project will provide the database needed to answer a question posed by the Legislature in FY00, namely, "What is the status of geologic mapping in Alaska?" It also will provide a useful starting point for anyone needing technical geologic framework information for an Alaska venture.
- Contingent on federal funding, begin a two-year project 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, and U.S. Bureau of Land Management (BLM) data. The resulting database will reference the analytical technique, laboratory, vintage, degree of reliability, and associated project information for each sample. The data will be published by BLM in conjunction with DGGS.
- 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

- Contingent upon Legislatively Designated Program Receipts, complete year four of a five-year project to determine the stratigraphy and reservoir potential of Nanushuk and Tuluvak Formation sandstones exposed along 120 miles of the northern Brooks Range foothills and Colville River in order to provide key geologic framework elements to aid future oil exploration in the central North Slope. This work will include 1:63,360-scale bedrock geologic mapping of oil-stained Cretaceous strata and evaluate source-rock potential of selected rock units in the southern Colville Basin and northern flank of the Brooks Range to help identify favorable oil or gas exploration plays.
- Funded by a 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 source-rock evaluation analyses.
- Contingent upon 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.
- Funded by a federal contract, 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.
- Funded by a federal contract, conduct the first year of a two-year, 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.
- Funded through a Reimbursable Services Agreement with the Division of Oil and Gas, evaluate the reservoir characteristics of a representative collection of 360–66.4–million-year-old North Slope and Brooks Range foothills rock formations. These rocks also occur in the subsurface within the North Slope Basin. Therefore, these data will help identify potential North Slope oil or gas reservoirs.
- Contingent on Legislatively Designated Program Receipts, expand the evaluation of reservoir characteristics of a representative collection of North Slope and Brooks Range foothills rocks ranging in age from 360 million years old to 66.4 million years old to provide porosity and permeability data characterizing their oil and gas reservoir quality.

- 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 80 responses).

STATEWIDE ENGINEERING GEOLOGY/CONSTRUCTION MATERIALS

- 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, conduct reviews of Coastal Policy Questionnaires and consistency applications to ensure compliance with the state's geophysical hazards standard (6 AAC 80.050).
- 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.
- Contingent on partial federal funding, complete a map of earthquake-induced liquefaction susceptibility in the Anchorage area.
- Contingent on partial 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.
- Contingent on partial 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.
- Supported by federal funding through the Coastal Management Enhancement Grants Program, publish generalized earthquake ground-shaking hazard maps for southeastern coastal districts.
- Contingent on continued federal funding, publish a geologic map of Mt. Spurr volcano.
- Contingent on continued federal funding, 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 will be the second year of a planned three-year project.
- Contingent on continued 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.
- Publish a CD-ROM disk containing geographical, geophysical, geological, geochemical, and land management data for the entire Aleutian volcanic arc in a georeferenced database format.
- 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.
- Provide field database and GIS support to ongoing mapping projects at Okmok Volcano and Veniaminof Volcano.
- Contingent on anticipated federal funding, initiate monitoring and hazards evaluation of far western Aleutian volcanoes.
- 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. The objective of this investigation is to identify prospective areas that may host previously overlooked placer gold resources.

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.
- Contingent upon 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.
- 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

- Assemble and edit the technical and educational maps and reports of DGGS in both conventional and digital format.
- Contingent upon continued federal funding, complete the design and construction of the Division-wide component of an interagency state-federal 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.
- Assemble, edit, and publish the annual Mineral Industry 2001 report. This report preserves the definitive statistics for Alaska's mineral industry.
- Maintain the DGGS information management microcomputer network infrastructure.
- Contingent upon federal funding, scan and make accessible on the Internet all USGS Professional Papers and Bulletins pertaining to Alaska geology.

PUBLICATIONS RELEASED TO DATE IN FY02

Geophysical Reports

GPR 2001-1. Edcon Land Gravity Survey, Holitna Basin, Southwest Alaska**,** by Edcon, Inc., 2001, 1 CD-ROM. $10.

Information Circulars

IC 32. Directory of aggregate, rock, and soil producers in Alaska, by D.S. Pinney and E.S. Duenwald, Updated October 2001, 19 p. Free.

IC 47. Alaska's mineral industry 2000: a summary, by D.J. Szumigala and R.C. Swainbank, 2001, 14 p. Free.

Miscellaneous Publications

MP 40. Geotechnical borehole and well-log database for Anchorage, Alaska, by R.A. Combellick, J.L. Mayer, K.D. Sink-Blair, and S.M. Weems, 2001, 8 p., 1 sheet, scale 1:25,000, 1 disk. $15 (disk information on paper, add $10 to cost of publication).

MP 41. Coalbed methane prospects of the Upper Cook Inlet—Field trip guidebook, by C.E. Barker, J.G. Clough, and T.A. Dallegge, 2001, 1 CD-ROM. $10.

MP 42. Opportunities in Alaska coalbed methane, Anchorage, Alaska, March 1-3, 2000—Proceedings, 2001, 1 CD-ROM. $10.

MP 43. Preliminary map of industrial minerals occurrences in Alaska, by D.S. Pinney and E.S. Duenwald, 2001, 69 p., 2 sheets, scale 1:2,500,000 1, CD-ROM. $43.

MP 44. Preliminary bibliogaphic database of Quaternary faults and folds in Alaska, by P.A. Craw, J.L. Mayer, and R.A. Combellick, 2001, 1 CD-ROM. $10.

MP 123. Historically Active Volcanoes of the Aleutian Arc, by J.R. Schaefer and C.J. Nye, 2002, 1 sheet, scale 1:3,000,000. $13.

MP 124. Preliminary engineering-geologic database of the proposed Alaska Natural Gas Transportation System (ANGST) corridor from Prudhoe Bay to Livengood, Alaska, by C.E. Cameron, E.E. Thoms, and C.A. Galló, 2002, 4 CD-ROMS. $40.

Preliminary Interpretive Reports

PIR 2001-3a. Geologic map of the Eagle A-2 Quadrangle, Fortymile mining district, Alaska, by M.B. Werdon, R.J. Newberry, and D.J. Szumigala, 2001, 1 sheet, scale 1:63,360. $13.

PIR 2001-3b. Bedrock geologic map of the Eagle A-2 Quadrangle, Fortymile mining district, Alaska, by M.B. Werdon, R.J. Newberry, D.J. Szumigala, and D.S. Pinney, 2001, 1 sheet, scale 1:63,360. $13.

PIR 2001-3c. Surficial-geologic map of the Eagle A-2 Quadrangle, Fortymile mining district, Alaska, by D.S. Pinney, 2001, 1 sheet, scale 1:63,360. $13.

PIR 2001-3d. Engineering-geologic map of the Eagle A-2 Quadrangle, Fortymile mining district, Alaska, by D.S. Pinney, 2001, 1 sheet, scale 1:63,360. $13.

PIR 2001-4. Palynology of Tertiary Holitna outcrops, McGrath and Talkeetna quadrangles, by Pierre A. Zippi, 2001, 22 p. $2.20.

PIR 2001-5. Reconnaissance bedrock geology map of the Pogo area, Big Delta B-2 and B-3 quadrangles, Alaska, by M.B. Werdon, R.J. Newberry, D.J. Szumigala, and L.E. Burns, 2001, 1 sheet, scale 1:63,360. $13.

Raw-Data Files

RDF 1999-2. Chulitna district paleomagnetic study, 1998, by David Stone, Howard Scher, and Chad Schopp, August 2001, 4 p. $2.

RDF 2001-1. Major oxide, minor oxide, trace element, and geochemical data from rocks collected in the Salcha River–Pogo area in 2000, Big Delta and northwestern Eagle quadrangles, Alaska, by M.B. Werdon, J.E. Athey, D.J. Szumigala, R.J. Newberry, J.C. Grady, and W.C. Munly, 2001, 19 p., 1 sheet, scale 1:250,000. $15.

RDF 2001-2. Whole-rock oxide and trace element analyses for rock samples from the Delta mineral belt, Tok mining district, Alaska, by C.F. Schaefer and S.S. Dashevsky, 2001, 3 p., 1 disk, 1 sheet, scale 1:63,360. $15.

RDF 2001-3. $^{40}Ar/^{39}Ar$ analyses from the Iron Creek area, Talkeetna Mountains Quadrangle, Alaska, by Jeff Drake and Paul Layer, 12 p. $2.

Reports of Investigations

RI 2000-4. Preliminary volcano-hazard assessment for Makushin Volcano, Alaska, by J.E. Begét, C.J. Nye, and K.W. Bean, 2000, 22 p., 1 sheet, scale 1:100,000. $16.

RI 2000-5. Fossil locality map for the Healy A-6 Quadrangle, southcentral Alaska, by R.B. Blodgett and K.H. Clautice, 2000, 42 p., 1 sheet, scale 1:63,360. $17.

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, 2001, 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, 2001, 32 p., 1 sheet, scale 1:63,360. $16.

RI 2001-1C. Surficial-geologic map of the Chulitna region, southcentral Alaska, by D.S. Pinney, 2001, 3 p., 1 sheet, scale 1:63,360. $14.

RI 2001-1D. Engineering-geologic map of the Chulitna region, southcentral Alaska, by D.S. Pinney, 2001, 5 p., 1 sheet, scale 1:63,360. $14.

Special Reports

SR 55. Alaska's mineral industry 2000, by D.J. Szumigala, R.C. Swainbank, M.W. Henning, and F.M. Pillifant, 2001, 66 p. Free.