THE U. S. GEOLOGICAL SURVEY IN **ALASKA**

1981 PROGRAMS

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GEOLOGICAL SURVEY
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ABOUT THIS CIRCULAR

This Circular describes the Fiscal Year (FY) 1981 programs and projects of the U.S. Geological Survey in Alaska. A brief description of the Alaskan operations of each office and division of the Survey is followed by project descriptions arranged by geographic regions in which the work takes place. A directory at the end of this booklet (table 3) lists all project chiefs in alphabetical order and summarizes other general information. Also in the back of this booklet is a listing (table 4) of cooperating agencies.

A companion Circular, 844, consists of articles describing significant accomplishments of the Survey's topical and field investigations in Alaska during 1980.

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CONVERSION TABLE

U.S. customary units used in this report may be expressed as metric units by use of the following conversion factors.

Multiply	By	To obtain
foot	0.3048	meter
mile	1.609	kilometer
pound	0.4536	kilogram
ton	0.9072	tonne, megagram
square mile	2.589	square kilometer
square foot (or foot squared) per day	0.0929	square meter per day

Metric units used in this report may be expressed as U.S. customary units by use of the following conversion factors.

Multiply	By	To obtain
meter	3.281	foot
kilometer	0.6214	mile
kilogram	0.205	pound
megagram	1.102	ton
square kilometer	0.3861	square mile
square meter per day	10.76	square foot per day

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THE U. S. GEOLOGICAL SURVEY IN **ALASKA**

THE CHALLENGE

Alaska programs of the Survey are expanding and changing in response to the Nation's need for energy and minerals, advancing technology, and passage of the Alaska National Interest Lands Conservation Act (ANILCA) in December 1980. By that act, Congress made fundamental decisions on the ownership and management of Alaska's vast lands.

Alaska is at once the largest and the least populated, least explored, and least developed of the Nation's States. The land area contains 375 million acres and comprises 16 percent of the onshore land and more than half of the Outer Continental Shelf (OCS) of the Nation. After Native and State of Alaska land selections of 44 million acres have been made, approximately 60 percent, 225 million acres, of Alaska land will remain under Federal jurisdiction. Federal lands in Alaska then will comprise approximately 30 percent of all onshore land in the Nation's public domain.

In a sense, the Geological Survey in Alaska in the 1980's faces the challenge it faced 100 years ago when it set out to map and assess the public domain. From this perspective, the 1980's will be a critical decade for resource exploration and appraisal in Alaska; although most of Alaska has been explored on a reconnaissance level, much work remains to be done to appraise its resources in more detail.

Declining oil and gas reserves in the United States and worldwide have caused an increase in the value of petroleum reserve units, and this change, coupled with advances in technology, has made many of the Alaskan resources economically competitive with resources elsewhere in the world. Demand for and increased cost of petroleum have brought Alaska into the forefront. In addition, Alaska's reserves are available from a politically stable area, and they tend to reduce the balance of payments deficit. Currently, 18 percent of domestic oil production is from Alaskan fields.

It is probable that, in the decade ahead, exploration for and production of Alaska's other mineral resources will follow a pattern similar to that of petroleum resources as demand and costs rise owing to global political conditions and declining reserves.

The Geological Survey is therefore challenged with evaluating Alaska's resources so that they can be used wisely for the benefit of the Nation's citizens and with providing information on the environmental effects associated with such development.

CURRENT PROGRAM

The Survey's programs in Alaska encompass the broad concerns of the bureau. The largest program at present is related to oil and gas exploration, but programs also include mineral appraisal, water-resource studies, volcanic and seismic programs, topographic mapping, glaciological and geohazard studies, and many other activities.

CONSERVATION DIVISION

Currently, the principal programs in Alaska are related to exploration and development of oil and gas north of the Brooks Range. Due to the national need to find very large oil reserves and the high costs involved in exploration, these activities appear to overshadow many of the other programs of the Survey in Alaska.

Exploration is currently focused on the North Slope and the arctic coastal areas. The Survey's Office of National Petroleum Reserve in Alaska is currently drilling four exploratory wells through its contractor, Husky Oil NPR Operations Inc., and conducting seismic and other work through other contractors on the reserve. This program alone is funded for $130 million in FY 1981. In addition, the Conservation Division, with the Bureau of Land Management, is preparing to lease by December 1981 a large part of the reserve to private industry for exploration. In response to the mandate of ANILCA, the Survey will begin oil, gas, and mineral appraisal of all other North Slope lands. It will also be preparing for additional OCS sales in the Beaufort Sea. All of these efforts contribute to one of the largest, most intense, and expensive oil "plays" in the Nation, and the Survey, along with industry, is and will be very much involved.

A major part of the Conservation Division's program in Alaska consists of preparing for ten OCS sales between FY 1981 and 1985. These sales cover parts of large frontier basins. In addition, the Division must establish a leasing program for onshore oil, gas, and coal as a result of the passage of ANILCA. Some perspective on the size of the Division's task is provided by the estimate made by the Survey and industry that 30 to 45 percent of the Nation's undiscovered oil and gas reserves will be found in Alaska.

GEOLOGIC DIVISION

The Geologic Division has strong programs in the appraisal of the hard mineral resources of Alaska; in marine geological studies of frontier basins; in geologic hazards and in volcanic and earthquake studies. ANILCA mandates that a special report to Congress containing all pertinent public information relating to minerals in Alaska shall be transmitted annually beginning in October 1982.

WATER RESOURCES DIVISION

The Water Resources Division, in response to future mineral and energy development and the need for hydrologic data as called for in ANILCA, is conducting studies of water availability and quality, urban hydrology, and glaciologic and hydrologic hazards in Alaska. The Division is establishing an arctic hydrologic research center in Fairbanks and will greatly increase the cooperatively funded hydrologic program with the State. The emphasis of that cooperative program will be on basin-by-basin appraisal of the State's water resources.

OFFICE OF EARTH SCIENCE APPLICATIONS

The Earth Resources Observation System (EROS) program has established an advanced remote-sensing analysis facility in Anchorage. The digital analysis capabilities and the remote-sensing assistance programs offered by the USGS/EROS Field Office complement the remote-sensing activities already ongoing in the State and promise to contribute significantly to the massive resource inventory challenges of ANILCA.

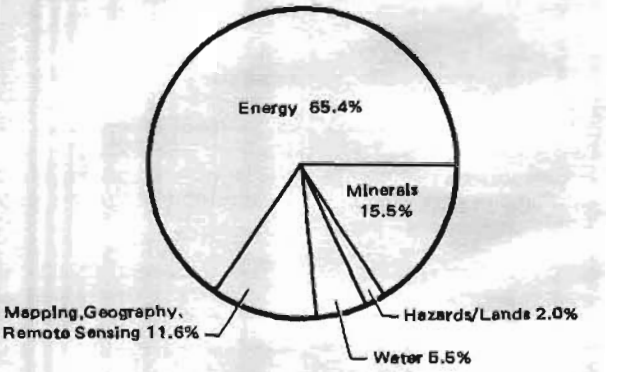
NATIONAL MAPPING DIVISION

To meet the major objectives of the National Mapping Division program for Alaska, the Geological Survey has formulated plans for establishing an Alaska Mapping Facility within the National Mapping Division (NMD). Presently, the NMD has in Anchorage an Alaska Program Office, which directs all Division activities in the State with the exception of certain ongoing production activities that are coordinated with the Regional Mapping Centers. The NMD also maintains Public Inquiries and map distribution offices in Alaska and plans to establish an office of the National Cartographic Information Center this year. In response to the needs of the State of Alaska, a much expanded cooperative orthophotoquad program is in the negotiation stage. This cooperative program, coupled with the map products needed for studies mandated by ANILCA, will result in increased production and revision of the intermediate-scale map series and new programs in land use - land cover mapping and digital cartography for Alaska.

PERSONNEL AND FUNDING

Currently, about 450 Survey employees are working on Alaska programs. Funding for the base Geological Survey programs in Alaska totaled about $56 million in 1980 and is expected to approach $80 million in FY 1981. In addition to this base funding, funding for the National Petroleum Reserve activities is expected to be $130 million in 1981.

Funding for major Alaska program elements, excluding the National Petroleum Reserve programs, is divided approximately as follows:



If the National Petroleum Reserve program is included, then energy-related programs would make up 87 percent of the Alaska program.

PUBLICATIONS OF THE U.S. GEOLOGICAL SURVEY

The Geological Survey publishes several types of reports that describe the results of projects or programs or that are the products of a Division's work. These reports range from books to preliminary maps.

Survey publications can be purchased at two offices in Alaska. The Public Inquiries Office (PIO) at 508 Second Ave., Anchorage, sells book reports and many kinds of maps relating to Alaska. It also acts as a depository for Open-File Reports about Alaska and maintains a library of Survey publications for public use. The Alaska Distribution Section in Room 126 of the Federal Building in Fairbanks provides maps of Alaska both by mail and over the counter. Alaska maps are also available from the Distribution Branch, Box 25286, Federal Center, Denver, Colo. 80225.

Listings of Survey reports and maps, but not including Open-File Reports, are available in "Publications of the Geological Survey 1879-1961" and "Publications of the Geological Survey 1962-1970"; these can be purchased for $2.00 each. Each month the Survey prints a catalog "New Publications of the Geological Survey," which contains a list of new reports and maps released during the month. At the end of each year these lists are compiled in a single volume. Both the monthly catalogs and the annual lists released since 1970 are available free from the PIO, as are

request forms for the monthly catalogs. The Survey began listing Open-File Reports in its 1974 catalog; information about older reports of this type is available from the PIO.

A list of publications (except Open-File Reports and Water-Resources Investigations) that describe geology or hydrology of Alaska and that were released before November 1977 may also be obtained, at no charge, from the PIO or the Alaska Distribution Center; updated information is available on request at both offices.

Book reports, such as Professional Papers, Bulletins, Water-Supply Papers, Techniques of Water Resources Investigations, Water-Resources Data Reports, the Survey's annual Yearbook, and non-technical leaflets, can be ordered from the Distribution Branch, 604 South Pickett St., Alexandria, Va. 22304, or from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Not all Survey reports are still in print, and information about price and availability can generally be obtained from the PIO.

Most Open-File Reports and Water-Resources Investigations can be ordered from the Open-File Services Section, Box 25425, Federal Center, Denver, Colo. 80225, in paper copy or microfiche form. Some Open-File Reports and Water-Resources Investigations are also available from the National Technical Information Service (NTIS), Springfield, Va. 22161. These are also in microfiche or paper copy. The PIO has prices for both NTIS releases and Open-File Reports.

Maps of Alaska are available at several scales; some maps have metric scales. Maps can be purchased at the PIO and at the Alaska Distribution Section; most cost $1.25 or $2.00 per sheet. Both of the Alaska offices provide free indexes that show the current status of orthophotoquad and topographic mapping in Alaska.

The Geologic Division's office in the O'Neill Building on the Fairbanks campus of the University of Alaska has a browse file of some Survey book-type reports. In addition, the PIO in Anchorage maintains a browse file of microforms of Landsat (satellite) imagery.

Mailing addresses and telephone numbers for the two offices from which publications can be purchased are:

Public Inquiries Office
508 Second Avenue
Anchorage, AK 99501
Tel. (907) 277-0577

and

Alaska Distribution Section
Box 12, Federal Building
101 12th Avenue (Room 126)
Fairbanks, AK 99701
Tel. (907) 456-7535

SOURCES OF ADDITIONAL INFORMATION

For further information about the Geological Survey activities in Alaska, please contact:

The Geological Survey

William Barnwell, Special Assistant to the Director for Alaska
Room 216, Skyline Building
218 E Street
Anchorage, AK 99501
Tel. (907) 271-4396

Office of Earth Science Applications

Gene Thorley, Chief
104 National Center
12201 Sunrise Drive
Reston, VA 22092
Tel. (703) 860-7471

EROS Program

David M. Carneggie, Chief, EROS Field Office
Room 316, Skyline Building
218 E Street
Anchorage, AK 99501
Tel. (907) 271-4165

National Mapping Division

Paul D. Brooks, Chief, Alaska District
Room 207, Skyline Building
218 E Street
Anchorage, AK 99501
Tel. (907) 271-4148

Geologic Division

Thomas P. Miller, Chief, Branch of Alaskan Geology
1209 Orca Street
Anchorage, AK 99501
Tel. (907) 271-4150

Water Resources Division

Philip A. Emery, Chief, Alaska District
733 West 4th Avenue, Suite 400
Anchorage, AK 99501
Tel. (907) 271-4138

Conservation Division

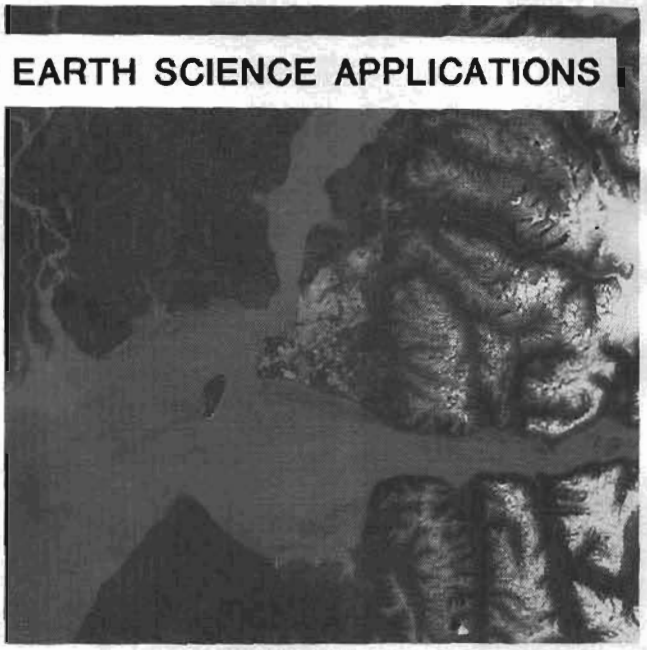
Joseph M. Jones, Manager, Alaska Region
800 A Street
Anchorage, AK 99501
Tel. (907) 271-4304

National Petroleum Reserve in Alaska

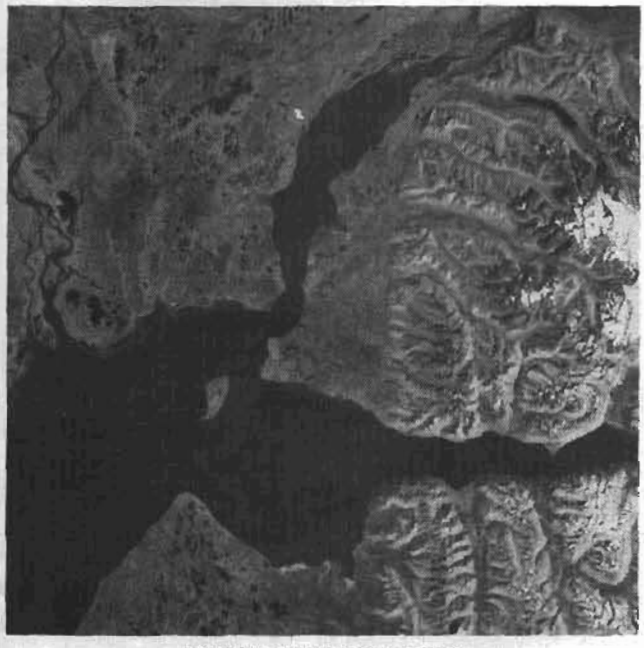
George Gryc, Chief
2525 C Street, Suite 400
Anchorage, AK 99501
Tel. (907) 276-7422

OFFICE OF EARTH SCIENCE APPLICATIONS

LANDSAT MSS 4 (Green) 1:1,000,000



LANDSAT MSS 5 (Red)



LANDSAT MSS 6 (Near-infrared)

LANDSAT MSS 7 (Near-infrared)

For further information, contact the offices listed below.

Anchorage, Alaska

David Carneggie

Chief, USGS/EROS Field Office
218 E Street, Anchorage, AK 99501
Tel. (907) 271-4065

Reston, Virginia

Gene A. Thorley

Chief, Office of Earth Science Applications
104 National Center, Reston, VA 22092
Tel. (703) 860-7471

OFFICE OF EARTH SCIENCE APPLICATIONS

The Office of Earth Science Applications (OESA) coordinates and administers some interrelated and interdisciplinary programs of the Geological Survey and other bureaus in the Department of the Interior. The major objective of the Office's work is to interpret and display resource information so as to be readily accessible and understandable to a wide range of users.

The Resource Planning Analysis Office (RPAO), a branch of the Office of Earth Science Applications, is conducting a project to develop standardized permit directories for each of the States. Permit requirements for 18 elements of natural resource development, including energy resources and air and water quality, will be included. Seven Title V Regional Commissions are cooperating on the project. The standardized format will facilitate easy State-by-State comparison of permit requirements.

The State of Alaska currently has a permit directory, but has agreed to cooperate in the Federal effort by working with the Four Corners Regional Commission. For information about the permit directory, contact Gail Green, of the Alaska Department of Environmental Conservation in Anchorage, at (907) 279-0254.

Another branch of OESA is the Earth Science Assistance Office. Although no representatives of this office are stationed in Alaska, it plays an active part of the Survey's activities in the State. Much of this involvement consists of supplying funds and encouraging projects that seek to apply scientific knowledge to practical problems. For example, this office is funding studies of construction materials in the Anchorage area being conducted by Henry Schmoll of the Engineering Geology Branch of the Geologic Division. In addition, the office coordinates activities that relate to such applications and has encouraged publication of information about the Survey's work nationwide. Information about the office's work in the western States can be obtained from:

William Kockelman
U.S. Geological Survey, MS 22
345 Middlefield Road
Menlo Park, CA
Tel. (415) 323-8111 ext. 2236

The Environmental Affairs Office (EAO), formerly the Environmental Impact Analysis Program, was established in 1975 to provide the Geological Survey's response to environmental impact statement (EIS) preparation and review requirements of the National Environmental Policy Act (NEPA).

The Geological Survey becomes involved as a lead agency in the preparation of EIS's as a result of the Conservation Division's supervision of mineral resource exploration, development, extraction, and reclamation operations on Federal lands, and as a nonlead agency as a result of its supervisor function (as described above) and through its special expertise in the areas of geology, hydrology, and mining and petroleum engineering. Survey review of EIS's focuses on the adequacy of description of the geologic and hydrologic environment, and of the analysis of related environmental impacts, and mitigating measures and alternatives.

The EAO, as the Bureau focal point for NEPA matters, provides an integrated Geological Survey response to the requirements of NEPA by: (1) Developing NEPA-related policy and guidance for the Geological Survey; (2) ensuring the quality of Geological Survey environmental documents; (3) monitoring Bureau-wide compliance with NEPA; (4) reviewing and commenting on environmental documents prepared by other bureas and agencies; (5) assisting in the performance of specialized studies in support of ongoing environmental analyses; (6) preparing environmental documents at the request of other agencies; (7) managing Geological Survey personnel assigned to other agencies' EIS's; and (8) conducting research to improve the NEPA process.

Oilspill risk analyses to determine the relative environmental hazards of developing oil have been conducted since 1976 by the Geological Survey in different regions of the Alaskan Outer Continental Shelf. These studies analyze the probability of spill occurrences, likely paths of oil slicks, and locations of resources vulnerable to spilled oil. The combined results yield estimates of the probability of oilspill impacts occurring due to development of proposed lease areas. Since 1978, oilspill risk analyses have been made by the EAO. Analyses for Norton Basin (Proposed Sale 57), St. George Basin (Proposed Sale 70), and Kodiak Island (Proposed Sale 61) are scheduled for release in April, June, and November 1981.

Additional information on the EAO may be obtained from:

Chief, EAO
U.S. Geological Survey
760 National Center
Reston, VA 22092
Tel. (703) 860-7455

A fourth major segment of OESA is the Earth Resources Observation System (EROS), whose work in Alaska is described below.

EARTH RESOURCES OBSERVATION SYSTEM (EROS) PROGRAM

The EROS Program was established by the U.S. Department of the Interior in 1967 to assist in realizing the practical benefits in earth-resource and environment inventory and monitoring that can be obtained by use of photographs and other remotely sensed data acquired by aircraft and spacecraft, including the Landsat satellite. The EROS Data Center in Sioux Falls, S. Dak. 57198, is responsible for distributing Landsat imagery, computer-compatible tapes, and other forms of remotely sensed data to users throughout the world. The Center also develops techniques to assist in applying remote sensing to various kinds of resource problems and helps users apply these techniques. Inquiries on specific problems or about remote-sensing technology, including future training opportunities, may be addressed to the Branch of Applications at the Data Center; the telephone number is (605) 594-6511.

Since late November 1974, an EROS Applications Assistance Facility has been in operation in Fairbanks, Alaska, to assist users to determine the availability of aircraft and spacecraft imagery and to handle image and photography orders. This facility is located at the Geophysical Institute, University of Alaska, Fairbanks, Alaska 99702. Interpretation equipment, including a color-additive viewer, zoom transfer scope, and variable magnification stereoscope, is available. In addition, files are maintained of selected Landsat images, National Aeronautics and Space Administration (NASA) and other aerial photographs, and other remotely sensed data for Alaska. For information concerning the Fairbanks facility, contact Katherine Martz at (907) 479-7487.

The EROS Data Center opened a Field Office in Anchorage in March 1980 to expand its programs for transferring remote-sensing technology to Department of the Interior agencies and to Federal, State, and local government agencies. The USGS/EROS Field Office has an Interactive Digital Image Manipulation System (IDIMS) to assist in automating the analysis of Landsat data. The primary objectives of the Field Office are to provide training on manual and automated analysis of remotely sensed data for resource inventory and to make the analysis equipment available to resource managers from government agencies in Alaska. To accomplish its mission, the Field Office will:

* Increase government personnel understanding and use of remote-sensing techniques for resource assessment through a variety of training programs.

* Encourage, where appropriate, resource agencies to develop or implement their own remote-sensing analysis capability consistent with their resource assessment needs.

* Encourage each resource agency to train one or more of their personnel to be remote-sensing data analysts capable of utilizing manual and digital analysis equipment available at the Field Office.

* Operate a state-of-the-art digital analysis laboratory that is available to resource management agencies for their operational inventories.

During calendar year 1980, Field Office personnel gave more than 30 demonstrations of the capabilities of the digital analysis system, assisted in conducting five 2-to-5-day training courses, and worked cooperatively with the National Park Service and the U.S. Forest Service on two vegetation mapping projects. In addition, personnel from the following agencies used the digital analysis system for their own inventory or project work: Bureau of Land Management, Soil Conservation Service, National Park Service, University of Alaska, U.S. Forest Service, and NASA.

The Field Office is staffed by four full-time scientists and, because of the close linkage with the EROS Data Center, it will utilize Center personnel, analysis techniques, and software where needed to address Alaskan needs. Several training courses on remote-sensing techniques will be offered in FY 1981 in the disciplines of Wildlife Habitat Evaluation, Vegetation Mapping, and Geologic Assessment.

The USGS/EROS Field Office has several state-of-the-art pieces of equipment for analyzing remotely sensed data. The IDIMS equipment will continue to be used operationally and to train resource managers to digitally display, enhance, classify, and manipulate Landsat data. The Field Office also has a film recorder that allows the user to produce geometrically correct and enhanced Landsat images; the film recorder can also be used to produce cover maps. Finally, the Field Office has a stereo zoom transfer scope which allows interpretive resource overlays to be transfered from remotely sensed data to maps.

During the next 5 to 10 years, the Field Office mission will shift in response to the changing role of the EROS Data Center as the National Oceanic and Atmospheric Administration (NOAA) assumes management responsibility for operational land resources satellites, and in order to respond to inventory requirements mandated by the Alaska National Interest Lands Conservation Act. EROS activities will focus on Department of the Interior and Geological Survey needs. In addition to the aforementioned objectives, increased attention will be given to research and development of remote-sensing techniques to meet inventory needs in Alaska. The Digital Analysis Laboratory will

continue to be available to government agencies for operational inventories, and EROS Field Office staff will provide analytical services for Interior bureaus and offices which do not have experienced personnel to utilize the analysis equipment of the Field Office. It is conceivable that the Field Office will maintain a direct communication link with the EROS Data Center for the acquisition of near-real time digital Landsat data, existing Landsat data, supporting geobased resource information formatted to 1:250,000-scale quadrangles or to other appropriate jurisdictional boundaries, and other forms of uniquely processed digital image data which have been tailored to meet Department of the Interior needs in Alaska. EROS personnel will work with other Government agencies to explore need for and/or installation of a remote terminal link to the Field Office digital analysis system or other Landsat processing capability implemented within the State.

The Field Office will work closely with the National Cartographic and Information Center (soon to be established in Anchorage) and the Applications Assistance Facility in Fairbanks to provide information on the availability of remotely sensed data and its uses. The USGS/EROS Field Office is located on the third floor of the Skyline Building at the corner of Second Avenue and E Street. For more information, contact the Field Office Chief, David M. Carneggie, 218 E Street, Anchorage, or phone (907) 271-4065.

A Landsat browse file is available for public inspection at the Public Inquiries Office of the Survey, Room 108, Skyline Building, 508 Second Avenue, Anchorage 99501.

EROS PROJECTS

With the exception of the Statewide project below, all project locations are shown on figure 1.

STATEWIDE

Project Title: Operational Use of USGS/EROS Digital Analysis System (IDIMS) for Vegetation Classification Using Landsat Data

Chiefs: David M. Carneggie and Michael D. Fleming

Objectives: To maintain and operate a digital analysis system for automating vegetation cover classification of Landsat data. The system (IDIMS) is available at an hourly fee to all Federal, State, and local agency personnel qualified to use the system. EROS Field Office personnel provide training to those who wish to use the system.

Status: During FY 1980 and the first half of FY 1981 personnel from the Bureau of Land Management (BLM), Soil Conservation Service (SCS), University of Alaska, and National Aeronautics and Space Administration (NASA) used the IDIMS system to conduct several resource inventories. NASA personnel have also used the system to train State agency personnel in performing digital classification. Members of BLM, SCS, and the University of Alaska have produced cover maps for more than two million acres of caribou range on the Seward Peninsula. BLM personnel have merged vegetation cover maps with digital terrain data (elevation, amount of slope) for parts of the National Petroleum Reserve in Alaska to demonstrate the applicability of remote-sensing techniques for producing information for Environmental Impact Statements. Agencies using the IDIMS system for operational inventories are not required to produce a written report of their results. However, most will produce documents detailing procedures and results. Availability of such publications can be determined by contacting the agency involved.

EAST-CENTRAL REGION

Project Title: Effects of Date and Phenology on Classification of Alaska Vegetation Using Landsat Data

Chiefs: Donald T. Lauer (EROS) and John Miller (Univ. of Alaska)

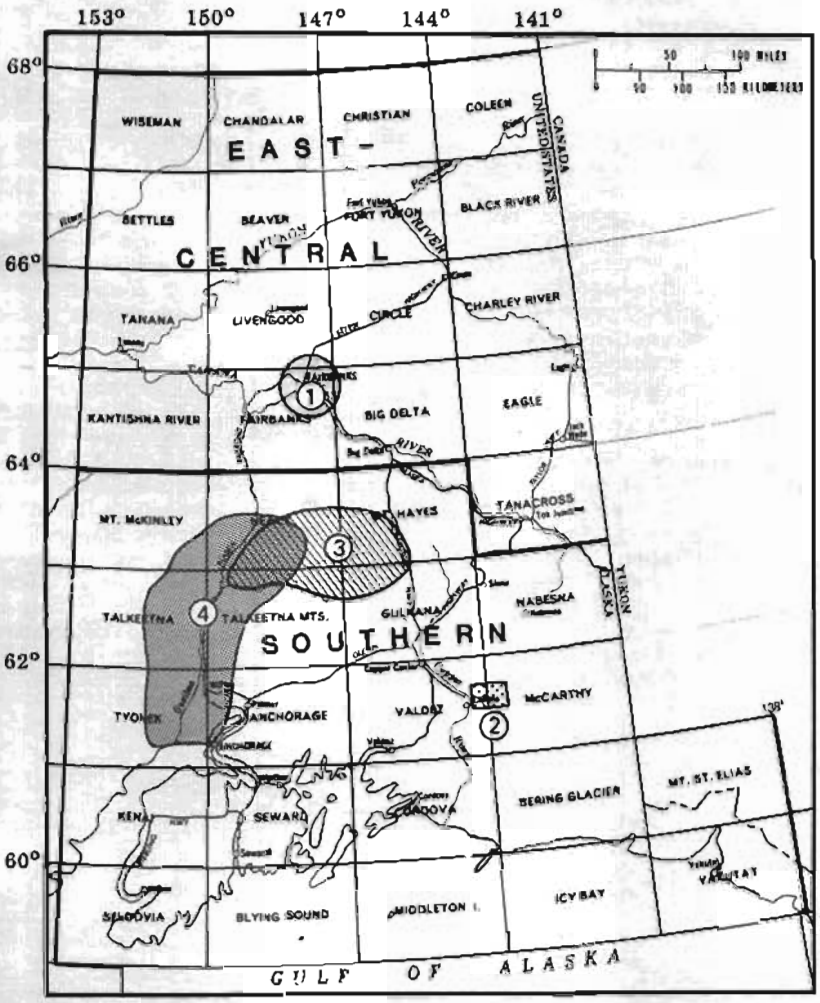
Objectives: To conduct remote-sensing research that should benefit resource managers using Landsat data to classify vegetation. The research is oriented toward determining the optimum dates on which to obtain Landsat data in order to produce the most accurate vegetation maps. The test area will include representative samples of vegetation from Alaska's interior. The results will be particularly useful for large cover-mapping projects, e.g. National Parks and Wildlife Refuges.

Status: Many cloud-free Landsat scenes, representing various dates prior to, during, and following the growing period, have been selected and processed for a test site near Fairbanks. The Interactive Digital Image Manipulation System (IDIMS) of the USGS/EROS Field Office is being used to conduct unsupervised classification of the Landsat data. Output maps have been produced for some of the dates. Comparison of the output maps with aerial photographs will begin soon. During the summer of 1981 field survey teams will collect data for evaluation of classification accuracy. A final report will be prepared in late 1981.

SOUTHERN REGION

Project Title: Classification of Vegetation and Sheep/Goat Habitat in a part of the Wrangell-St. Elias National Monument Using Digital Landsat Data

Chiefs: Michael D. Fleming (EROS) and Gerald Wright (National Park Service)



EXPLANATION

1. Effect of Date and Phenology on Classification of Alaska Vegetation using Landsat Data
2. Mapping of Vegetation and Sheep/Goat Habitat within Wrangell-St. Elias National Monument
3. Denali Resource Map Assessment Project
4. Renewable Resource Evaluation for Alaska

Figure 1.--Office of Earth Science Applications activities in Alaska carried out by the EROS Program.

Objectives: To determine the accuracy of classifying vegetation cover by digital analysis of Landsat data. Landsat data for mid-July, mid-August, and mid-September provide an opportunity to determine effects of seasonal changes on classification accuracy. The cover maps produced will be merged with digital terrain data (elevation, amount of slope, slope direction) to define areas suitable for sheep and goat habitat. The development and refinement of remote-sensing techniques used in this project will serve as a model for gathering resource information in other areas administered by the National Park Service.

Status: The digital classification has been performed, and an accuracy assessment is in progress. Cover maps for the three dates are available in photographic format. Digital terrain data are available and need to be merged with the Landsat-classified data to display suitable habitats. A draft manuscript describing procedures is being prepared.

Project Title: Denali Resource Map Assessment Project

Chiefs: Wayne G. Rohde (EROS), David Linden (EROS), and Paula V. Krebs (Bureau of Land Management)

Objectives: To develop and apply statistical sampling procedures to determine the accuracy of vegetation maps produced by a joint Bureau of Land Management (BLM) and National Aeronautics and Space Administration (NASA) Application Systems Verification Test (ASVT) in the upper basins of the Susitna, MacClaren, Delta, Gulkana, and Nenana Rivers. These maps cover an area of 2.7 million acres and were produced by a private contractor for NASA by applying automated computer classification techniques to Landsat data. A second objective was to determine the effect of smoothing on the classification accuracy of the cover maps. Smoothing is the process whereby individual or small groups of picture elements that constitute Landsat data are reclassified to the class corresponding to the majority of picture elements in a given area.

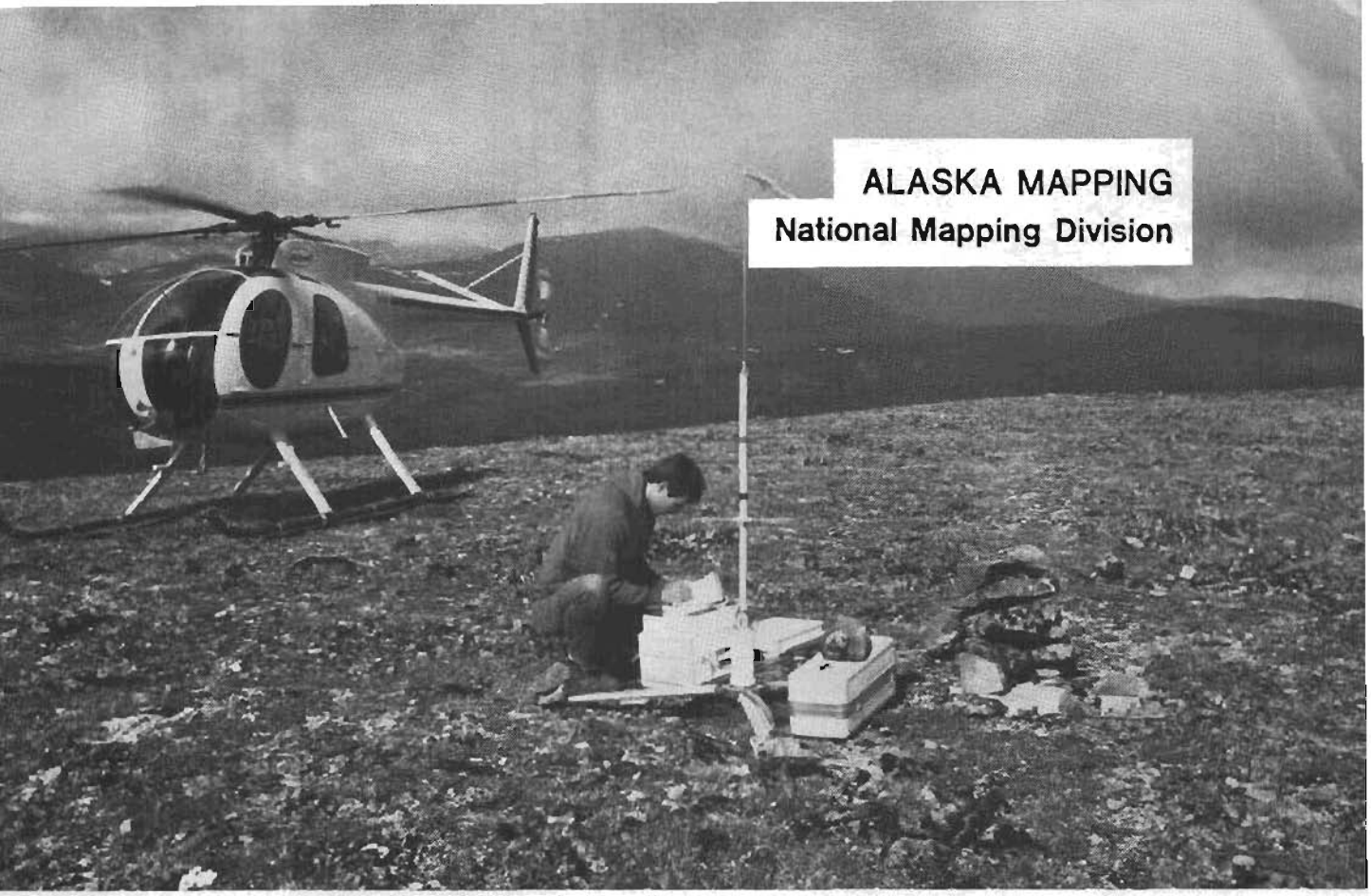
Status: The EROS part of this project was completed in FY 1980, and a BLM document detailing project results is in press. The document will be titled "Denali Study Area, Alaska: Technical Report of the Evaluation, ASVT Project Phase I, April 1980." Paula V. Krebs was the editor.

Project Title: Vegetation Classification Using Landsat Data for Renewable Resource Evaluation Research for Alaska

Chiefs: Michael D. Fleming (EROS), Vernon J. LaBau (U.S. Forest Service), and T. S. Setzer (U.S. Forest Service)

Objectives: To determine the accuracy of classifying vegetation at sample points through digital analysis of Landsat data. The U.S. Forest Service is testing sample methodologies for inventory of vegetation in the lower Susitna River basin. Landsat data, aerial photographs, and ground samples are being compared to determine optimum sampling procedures to collect data for the National Resource Inventory.

Status: Vegetation cover maps have been produced for 45 sample plots (320 acres each) that were randomly selected from a 5,000-meter grid superimposed on the lower Susitna basin. The maps were produced using digital analysis procedures on the USGS/EROS Field Office Interactive Digital Image Manipulation System. Forest Service personnel will compare these maps with ground data and aerial photographs to assess classification accuracy. Area estimates accompany the map data. This cooperative project is part of the National Inventory evaluation project conducted by the Forest Service.



Instruments used for positioning geodetic control of topographic mapping

For further information, contact the offices listed below.

Anchorage, Alaska

Paul D. Brooks

Chief, Alaska Office, National Mapping Division
218 E Street, Anchorage, AK 99501
Tel. (907) 271-4149

Denver, Colorado

John D. McLaurin

Chief, Rocky Mountain Mapping Center
National Mapping Division, Bldg. 25,
Box 25046, 510 Denver Federal Center
Lakewood, CO 80225
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Reston, Virginia

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ALASKA MAPPING

The National Mapping Division is responsible for the preparation of maps, map products, including digital cartographic and geographic data, and research for the National Mapping Program. The Division also operates the National Cartographic Information Center (NCIC) which provides information on maps, aerial and space imagery, geodetic control, and other cartographic data.

The Alaskan mapping program field activities are managed by the Chief, Alaska Office, with operational management support being provided by the Chief, Rocky Mountain Mapping Center in Denver, Colo., and the Chief, Eastern Mapping Center in Reston, Va. The newly established Alaska Office, located in Anchorage, gathers and maintains files on cartographic material used in mapping. In addition, this office provides technical assistance in mapping to Federal and State agencies and to the public in obtaining cartographic data, photographic products, geodetic control, and base-map materials.

Topographic maps at a scale of 1:63,360 (1 inch = 1 mile) are available for about 85 percent of Alaska. Maps of an additional 10 percent of the State are in various stages of production at either 1:63,360 scale or 1:50,000 scale (metric).

The Division plans to provide 1:25,000-scale (metric) maps for the agricultural, industrial, and urbanized areas of Alaska. Maps of the Anchorage area were published in FY 1980. Other areas for which maps are being prepared include Valdez, Seward, Cordova, Whittier, Willow, North Kenai, and, in newly authorized projects, for Homer and Kodiak.

The Division also prepares indexes for each State that show the topographic maps that have been published. The Alaska index is available free from the Division's Public Inquiries Office, Room 108, Skyline Building, 508 Second Avenue, in Anchorage and the Map Distribution Office, Federal Building, Box 12, 101 Twelfth Avenue, in Fairbanks. In addition, a periodic index of publication status is also available free. For detailed information on revisions or current mapping status of specific areas, contact the Alaska Office, 218 E Street, in Anchorage.

The National Mapping Division will continue the support of the public lands surveys of the Bureau of Land Management (BLM) in Alaska through the preparation of orthophoto products. In the past the Division has provided horizontal geodetic control, but this support is not expected to continue because BLM has developed sufficient capacity of their own. The Division also continues its supportive role in the State-Federal interagency program to obtain uniform high-altitude aerial photograph coverage for the entire State.

PROJECTS OF THE NATIONAL MAPPING DIVISION

Listed below are current projects of the National Mapping Division. All project locations are shown in figure 2.

NORTHERN REGION

Project Title: Northern Alaska Landsat Land Cover Mapping

Chief: Leonard Gaydos

Objective: To produce land cover maps for northern Alaska using Landsat multispectral scanner digital data.

Status: Final products from mapping land cover and vegetation using Landsat imagery for the National Petroleum Reserve in Alaska (NPRA) are being readied. Digital tapes containing land cover classifications for areas mapped in Barrow, Wainwright, Meade River, Teshekpuk, Harrison Bay, Utukok River, Lookout Ridge, Ikpikpuk River, Umiat, Misheguk Mountain, and Howard Pass quadrangles will be released to the open file. Several land cover maps and aggregations by townships will be published in color using a "smoothed" version of the original data along with a text describing the methodology.

Work continues in the Prudhoe Bay region and along the haul road south to the Yukon River in cooperation with the U.S. Army Cold Regions Research and Engineering Laboratory and the University of Colorado Institute of Arctic and Alpine Research.

Cover in the Beechey Point and Sagavanirktok quadrangles will be reclassified using information obtained during field investigations. Field sites for areas in the Dietrich and Bettles quadrangles will be selected and visited during the summer of 1981.

Project Title: Tikikluk

Chief: Roy E. Fordham

Objectives: To provide orthophotoquads at a scale of 1:63,360 in a 12-quadrangle area of the North Slope and gas fields near Point Barrow.

Status: The image bases are complete. The protracted public land survey lines, UTM grid, and type bases are being generated. The orthophotoquads will be available in mid-1981.

Project Title: Lookout Ridge

Chief: Roy E. Fordham

Objectives: To provide nine orthophotoquads at a scale of 1:50,000. The orthophotoquads are companion products to nine of the topographic maps being prepared for the National Petroleum Reserve in Alaska project.

Status: Rectification equipment problems have delayed completion of this project.

Project Title: National Petroleum Reserve in Alaska

Chiefs: John D. McLaurin and Roy E. Fordham

Objectives: To provide 1:50,000-scale maps for that part of the National Petroleum Reserve in Alaska presently mapped only at a scale of 1:250,000.

Status: The project consists of 82 quadrangles being mapped at a scale of 1:50,000 with metric contours. Advance manuscript copy is available for the complete project area and may be ordered from the Rocky Mountain Mapping Center. Map-finishing operations have been started for 15 of the quadrangles in the Eastern Mapping Center.

Project Title: Coal Resources Area, Northern Alaska

Chief: Roy E. Fordham

Objectives: To provide 1:50,000-scale maps of an area presently mapped only at 1:250,000 scale.

Status: The project consists of 45 quadrangles to be mapped at 1:50,000 scale with metric contours. Aerotriangulation was completed on 36 of the quadrangles, and compilation is scheduled for FY 1981. Photographic coverage is not available for the remaining nine quadrangles.

Project Title: Eastern Brooks Range

Chief: John D. McLaurin

Objectives: To provide 1:63,360-scale maps of an area previously unmapped at this scale.

Status: The project consists of 37 quadrangles being mapped at a scale of 1:63,360. Advance manuscript copy is available for 18 of the quadrangles and may be ordered from the Rocky Mountain Mapping Center. The remaining 19 quadrangles are being completed; map-finishing operations are scheduled for 16 of the quadrangles during FY 1981.

WEST-CENTRAL REGION

Project Title: Hughes-Shungnak

Chiefs: John D. McLaurin and Roy E. Fordham

Objectives: To provide 1:63,360-scale maps of an area previously mapped only at the 1:250,000 scale.

Status: The project consists of 50 quadrangles that will be mapped at 1:50,000 scale with metric contours. Field mapping control has been completed. Aerotriangulation is in progress, and compilation for 46 quadrangles is scheduled for contract during FY 1981. The remaining four quadrangles will be compiled at the Eastern Mapping Center.

EAST-CENTRAL REGION

Project Title: Christian South

Chief: Roy E. Fordham

Objectives: To produce eight orthophotoquads at a scale of 1:63,360 in the southeast corner of the Christian 1:250,000-scale quadrangle.

Status: The project has been delayed by operational problems with rectification equipment.

SOUTHERN REGION

Project Title: Willow South

Chief: John D. McLaurin

Objectives: To provide large-scale maps of the new State capital site near Willow.

Status: The project consists of four 1:25,000-scale maps with metric contours. Aerotriangulation is 95 percent complete, and compilation is scheduled for FY 1981.

Project Title: Whittier

Chief: John D. McLaurin

Objectives: To provide large-scale maps of Whittier, Portage, and the Turnagain Arm area south of Anchorage.

Status: The project consists of seven 1:25,000-scale quadrangles with metric contours. Aerotriangulation is complete, and the maps are scheduled to be compiled during FY 1981.

Project Title: Seward

Chief: John D. McLaurin

Objectives: To provide large-scale maps of the Seward area and vicinity.

Status: The project consists of six 1:25,000-scale quadrangles with metric contours. The quadrangles have been scheduled for map compilation during FY 1981.

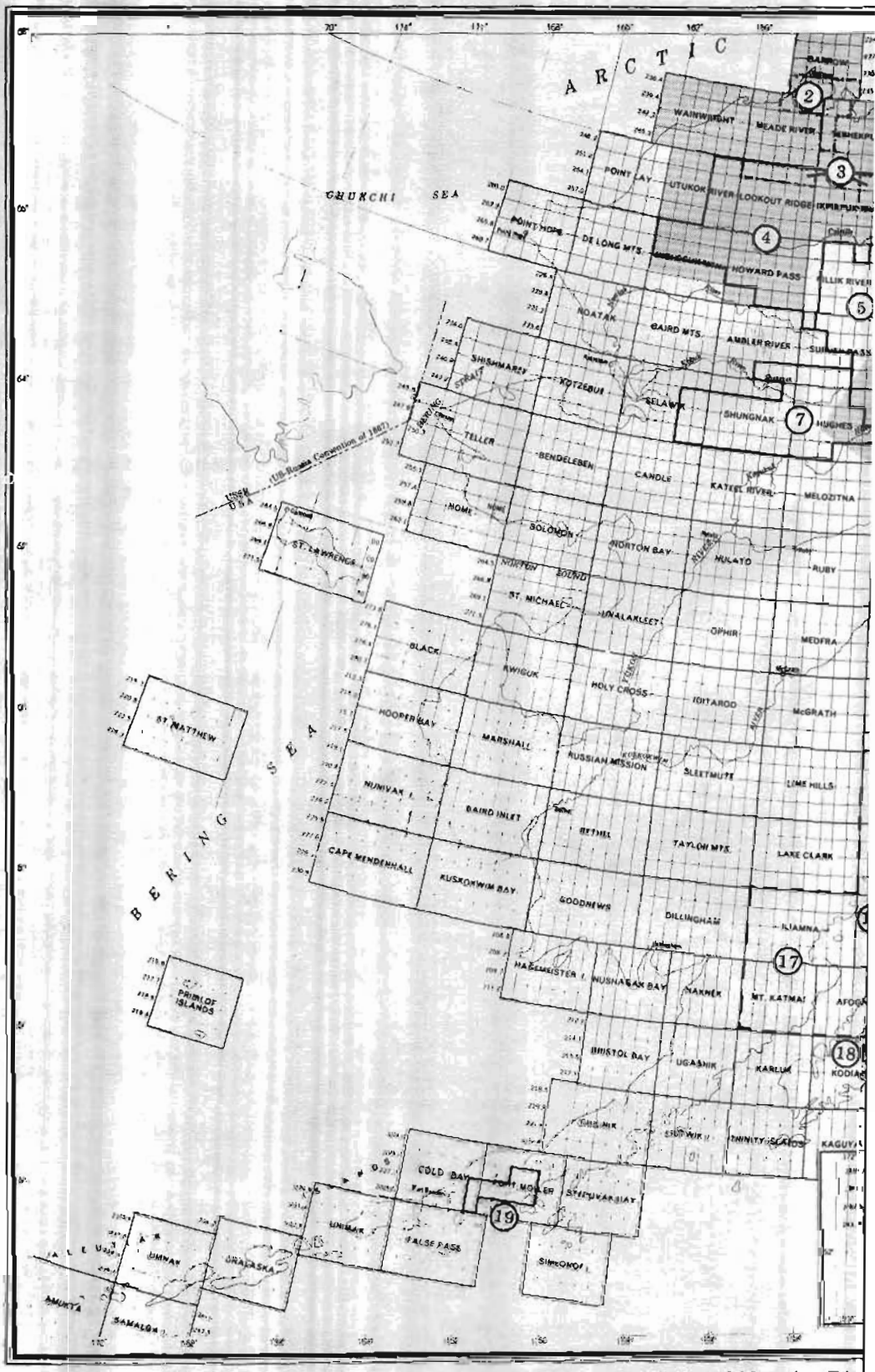
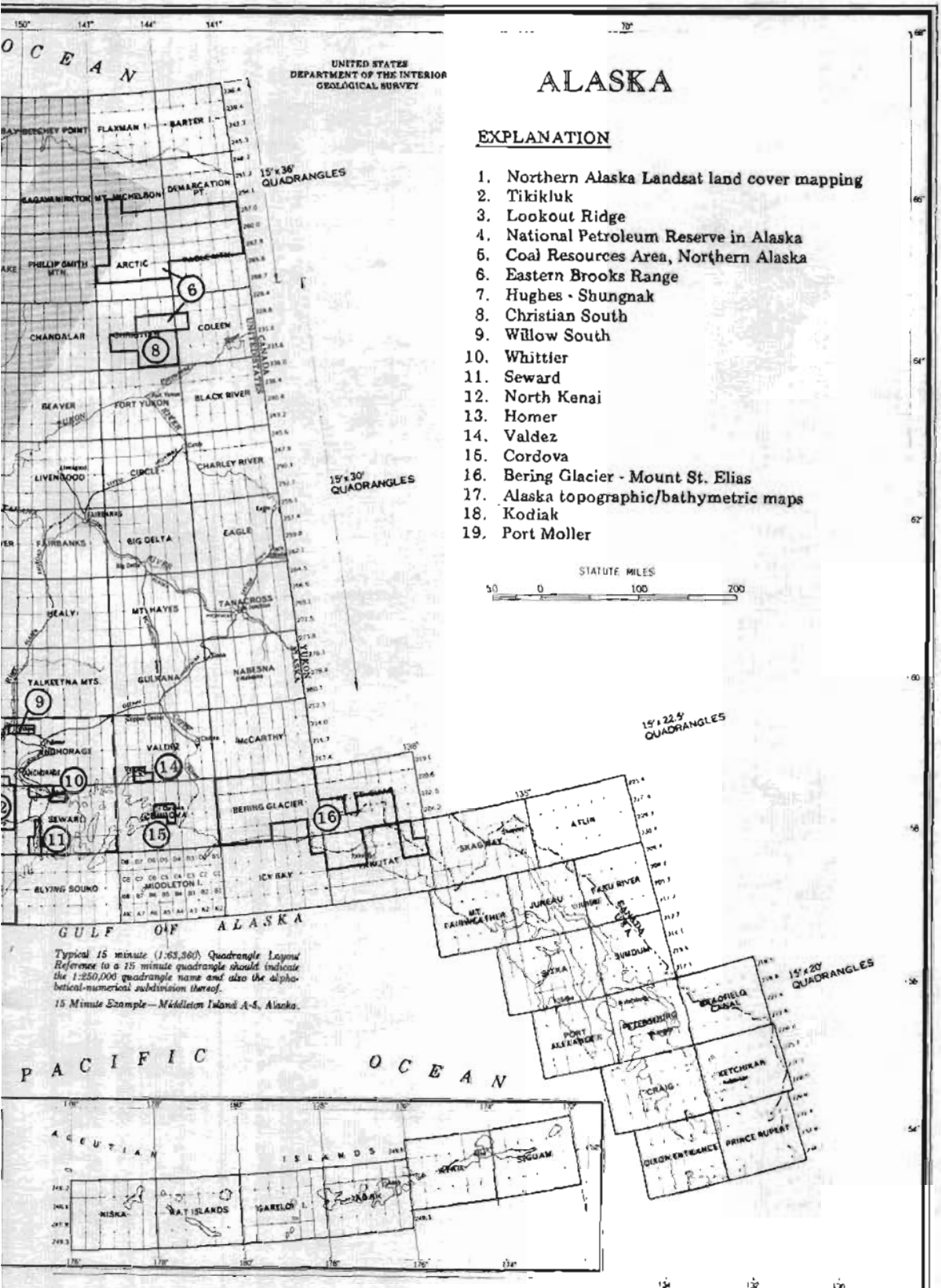


Figure 2-- National Mapping Div



vities in Alaska for 1981.

ALASKA MAPPING

Project Title: North Kenai

Chief: John D. McLaurin

Objectives: To provide large-scale maps for an area that covers the towns of Kenai and Soldotna, the industrial complex north of Kenai, area along Sterling Highway in the National Moose Range, and recreation areas.

Status: During 1980, the horizontal and vertical geodetic control was established for 41 quadrangles in the project area. Geodetic computations of the field surveys are in progress, and map compilation at 1:25,000 scale with metric contours will follow.

Project Title: Homer

Chief: John D. McLaurin

Objectives: To provide large-scale maps with metric contours for the part of the southern end of the Kenai Peninsula including the towns of Homer and Seldovia.

Status: In 1981 the Division proposes to establish the horizontal and vertical control necessary for compilation of the twenty-seven 1:25,000-scale maps in the project area.

Project Title: Valdez

Chief: John D. McLaurin

Objectives: To provide large-scale maps for the city of Valdez and the surrounding area.

Status: The project consists of five 1:25,000-scale maps with metric contours. Compilation is complete, and the map-finishing operations are scheduled in FY 1981.

Project Title: Bering Glacier - Mount St. Elias

Chief: John D. McLaurin

Objectives: To provide 1:63,360-scale maps in an area previously unmapped at this scale.

Status: This project consists of 50 quadrangles of 1:63,360 scale. Five maps of areas along the coast of the Gulf of Alaska have been compiled and are available in advance manuscript copy. Compilation of the eight remaining quadrangles in the "A" and "D" rows of the Bering Glacier 1:250,000-scale quadrangle will be completed in FY 1981. The 37 quadrangles in the remainder of the project area will be compiled under contract with expected completion in FY 1982.

Project Title: Cordova

Chief: John D. McLaurin

Objectives: To provide large-scale maps of Cordova and vicinity.

Status: The project consists of four 1:25,000-scale quadrangles with metric contours. These quadrangles have been compiled, and advance copy of the compilation manuscripts is available. Map-finishing operations have been started; completion is expected in FY 1982.

Project Title: Alaska Topographic/Bathymetric Maps

Chief: John D. McLaurin

Objectives: To provide 1:250,000-scale topographic/bathymetric maps of the Anchorage and Cook Inlet area in support of the Bureau of Land Management's Outer Continental Shelf and other coastal zone studies.

Status: The project consists of eight 1:250,000-scale quadrangles that will be prepared under the Geological Survey/National Oceanographic Survey (NOS) joint topographic/bathymetric mapping agreement. NOS plans to provide the bathymetric data during FY 1981, and the Survey plans to add these data to the topographic maps during FY 1982. (Some quadrangles included in this study are in the southwestern region.)

SOUTHWESTERN REGION

Project Title: Kodiak

Chief: John D. McLaurin

Objectives: To provide large-scale maps for the port and town of Kodiak.

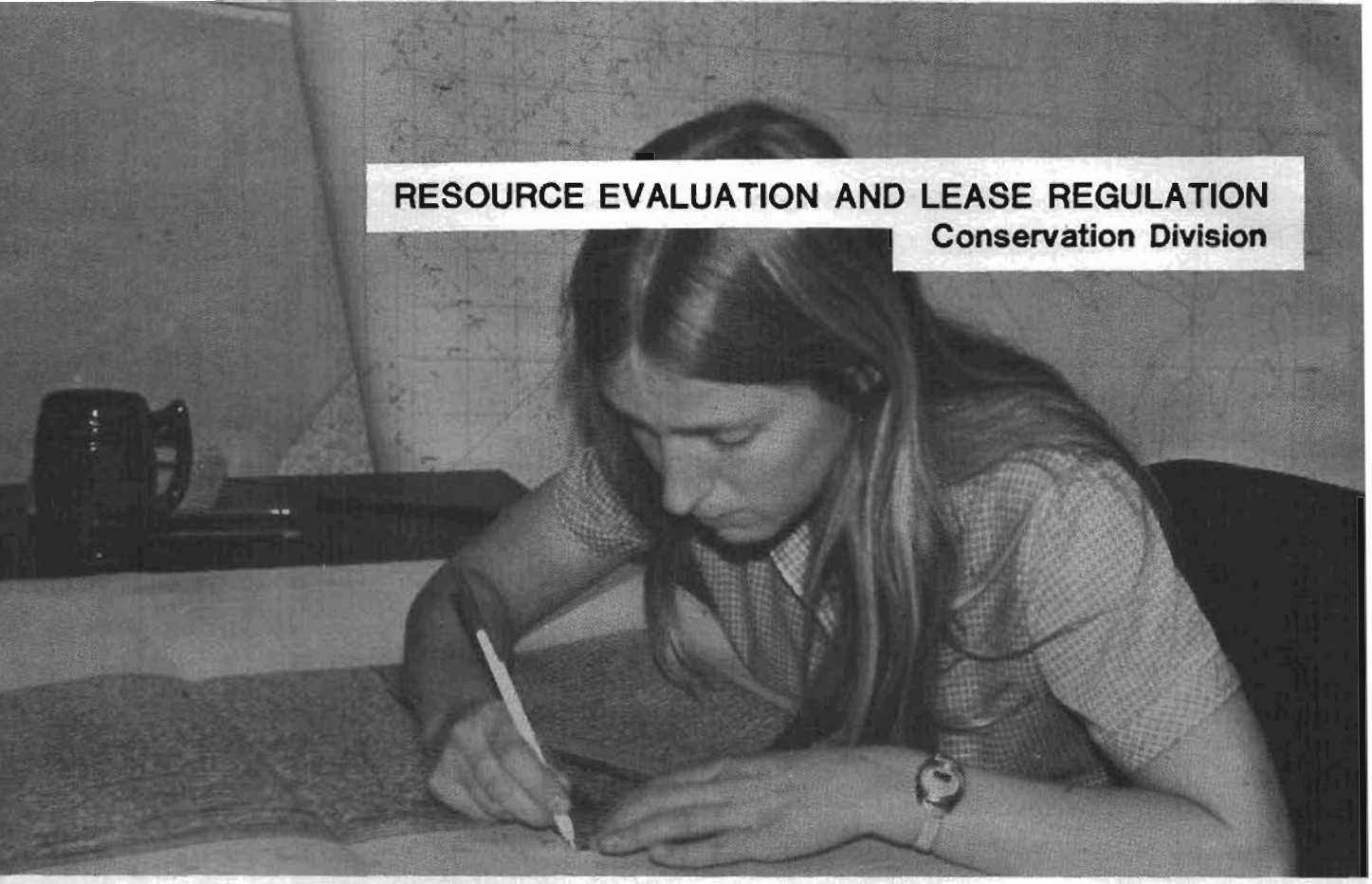
Status: During 1981 the Division plans to acquire the aerial photography for 12 quadrangles in the project area by commercial contract. Scheduled for FY 1982 are field surveys to establish the horizontal and vertical geodetic control for the compilation of the 1:25,000-scale maps with metric contours.

Project Title: Port Moller

Chief: John D. McLaurin

Objectives: To provide eight 1:63,360-scale maps of the Port Moller area presently mapped only at a scale of 1:250,000.

Status: Advance copy of the compilation manuscripts is available for the eight quadrangles. Map-finishing operations are expected to be completed by FY 1982.



RESOURCE EVALUATION AND LEASE REGULATION
Conservation Division

Conservation Division employee interpreting seismic data

For further information, contact the offices listed below.

Anchorage, Alaska

Joseph M. Jones	Conservation Manager, Alaska Region 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4304
Irven F. Palmer Jr.	Deputy Conservation Manager Offshore Resource Evaluation 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4361
Rodney A. Smith	Deputy Conservation Manager Offshore Field Operations 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4303
James E. Callahan	Acting Deputy Conservation Manager Onshore Resource Evaluation 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4361
Barry A. Boudreau	Acting Deputy Conservation Manager Onshore Field Operations 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4356

Reston, Virginia

Don E. Kash	Chief, Conservation Division 600 National Center, Reston, VA 22092 Tel. (703) 860-7524

RESOURCE EVALUATION AND LEASE REGULATION

The Conservation Division examines and classifies Federal lands according to their mineral resources and waterpower or water-storage values, determines fair-market values of tracts offered for lease in competitive onshore and offshore sales, supervises exploration and development for leases on the Outer Continental Shelf (OCS) and on Federal, Indian, and national petroleum reserve lands, and maintains accounts and collects rentals and royalties from petroleum production on Federal lands.

Consistent with national concern for environmental protection, the Division's regulations and procedures are frequently reappraised and revised to avoid or lessen consequences that may result from pollution incidents, surface damage from mining, geothermal, or petroleum operations, and other hazards that may be associated with mineral operations conducted under leases or prospecting permits.

The Conservation Division performs the following functions in Alaska:

REGULATORY ACTIVITIES: Supervises and inspects oil and gas exploration and production operations on Federal lands to insure safety, prevent pollution, and assure environmental protection. These activities are carried out by personnel from Deputy Conservation Manager - Offshore Field Operations and Onshore Field Operations (DCM-OFO and ONFO) offices and presently include supervision and inspection of onshore lease operations on the Kenai Peninsula, the Cook Inlet area, and the OCS lease operations in the Gulf of Alaska, Beaufort Sea, and in lower Cook Inlet. In addition, the DCM-OFO regulates all pre-lease exploration activities on the OCS, and the DCM-ONFO supervises and inspects drilling operations in the National Petroleum Reserve in Alaska (NPRA).

ROYALTY ACCOUNTING: The DCM-OFO and ONFO are responsible for the collection of all money due the Federal Government from oil and gas produced from Federal leases onshore and on the OCS.

PRE-SALE REPORTS: Several years prior to lease sales, scheduled dates of which are shown in table 1, the Division prepares reports and background material on lease sale areas (fig. 3; table 1). This work is closely coordinated with the Bureau of Land Management and other Federal and State agencies. Results of such coordinated efforts include: (1) Summary reports prepared in cooperation with the Survey's Geologic Division. These reports consist of information on the stratigraphy, structure, petroleum resource potential, environmental geology and geologic hazards, technology, time-frame, and infrastructure needed for exploration and development. Work on these reports begins several years prior to a lease sale and continues until the report is published at the beginning of the tract-selection process, and (2) Tract selection based on data from summary reports, as well as on other geologic and geophysical data that may exist at the time before the sale.

RESOURCE ESTIMATES: The Geologic Division estimates petroleum resources for geologic basins using volumetric yield methods. These estimates are revised periodically when new data become available. Prior to tract selection, more refined estimates are made by the DCMs for Offshore (ORE) and Onshore Resource Evaluation (ONRE). These estimates are further refined by detailed structural mapping and analysis, and the evaluation process continues right up to the lease sale date.

GEOLOGIC HAZARDS: High-resolution seismic data and/or shallow core-hole data are used to delineate areas within proposed lease areas where geologic conditions are dangerous for man-made structures. These potential hazards are made known to the public so that mitigating measures can be taken in the leasing, exploration, and production processes.

TRACT EVALUATION: The Conservation Division makes detailed prospect and tract evaluations for each geologic structure within a sale area by using all available geologic and geophysical data. Using a Monte Carlo Range of Values Program, a net present value is calculated for each tract. These values serve as a basis for accepting or rejecting bids for tracts during the lease sale.

SPECIAL STUDIES: The Division has several special projects underway that will provide data for appraisal and regulation of Federal mineral and oil and gas resources. These projects include one geologic study to define the extent of coal resources, four geologic studies to help define the petroleum reservoir- and source-rock potential of basins, five paleontologic studies to support oil and gas exploration activities, seven geophysical and geotechnical studies to provide detailed environmental data on seafloor surficial geology and foundation conditions in future OCS lease sale areas, and one project which involves organization of data gathered in exploration of NPRA so as to make such data more readily available to the public. These projects are described in detail in the following section.

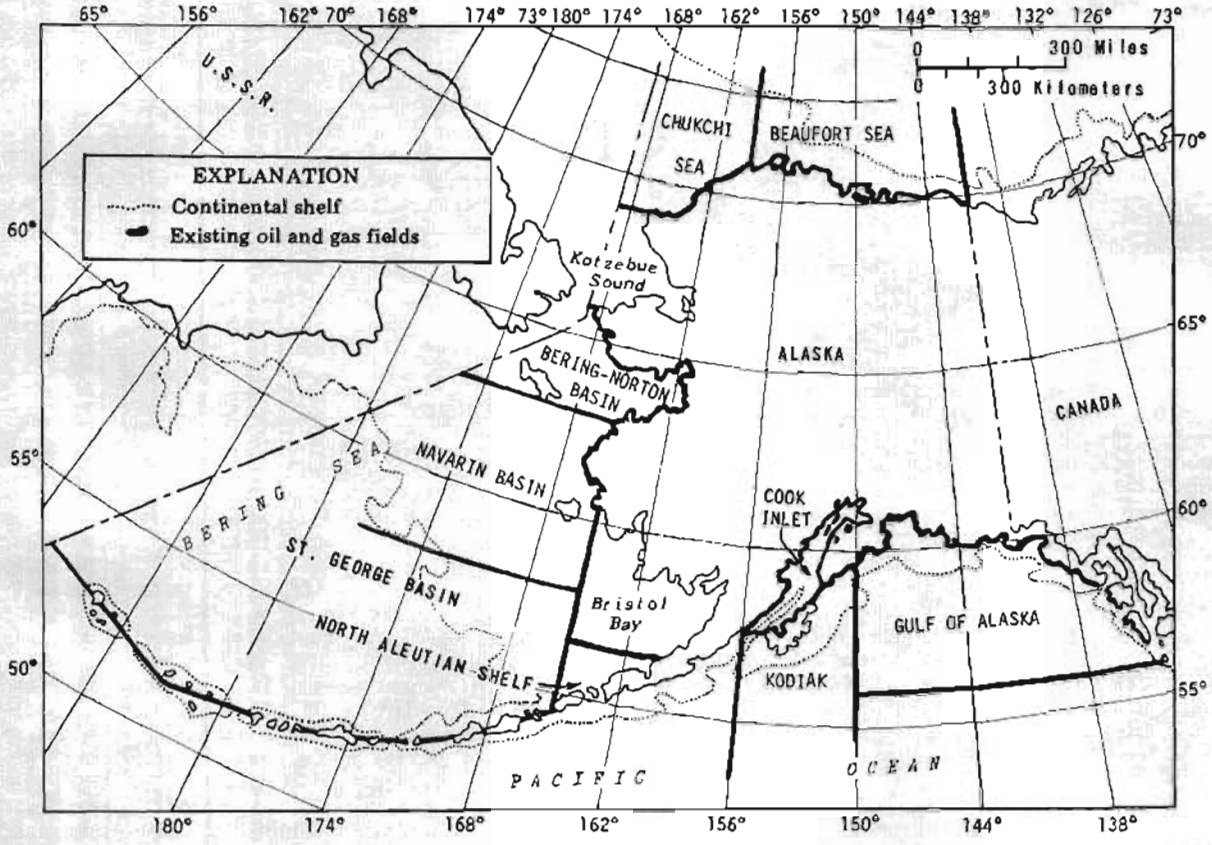


Figure 3.– Location of Outer Continental Shelf basins.

Table 1.–Oil and gas leasing schedule for onshore and offshore areas of Alaska.

	1981	1982	1983	1984	1985
NAT'L PETROL. RES. - AK	T H P S	H P S			
RS - 1 REOFFERING SALE	P SC RNS				
60 - COOK INLET	F P SC RNS				
57 - NORTON BASIN	E H	F P SC RNS			
RS - 2 REOFFERING SALE		P SC RNS			
70 - ST. GEORGE BASIN	E	H F P SC RNS			
71 - BEAUFORT SEA					
61 - KODIAK	E	H F P SC RNS			
RS - 3 REOFFERING SALE			P SC RNS		
75 - NO. ALEUTIAN SHELF		E H	F P SC RNS		
RS - 4 REOFFERING SALE				P SC RNS	
83 - NAVARIN BASIN	C D	T	E	H F P SC RNS	
85 - CHUKCHI SEA	C D	T	E	H F P SC RNS	
86 - HOPE BASIN	C D	T		E H F P	SC RNS
RS - 5 REOFFERING SALE					P SC RNS

C - Call for nominations D - Nomination due T - Tentative tract selection E - Draft environmental statement H - Public hearing
F - Final environmental statement P - Proposed notice of sale SC - State comments due R - Energy review N - Notice of sale S - Sale

PROJECTS OF THE CONSERVATION DIVISION

NORTHERN REGION

Project Title: Coal Resources of National Petroleum Reserve in Alaska (NPRA)

Chief: James E. Callahan

Objectives: To determine identified and hypothetical coal resources in western NPRA for use in land-use planning and to delineate areas suitable for leasing.

Status: The project is of an indefinite term and has been dependent in recent years on timing and location of oil and gas exploratory activity in the petroleum reserve. Currently, data on coal bed thickness, quality, and distribution acquired from shot holes during the 1980 seismic program are being integrated with existing data for the Wainwright and Utukok River topographic quadrangles. An attempt is also being made to project surface and near-surface data into available seismic record sections for structural control and to provide approximate stratigraphic ties to coal zones logged in several coastal plain exploratory wells. The future of the project depends to a large extent on pending legislation affecting the leasing status of the reserve.

The project location is shown in figure 4.

Project Title: National Petroleum Reserve in Alaska (NPRA) Data Open File

Chief: Robert D. Carter

Objectives: To acquire, inventory, organize, reproduce, store, and make available to the public through the National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colo., all geologic and geophysical data generated in the petroleum exploration of the NPRA by the U.S. Navy and the Office of National Petroleum Reserve in Alaska.

Status: Releases to date include all seismic data acquired from 1972 through 1978 along with interpretive reports; well logs and histories of 28 wells drilled from 1964 through 1979; micropaleontology and palynology reports for 38 wells; velocity surveys for 16 wells; and eight miscellaneous reports. NOAA is presently processing for release the seismic data acquired in 1979 along with interpretive geophysical and geologic reports, well information on five of the wells completed in 1980, and a magnetic tape containing gravity data for the 1974-80 surveys.

The project location is shown in figure 4. (See also information in the section for Office of National Petroleum Reserve.)

Project Title: National Petroleum Reserve in Alaska (NPRA) Paleontological Data

Chief: Roger J. Witmer

Objectives: Biostratigraphically to date and correlate strata penetrated by the test field wells in NPRA, to make available to the public, by loan agreement, microscope slides of palynological and foraminiferal material, and to describe micropaleontological material for reports prepared on the basis of these well samples.

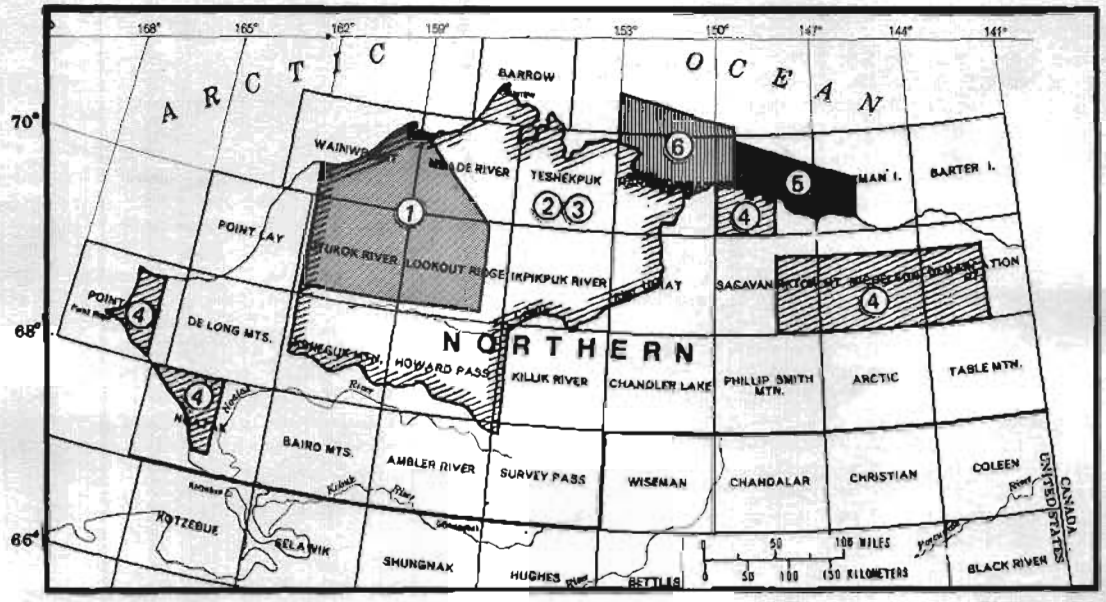
Status: Anderson, Warren, and Associates Micropaleontology Consultants of San Diego, Calif., have processed and analyzed samples of well cuttings, cores, and sidewall cores provided by Husky Oil NPR Operations, drilling contractor for the Office of the National Petroleum Reserve in Alaska (ONPRA). Microfossil assemblages, including palynomorphs and foraminifers (dinoflagellates, acritarchs, pollen, spores, and the like) from 38 wells have been analyzed with respect to their biostratigraphy and paleoecology. Reports on microfossils and biostratigraphy distribution charts (paper copy and microfiche) for all wells can now be purchased from the National Oceanic and Atmospheric Administration (NOAA), Boulder, Colo. A report discussing the biostratigraphic correlation of three lines of section (19 wells) across the Reserve will be completed shortly. Open-File Reports 80-193 and 81-13 list all available palynomorph and foraminiferal microscope slides available, as well as details regarding loan policy. Additional information can also be obtained at the Office of National Petroleum Reserve in Menlo Park, Calif. All microfossil data have now been encoded in computers at Petroleum Information Corporation, Denver, Colo. Plots of species diversities and a report describing paleontological stage/zonule tops for all wells are currently being printed. Reports have been written by the Survey's Paleontology and Stratigraphy Branch describing approximately three-quarters of the several hundred core samples containing megafossils.

The project location is shown in figure 4.

Project Title: Alaskan Conodont Biostratigraphy and Thermal Maturity Study

Chief: John A. Larson

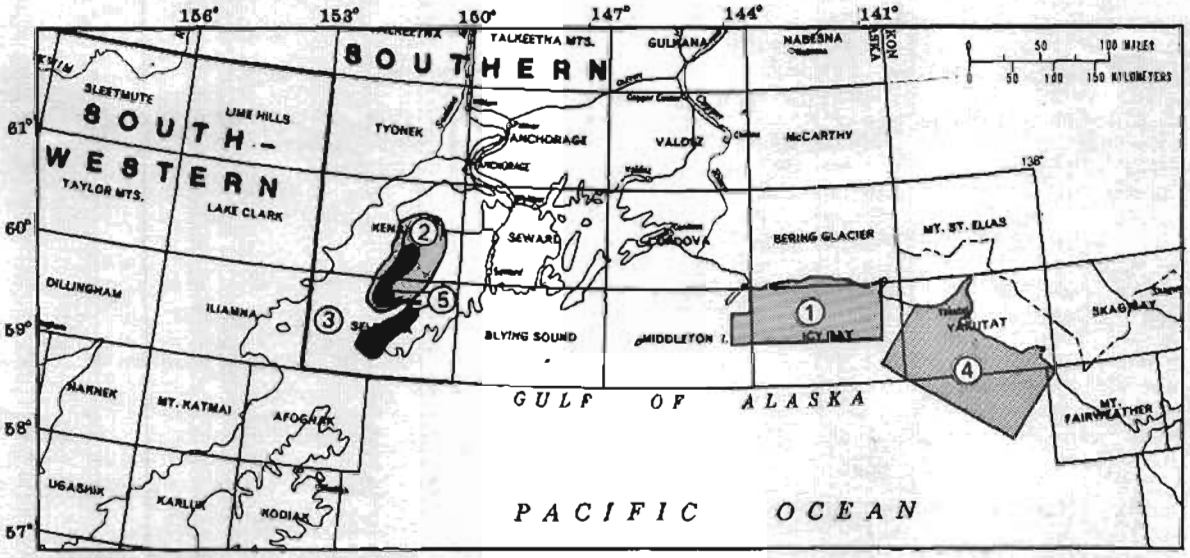
Objectives: To refine the biostratigraphy and establish thermal maturity of Paleozoic and Triassic rocks in potential oil-producing areas in and relating to the Alaska Outer Continental Shelf, such as the Brooks Range, North Slope, and Beaufort Sea. This will be done by processing samples (such as outcrop samples and well cuts) from these areas and examining the conodonts. Conodont biostratigraphy is quite well developed in the conterminous United States, in Canada, and in Europe. Conodont color tran-



EXPLANATION

1. Coal Resources of National Petroleum Reserve in Alaska
2. National Petroleum Reserve in Alaska Data Open File
3. National Petroleum Reserve in Alaska Paleontological Data
4. Conodont Biostratigraphy and Thermal Maturity Study
5. Geotechnical Investigation, Beaufort Sea
6. Shallow Geology of the Beaufort Outer Continental Shelf

Figure 4 - - Conservation Division activities in northern Alaska.



EXPLANATION

1. Biostratigraphy and Paleoenvironments of the Outer Continental Shelf in the Sale 39 area
2. Diatomite and Ash Studies of the Kenai Peninsula
3. Lower Cook Inlet Basin Analysis
4. Shallow Geology of the Eastern Gulf of Alaska Outer Continental Shelf
5. Lower Cook Inlet Stratigraphic Study

Figure 5 – Conservation Division activities in southern Alaska.

sitions from transluscent pale amber to black are accurate indicators of the thermal history of the enclosing rock. Potential localities for this study include the Prudhoe Bay area, the Brooks Range, and Cape Lisburne for a sampling of the Shublik and older formations, and samples from Continental Offshore Stratigraphic Test (COST) wells penetrating the Triassic and (or) Paleozoic section will be examined. The project will be carried out in many regions of the State. Figure 4 shows those in the north, but some work is being done in the Goodnews, Iliamna, Teller, and Seldovia quadrangles as well.

Status: The project is in early planning stages, and personnel are seeking to develop a program for sampling outcrops in the above-mentioned areas and to acquire from Prudhoe Bay area wells the large amount of well cuttings required for this research. Rock crushing equipment is needed. Expansion and refinement of existing lab facilities will have to precede acid processing of samples and subsequent heavy-liquid separation of residues that may contain condonts.

SOUTHERN REGION

Project Title: Biostratigraphy and Paleoenvironments of the Outer Continental Shelf (OCS) in the Sale 39 Area, Gulf of Alaska

Chiefs: Ronald F. Turner and John A. Larson

Objectives: To make a detailed biostratigraphic, lithologic, and paleoenvironmental analysis of three Gulf of Alaska Outer Continental Shelf wells (Y-0007, Y-0032, and Y-0080) that penetrate through the glaciomarine Yakataga Formation in sale area 39. This analysis will involve recovery, identification, and analysis of microfossils such as foraminifers, diatoms, radiolarians, dinoflagellates, and nanoplankton from well samples, and examination of rock cuttings contained in the samples. Detailed biostratigraphic analysis of these wells will provide a correlation base for projection to and comparison with wells drilled on tracts leased in the recent Gulf of Alaska OCS Sale 55 and with any subsequent wells on the Kodiak Shelf. Paleoenvironmental analysis will provide an additional tool for locating the most favorable parts of the Gulf of Alaska OCS geologic section for petroleum source and reservoir rocks and for projecting the lateral trends of these rocks.

Status: Mud samples from these wells have been received by the Conservation Division and have been washed for recovery of foraminifers. Processing for other microfossil groups will be undertaken following upgrading and expansion of laboratory facilities. Preliminary biostratigraphy based on foraminifers has been completed for wells Y-0007 and Y-0032.

The project location is shown in figure 5.

Project Title: Diatomite and Ash Studies of the Kenai Peninsula

Chief: Don W. Olson

Objectives: To improve understanding of paleoecology, paleoclimatology, and biostratigraphy interpretations of Tertiary rocks through the use of diatomites and the radiometric dating of ash layers. Pre-selected sites will be sampled for diatoms. Samples will be processed principally for diatoms, but there may well be a subsequent palynological study of the same samples. These data would then be correlated with onshore well data from the State of Alaska holdings and with offshore data from Leg 19 of the Deep Sea Drilling Program. Subsequent studies on the west side of the Cook Inlet will extend the information geographically.

Status: Literature review and site selections are in progress.

The project location is shown in figure 5.

Project Title: Lower Cook Inlet Basin Analysis

Chiefs: John G. Bolm, John Larson, and Ronald F. Turner

Objectives: To integrate data from exploratory wells in Lower Cook Inlet with seismic data and information from wells and outcrops in surrounding areas and develop a regional framework for use in tract selection and evaluation for future oil and gas lease sales.

Status: Work is to begin in mid-1981 and should be completed in about 1 year. A comprehensive interpretive report will be written but will remain in-house until proprietary data used in the study have been released to the public.

The project location is shown in figure 5.

Project Title: Lower Cook Inlet Stratigraphic Study

Chiefs: John G. Bolm and William M. Lyle (State of Alaska)

Objectives: To collect reservoir and source-rock data from outcrops of rocks along the east side of Lower Cook Inlet for use in overall analysis of the basin.

Status: This is a cooperative project with the State of Alaska, Division of Geological and Geophysical Surveys. Fieldwork is planned for the summer of 1981, and it is expected that a report describing the results of the project will be ready for publication in mid-1982.

The project location is shown in figure 5.

Project Title: Taxonomy, Ecology, and Bathymetric Distribution of Fossil and Recent Bryozoa, Kodiak Shelf, Gulf of Alaska

Chief: Ronald F. Turner

Objectives: To make detailed taxonomic and ecologic analysis of the fossil and modern fauna and flora of the Albatross Bank, Kodiak Shelf, with special emphasis on the bryozoans. Sediment type and distribution will be analyzed with reference to faunal distribution, source, and tectonic setting. The recent tectonic evolution of this area of the shelf will be interpreted utilizing changes in bathymetrically sensitive components of the fauna and flora.

Status: Sampling, initial processing, and mapping have been completed; integration of seismic lines is incomplete. If goals of individual collaborators are met, the project could be completed in summer 1981.

The project location is shown in figure 6.

SOUTHWESTERN REGION

Project Title: Lower Cook Inlet-Shelikof Strait Field Project - 1979

Chiefs: George W. Petering and Thomas N. Smith

Objectives: To investigate potential reservoir and source rocks in upland areas adjacent to proposed Outer Continental Shelf sale areas to aid in tract selection and block evaluations.

Status: A report on this project's findings is in review.

The project location is shown in figure 6.

Project Title: Lower Cook Inlet-Shelikof Strait Field Project - 1980

Chiefs: Thomas N. Smith and George W. Petering

Objectives: To investigate potential reservoir and source rocks in upland areas adjacent to proposed Outer Continental Shelf sale areas to aid in tract selection and block evaluations.

Status: A report describing results of project work is in progress.

The project location is shown in figure 6.

OFFSHORE

Project Title: Shallow Geology of Lower Cook Inlet and Northern Shelikof Strait

Chiefs: Peter J. Hoose and Kenneth D. Holden

Objectives: To identify geologic features and conditions which might represent hazards or constraints to petroleum exploration and production in the area of Oil and Gas Lease Sale 60. These hazards include faulting, slumping, gas-charged sediments, gas seeps, mobile bed forms, and proximity to active volcanoes.

Status: During the summer of 1979, 2,557 km of multisystem, high-resolution geophysical data was collected in Shelikof Strait between Cape Iliktugitak and Cape Douglas. From these data, five maps and seven cross sections were released as Open-File Reports 80-2031 through 80-2036. These interpretations were combined with a similar study done on lower Cook Inlet in order to provide a comprehensive geologic picture of the entire lease sale area. Presently, each lease block is being studied individually to determine whether it contains geologic hazards.

The project location is shown in figure 6.

Project Title: Shallow Geology of the Kodiak Outer Continental Shelf

Chiefs: Glenn P. Thrasher and Bruce W. Turner

Objectives: To carry out investigations of surficial geology in the area of the proposed Oil and Gas Lease Sale 61, offshore of Kodiak Island. Of particular importance is the identification of geologic features and conditions that might represent hazards or constraints to petroleum exploration.

Status: Mapping of shallow geology and geologic hazards using data collected in 1976 and 1977 is complete. Additional data may be collected during the 1981 field season. Effort is being concentrated on determining the environmental geology and shallow drilling conditions in the proposed lease sale area.

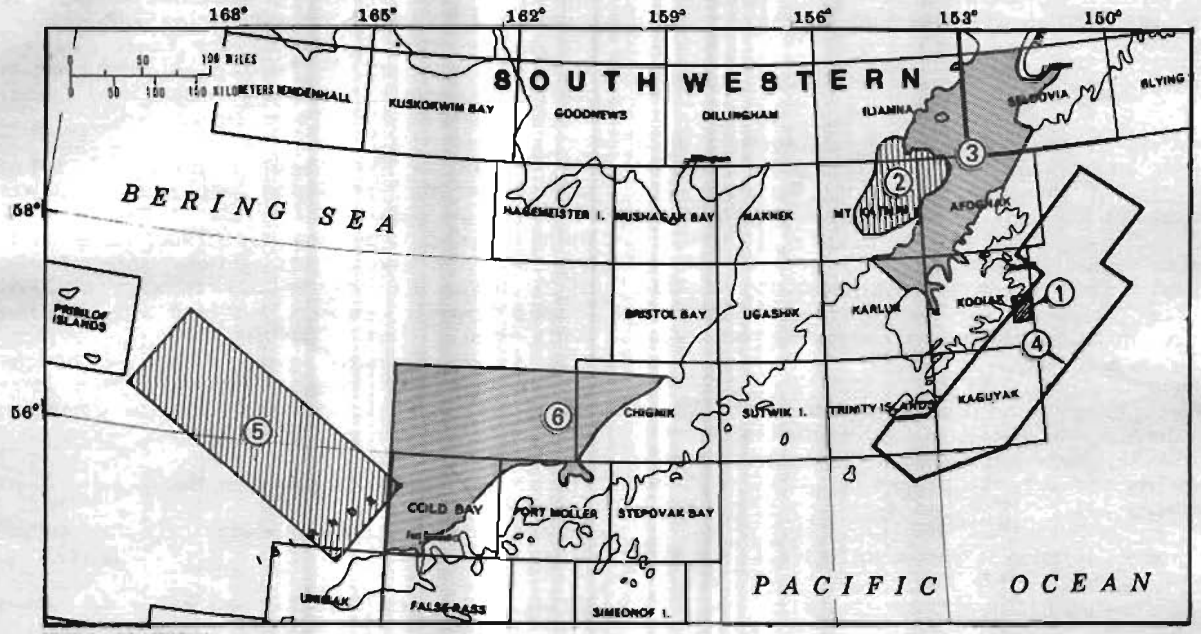
The project location is shown in figure 6.

Project Title: Shallow Geology of St. George Basin, Southern Bering Sea

Chief: C. Drew Comer

Objectives: To map the near-surface geology of the St. George Basin and to identify features such as shallow faults, shallow gas accumulation, and unstable sediments that may constitute hazards or constraints to petroleum exploration or development activities in the area of Oil and Gas Lease Sale 70, scheduled for December 1982.

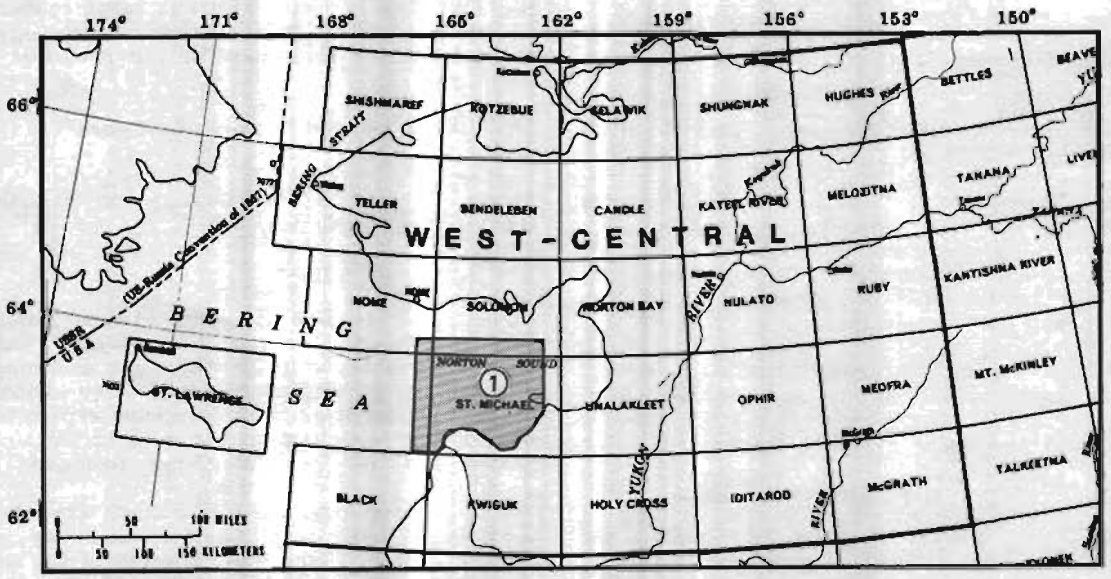
Status: Approximately 2,590 kilometers of high-resolution geophysical data, including multichannel seismic data, was collected in the summer of 1980. Interpretation of the data began in November 1980. The results will be incorporated with interpretations of data collected in 1976-77, and bathymetric and isopach maps and maps of



EXPLANATION

1. Taxonomy, Ecology and Bathymetric Distribution of Fossil and Recent Bryozoa, Kodiak Shelf, Gulf of Alaska
2. Lower Cook Inlet - Shelikof Strait Field Program
3. Shallow Geology of Lower Cook Inlet and Northern Shelikof Strait
4. Shallow Geology of the Kodiak Outer Continental Shelf
5. Shallow Geology of St. George Basin, Southern Bering Sea
6. Shallow Geology of the Northern Aleutian Shelf, Bering Sea

Figure 6.–Conservation Division activities in southwestern and offshore Alaska.



EXPLANATION

1. Shallow Geology of Norton Basin, Bering Sea

Figure 7.–Conservation Division activities, offshore Alaska.

shallow structures, and geologic hazards will be released to the open file.

The project location is shown in figure 6.

Project Title: Shallow Geology of the Eastern Gulf of Alaska Outer Continental Shelf

Chiefs: Bruce W. Turner and Glenn P. Thrasher

Objectives: To carry out investigations of surficial geology on the eastern Gulf of Alaska Outer Continental Shelf between Malaspina Glacier and Dry Bay. Of particular importance is the identification of geologic features and conditions that might represent hazards or constraints to petroleum exploration.

Status: During the summer of 1979, 5,580 kilometers of multisystem, high-resolution geophysical data was collected offshore on a rectangular grid between Malaspina Glacier and Dry Bay. Bathymetric, geologic, isopach, and geologic hazards maps have been prepared from the data. Studies of the geologic history and sedimentary environment of the area are continuing.

The project location is shown in figure 5.

Project Title: Shallow Geology of Norton Basin, Bering Sea

Chiefs: C. Drew Comer, Bruce W. Turner, and David Steffy

Objectives: To map the near-surface geology of the Norton Sound sedimentary basin and to identify and map features such as shallow gas accumulations, shallow or minor faults, and unstable sediments that may constitute hazards or constraints to petroleum exploration or development activities in the area of Oil and Gas Lease Sale 57.

Status: Data acquisition is complete. About 5,800 kilometers of multisystem seismic data was collected, and interpretation began in January 1981. The following maps will be published in the open file by late 1981: shallow structure map, isopach map, bathymetric map, and an engineering hazards map. The open-file maps will be followed by a more formal publication at a later date.

The project location is shown in figure 7.

Project Title: Shallow Geology of the Northern Aleutian Shelf, Bering Sea

Chief: Peter J. Hoose

Objectives: To map the surface and near-surface geology of the northern Aleutian Shelf sedimentary basins in order to identify features that might constitute a hazard or constraint to petroleum exploration and production in the area of Oil and Gas Lease Sale 75.

Status: In late 1980, a comprehensive search of pertinent geologic literature was made for the lease sale area. Data acquisition will take place during the summer of 1981. Data will be interpreted in late 1981 and early 1982. A series of maps, including bathymetric and isopach maps, shallow structure map, and engineering hazards map, is being prepared.

The project location is shown in figure 6.

Project Title: Shallow Geology of the Beaufort Outer Continental Shelf

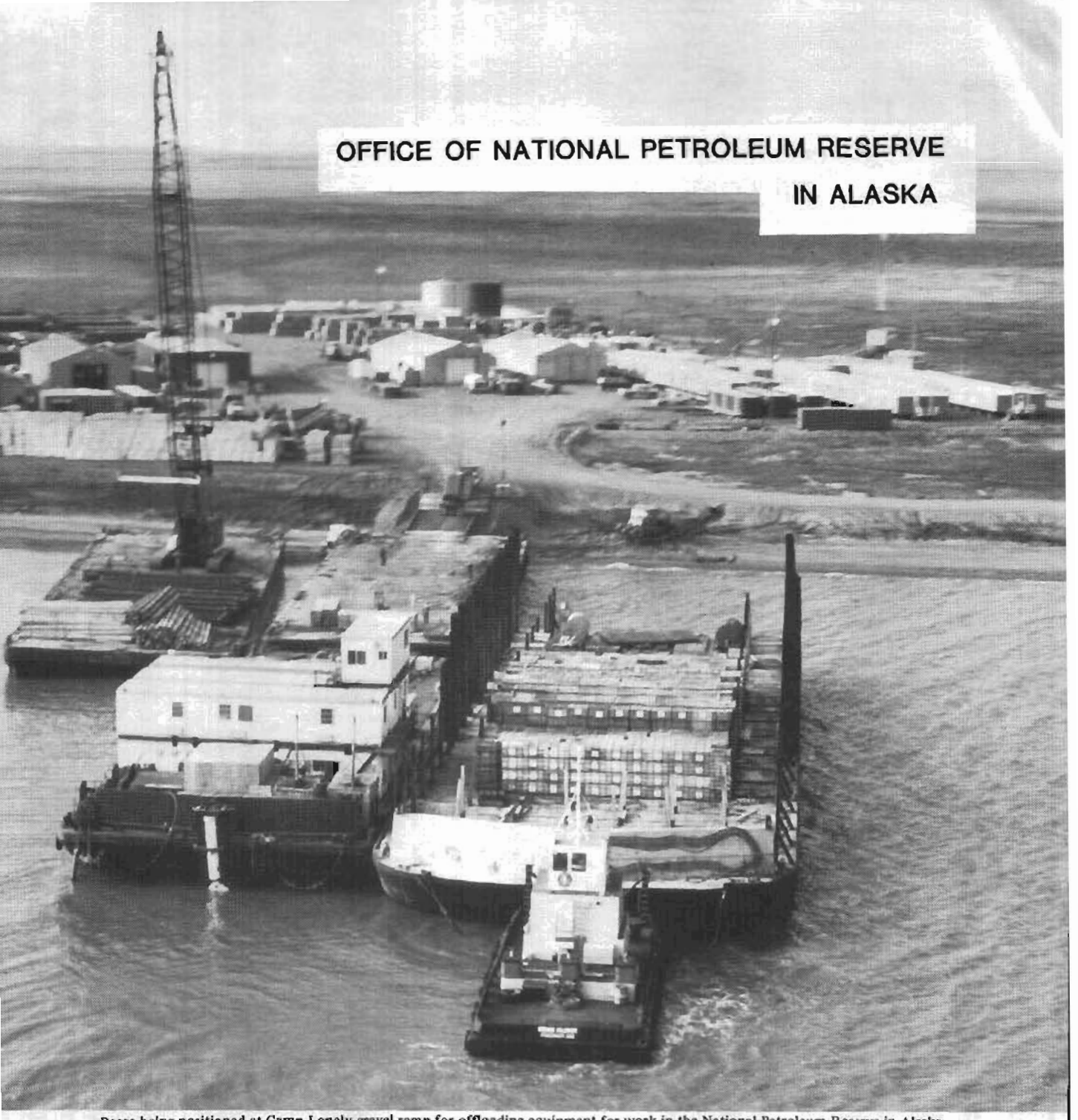
Chiefs: Glenn P. Thrasher and James D. Craig

Objectives: To identify geologic features and processes that might represent hazards or constraints to petroleum exploration in the area of Oil and Gas Lease Sale 71. Additional objectives are to locate potential sources of gravel for construction of offshore facilities and better to understand the subsea permafrost conditions in the area.

Status: High-resolution geophysical data were collected over Harrison Bay, about one-half of the sale area, during the summer of 1980. Data were also collected from previously drilled core holes to obtain stratigraphic and permafrost control. Interpretation should take 2 years to complete, and project products will include bathymetric maps, as well as maps showing shallow geology, environmental geology, permafrost, and ice scour features. Additional data may be collected during the 1981 field season.

The project location is shown in figure 4.

OFFICE OF NATIONAL PETROLEUM RESERVE IN ALASKA



Barge being positioned at Camp Lonely gravel ramp for offloading equipment for work in the National Petroleum Reserve in Alaska

For further information, contact the offices listed below.

Anchorage, Alaska

George Gryc, Chief; or
Max Brewer, Chief, Operation Office

Office of National Petroleum Reserve in Alaska
2525 C Street, Suite 400
Anchorage, AK 99503
Tel. (907) 276-7422

OFFICE OF NATIONAL PETROLEUM RESERVE IN ALASKA

During FY 1980, the U.S. Geological Survey continued petroleum exploration activities on the National Petroleum Reserve in Alaska (NPRA). Responsibility for the exploration program on the Reserve was transferred from the Department of the Navy to the Department of the Interior on June 1, 1977, in accordance with the Naval Petroleum Reserves Production Act of 1976. The Geological Survey was assigned the responsibility of continuing the petroleum exploration program and other activities initiated by the Department of the Navy, namely to:

- Explore and evaluate the petroleum resources of NPRA by means of drilling and geological and geophysical investigations;
- Continue to develop and produce natural gas from the South Barrow gas field, or other fields as may be necessary, to supply gas at reasonable and equitable rates to the Native village of Barrow and other communities and Federal installations in the vicinity of Barrow; and
- Continue environmental rehabilitation of those areas of the Reserve disturbed by previous exploration activities.

The petroleum exploration activities on NPRA in 1980 were coordinated with two related studies. One study relates to "the best overall procedures to be used in the development, production, transportation, and distribution of the petroleum resources in the Reserve." That study is referred to as the Presidential study or the 105(b) study and was submitted to Congress in December 1979. It consists of an economic and policy analysis conducted by the Office of Minerals Policy and Research Analysis of the Department of the Interior and an environmental evaluation completed by the Geological Survey. The second study was managed by the Bureau of Land Management, "to determine the values of, and best uses for, the lands contained in the Reserve, taking into consideration (A) the natives who live or depend upon such lands, (B) the scenic, historical, recreational, fish and wildlife, and wilderness values, (C) mineral potential, and (D) other values of such lands." This study, referred to as the 105(c) study, was submitted to Congress in April 1979.

In the Department of the Interior Appropriation Bill for 1981, Congress authorized leasing of the lands in the NPRA.

Highlights of FY 1980 include:

- Eight exploratory wells were active during the year. Seven wells were completed, including one deep well which was started in November 1978 and one medium-depth well which was suspended during the previous spring. One well was suspended during the summer for re-entry in FY 1981, and the pad for another well was constructed but drilling was delayed until FY 1981. (See table 2a.)
- 1,110 line miles of seismic data were acquired, processed, and interpreted.
- Three gas development wells were drilled in the East Barrow gas field. (See table 2b.)
- Environmental rehabilitation activities were continued with the collection of 1,760 tons of debris and waste materials, including 10,700 barrels, from seven old construction and drilling sites, and burial of over 660 tons of additional debris at two sites.
- Well data were released to the public on the additional wells completed in FY 1979. All seismic and gravity data acquired from 1974 through FY 1979 were released to the public. Summary geological and geophysical reports for 1979 were also released. Drilling and geophysical data acquired during FY 1980 is being processed for early release. Weekly summaries of drilling data and well logs were also made available to the public at the Menlo Park, Calif., and Anchorage, Alaska, offices of ONPRA.
- Four drilling sites were selected for FY 1981 drilling.

The Tunalik well, started in November 1978 as a deep test in the western part of the Reserve, was completed at a depth of 20,335 feet in January 1980. Numerous gas shows were encountered, and high-pressure, non-commercial gas was tapped at 12,550 and 14,725 feet, creating severe drilling problems. The Ikpikpuk well, also started in November 1978 as a medium-depth well, was completed in February 1980 at a depth of 15,481 feet, recovering only small amounts of gas. The Lisburne well, in the foothills region, was drilled to 17,000 feet. Although the well did not encounter commercial quantities of oil and gas, data from the well will be useful to future exploration in similar geologic environments.

The Seabee well, drilled on the flank of the Umiat anticline which contains the Umiat oil field discovered in 1950, tested deeper hydrocarbon reservoirs. Minor oil and gas shows were encountered, but tests revealed limited, depleting reservoirs. Three other wells were completed in

Table 2a.--Exploration wells drilled by the Navy from 1975 through 1977 and wells drilled or planned during the USGS program from FY 1978 through FY 1980. Status of wells in progress is shown as of February 1, 1981.

Map Number	Name	Location	Date Spudded	Date Completed	Total Depth	Deepest Horizon Attained	Remarks
1	Cape Halkett No. 1	18 mi ESE of Lonely	3/24/75	5/23/75	9,900 ft	Argillite basement (Devonian or older)	Dry; plugged and abandoned
2	East Teshekpuk No. 1	25 mi S of Lonely	3/12/76	5/11/76	10,664 ft	Granite basement	Dry; plugged and abandoned
3	So. Harrison Bay No. 1	50 mi SE of Barrow	11/21/76	1/27/77	11,290 ft	Lisburne Group (Mississippian)	Poor oil shows; plugged and abandoned
4	Atigaru Point No. 1	44 mi SE of Lonely	1/12/77	3/10/77	11,535 ft	Argillite basement (Devonian or older)	Poor oil shows; plugged and abandoned
5	West Fish Creek No. 1	51 mi SE of Lonely	2/14/77	4/21/77	11,427 ft	Kayak Shale (Mississippian)	Poor oil shows; plugged and abandoned
6	So. Simpson No. 1	41 mi WSW of Lonely	3/9/77	4/18/77	8,805 ft	Argillite basement (Devonian or older)	Dry; plugged and abandoned
7	W. T. Foran No. 1	23 mi ESE of Lonely	3/7/77	4/16/77	8,864 ft	Argillite basement (Devonian or older)	Oil and gas shows; plugged and abandoned
8	Drew Point Test Well No. 1	14 mi W of Lonely	1/13/78	3/13/78	7,946 ft	Argillite basement (Devonian or older)	Poor oil and gas shows; plugged and abandoned
9	No. Kilikpik Test Well No. 1	37 mi SE of Lonely	2/27/78	4/14/78	7,395 ft	Kingak Shale (Jurassic)	Poor oil and gas shows; plugged and abandoned
10	So. Meade Test Well No. 1	45 mi S of Barrow	2/8/78 (reentered 12/1/78)	1/22/79	9,945 ft	Argillite basement (Devonian or older)	Poor gas shows; plugged and abandoned
11	Kugrua Test Well No. 1	67 mi SW of Barrow	2/13/78	5/30/78	12,588 ft	Lisburne Group (Mississippian)	Dry; plugged and abandoned
12	Inigok Test Well No. 1	60 mi S of Lonely	6/7/78	5/22/79	20,102 ft	Kekiktuk Formation (Mississippian)	Encountered hydrogen sulfide and sulfur at 17,570 ft; poor gas shows; plugged and abandoned
13	Tunalik Test Well No. 1	22 mi SE of Icy Cape	11/10/78	1/7/80	20,335 ft	Argillite basement	Gas test; plugged and abandoned
14	Peard Test Well No. 1	25 mi NE of Wainwright	1/26/79	4/13/79	10,225 ft	Argillite basement	Poor gas shows; plugged and abandoned

Table 2a.--Exploration wells--Continued

Map Number	Name	Location	Date Spudded	Date Completed	Total Depth	Deepest Horizon Attained	Remarks
15	Ikpikpuk Test Well No. 1	42 mi SW of Lonely	11/29/78	2/28/80	15,481 ft	Argillite basement	Shows; plugged and abandoned
16	East Simpson Test Well No. 1	55 mi SE of Barrow	2/19/79	4/10/79	7,739 ft	Argillite basement	Oil and gas shows; plugged and abandoned
17	J. W. Dalton Test Well No. 1	3 mi E of Lonely	5/7/79	8/2/79	9,367 ft	Argillite basement	Oil and gas shows; some heavy oil recovered during testing; plugged and abandoned
18	Lisburne Test Well No. 1	110 mi SW of Umiat	6/11/79	6/2/80	17,000 ft	Lisburne-Endicott Group	Shows of gas; plugged and abandoned
19	Seabee Test Well No. 1	1 mi NW of Umiat	7/1/79	4/16/80	15,611 ft	Basal Cretaceous	Gas test; plugged and abandoned
20	Walakpa Test Well No. 1	15 mi S of Barrow	12/25/79	2/7/80	3,666 ft	Argillite basement	Shows of gas; plugged and abandoned
21	East Simpson Test Well No. 2	50 mi SE of Barrow	1/28/80	3/15/80	7,505 ft	Argillite basement	Poor shows; plugged and abandoned
22	West Dease Test Well No. 1	28 mi SE of Barrow	2/19/80	3/26/80	4,170 ft	Argillite basement (Devonian or older)	Poor shows; plugged and abandoned
23	Awuna Test Well No. 1	150 mi S of Barrow	3/1/80		15,000 ft (projected)	Lisburne Group (Mississippian)	Suspended at 5,300 ft for summer
24	Koluktak Test Well No. 1	75 mi S of Smith Bay	Being Planned		4,500 ft (projected)	Torok Formation (Cretaceous)	Planned for drilling in in FY 1981
*	Walakpa Test Well No. 2	18 mi SSW of Barrow	1/3/81		4,100 ft (projected)	Argillite basement (Devonian or older)	Drilling ahead at 1,984 ft as of 1/20/81
*	North Inigok Test Well No. 1	46 mi S of Lonely	Being Planned		10,800 ft (projected)	Sag River Sandstone (Triassic)	
*	Kuyanak Test Well No. 1	30 mi SE of Barrow	Being Planned		6,300 ft (projected)	Argillite basement (Devonian or older)	
*	Tulageak Test Well No. 1	25 mi ESE of Barrow	Being Planned		4,000 ft (projected)	Argillite basement (Devonian or older)	

* Shown only by name on figure 8.

Table 2b.--Barrow gas wells recently drilled by the Navy and the Geological Survey. (See fig. 8.)

Map Number	Name	Location	Date Spudded	Date Completed	Total Depth	Deepest Horizon Attained	Remarks
28	So. Barrow No. 13	5 mi SE of Barrow	12/17/76	1/16/77	2,535 ft	Argillite basement (Devonian or older)	Shows of gas; suspended as marginal gas well
29	So. Barrow No. 14	12 mi ESE of Barrow	1/28/77	3/3/77	2,257 ft	Sag River Sandstone (Triassic)	Completed as gas well
30	So. Barrow No. 16	6 mi E of Barrow	1/28/72	2/18/78	2,400 ft	Argillite basement (Devonian or older)	Dry; plugged and abandoned
31	So. Barrow No. 17	13 mi ESE of Barrow	3/2/78	4/13/78	2,382 ft	Argillite basement (Devonian or older)	Suspended; edge well; produces water with gas
32	So. Barrow No. 19	11 mi ESE of Barrow	4/17/78	5/17/78	2,300 ft	Argillite basement (Devonian or older)	Completed as a gas well
33	So. Barrow No. 15	10 mi ESE of Barrow	8/23/80	9/18/80	2,278 ft	Argillite basement	Completed as a gas well
34	So. Barrow No. 18	12 mi ESE of Barrow	9/22/80	10/14/80	2,135 ft	Argillite basement	Completed as a gas well
35	So. Barrow No. 20	11 mi ESE of Barrow	4/7/80	5/10/80	2,356 ft	Argillite basement	Shows of gas; suspended as a nonproducer

the coastal plain, Walakpa, West Dease, and East Simpson No. 2, to depths of 3,660, 4170, and 7,505 feet, respectively, but no commercial quantities of oil or gas were found.

Awuna, a well to be drilled to 15,000 feet in the central part of the Reserve, was suspended for the summer in May 1980 at a depth of 5,300 feet. A drilling pad for Koluktak was constructed, but drilling was delayed until FY 1981. Additional wells to be drilled in FY 1981 include North Inigok in the east-central part of the Reserve, and Walakpa No. 2, Tulageak, and Kuyanak in the coastal plain.

In FY 1981, approximately 575 line miles of seismic data will be acquired in the eastern coastal plain area.

In the Barrow area, the Geological Survey continues to operate and maintain the South Barrow gas field, which supplies gas to the village of Barrow and Federal installations in the Barrow area. A gas production system was constructed at the recently discovered East Barrow gas field to permit production of gas from this field during the winter of 1980-81. Reserves from the East Barrow field will double the amount of natural gas available to the Barrow area. Three gas development wells were drilled in the East Barrow field, Barrow Wells 15, 18, and 20, in FY 1980. Wells 15 and 18 were completed as gas producers, and Well 20 was suspended as a possible oil producer.

Geological and geophysical reports and well data from the drilling program are made available to the public through the Environmental Data and Information Service, National Oceanic and Atmospheric Administration (NOAA), Boulder, Colo. 80303; (303) 499-1000, ext. 6338. Core chips and ditch cuttings are provided through the Alaska Department of Natural Resources, Division of Oil and Gas Conservation, 3001 Porcupine Drive, Anchorage, Alaska 99501.

A 16-mm film, "National Petroleum Reserve in Alaska", is available for public showings. For information on obtaining a copy of this film, contact the ONPRA office in Alaska.

The NPRA exploration program requires many technical background studies and activities in addition to the drilling and seismic operations carried out by the prime contractor, Husky Oil NPR Operations, Incorporated. These studies, conducted primarily by the Geological Survey's Geologic Division, are described in this circular as part of each operating division's program in the northern region of the State.

For additional information about the ONPRA activities, contact:

George Gryc, Chief, ONPRA, or
Max Brewer, Chief, Operation Office, ONPRA
2525 "C" Street, Suite 400
Anchorage, Alaska 99503
Tel. (907) 276-7422

Listed below are current projects of ONPRA. All project locations are included in the area shown in figure 8.

PROJECTS OF THE OFFICE OF NATIONAL PETROLEUM RESERVE IN ALASKA

Project Title: Geophysical Exploration of the National Petroleum Reserve in Alaska

Chief: Arthur L. Bowsher

Objectives: To acquire and interpret common depth point (CDP) seismic and gravity data for use in locating drilling sites for exploratory wells and to aid in assessing the hydrocarbon potential of NPRA.

Status: Approximately 575 line miles of seismic and gravity data will be acquired by a Geophysical Services, Incorporated (GSI), field crew in the east coastal area of the Reserve during FY 1981. The gravity and seismic data will be processed by GSI and interpreted by Tetra Tech, Incorporated. With the completion of the FY 1981 field work, more than 13,000 line miles of seismic and gravity data will have been collected in the NPRA since 1972.

Project Title: National Petroleum Reserve in Alaska (NPRA) Data Open-File

Chief: Robert D. Carter

Objectives: To inventory, organize, and make available to the public all geological and geophysical data generated in the petroleum exploration of the NPRA by the U.S. Navy and by the Office of National Petroleum Reserve in Alaska.

Status: All well information acquired through FY 1979 has been released to the public through NOAA. All seismic and gravity data acquired from 1974 through FY 1979 were released to the public. Summary geological and geophysical reports for FY 1979 activities has been released through NOAA. Drilling and geophysical data acquired in FY 1980 is being processed for early release. A summary report of seismic-reflection and gravity data for FY 1978 have been released. All well and basic geophysical data generated prior to FY 1978 have also been released by NOAA.

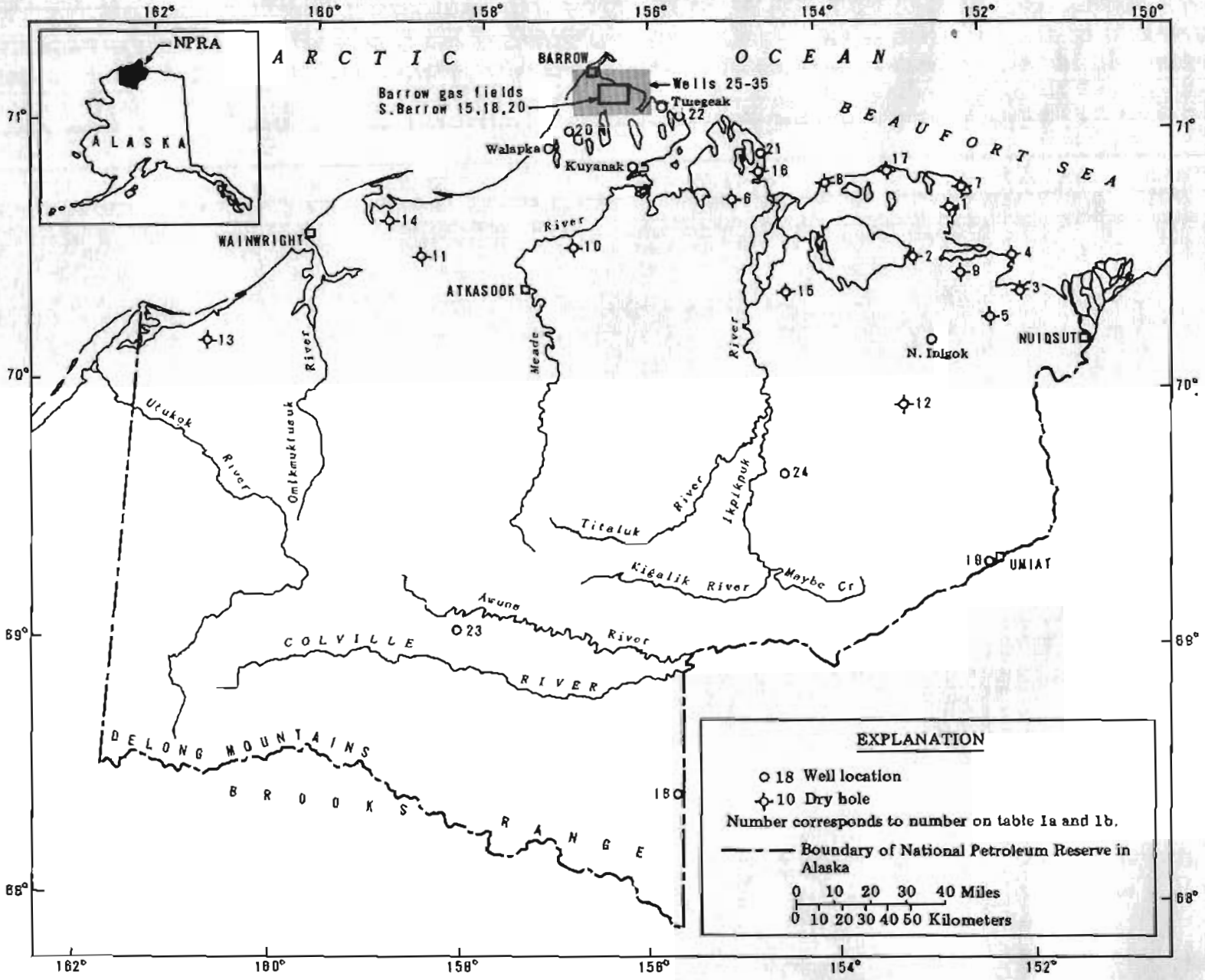


Figure 8. – Exploration wells on National Petroleum Reserve in Alaska.

Project Title: *Development and Operation of Gas Fields in the Barrow Area*

Chiefs: Robert J. Lantz and Robert D. Carter

Objectives: To explore the Barrow area by geologic and geophysical methods, including drilling wells, in order to determine the presence of natural gas, to determine the gas reservoirs of known or newly discovered fields and to develop such fields, and to operate and maintain the South Barrow and East Barrow gas fields through an Interagency Support Agreement with the Naval Arctic Research Laboratory at Barrow. These activities are undertaken in order to continue the supply of gas to the village of Barrow and to the Federal installations in the vicinity of Barrow.

Status: The Geological Survey continued to operate the South Barrow gas field. A gas production system was constructed at the newer East Barrow gas field to permit production of gas from this field beginning in FY 1981. Three gas development wells were drilled in FY 1980 in the East Barrow gas field, two of which were completed as gas producers and one was suspended as a possible oil producer. No additional gas wells will be drilled in the Barrow area during FY 1981.

WATER RESOURCES INVESTIGATIONS
Water Resources Division

Gaging station on the Miguakiak River, northern Alaska

For further information, contact the offices listed below.

Anchorage, Alaska

Philip A. Emery — District Chief
733 West 4th Avenue, Suite 400
Anchorage, AK 99501
Tel. (907) 271-4138

Larry Leveen — Chief, Anchorage Subdistrict
1209 Orca Street
Anchorage, AK 99501
Tel. (907) 271-4513

Fairbanks, Alaska

Bruce Parks — Chief, Fairbanks Subdistrict
P.O. Box 11, 101 12th Avenue
Fairbanks, AK 99701
Tel. (907) 452-1951 ext. 214

Juneau, Alaska

Harold Seitz — Chief, Juneau Subdistrict
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Juneau, AK 99802
Tel. (907) 586-7216

Menlo Park, California

John D. Bredehoeft — Regional Hydrologist
Western Region
345 Middlefield Road
Menlo Park, CA 94025
Tel. (415) 323-8111
ext. 2337

Reston, Virginia

Philip Cohen — Chief Hydrologist
409 National Center
Reston, VA 22092
Tel. (703) 860-6921

WATER RESOURCES INVESTIGATIONS

The water-resources program of the Geological Survey "has the objective of seeing that the Nation's water resources are appraised and that the necessary water data to develop and manage them efficiently are available when needed."[1] The Survey is the primary source of hydrologic data that are basic not only to quantification of water resources but also to their development and conservation, including data for both planning and management. This role, practiced for many years and tacitly accepted by the water-resource community, was given express recognition in 1964 when the responsibility for coordinating water-data programs of Federal agencies was delegated to the Geological Survey (Office of Management and Budget Circular A-67). For the past decade, largely in response to the growing public awareness of the environment, the Survey has provided data and technology needed to predict the impact of man's activities upon the water resource and the water environment.

The Geological Survey's Water Resources Division determines the source, quantity, quality, distribution, movement, and availability of surface and ground water. This work includes investigations of floods and potential sources of water supply in river basins and ground-water systems; determination of the chemical, biological, and physical quality of water resources and their relation to various parts of the hydrologic cycle; special hydrologic studies of the inter-relations between climate, topography, vegetation, soils, and the water supply; research to improve the scientific basis of investigations and techniques; scientific and technical assistance to other Federal agencies and to licensees of the Federal Energy Regulatory Commission; coordination of Federal water-data acquisition activities; design and operation of a national water-data network; and publication of results of investigations.

The Division's program in Alaska is divided into three broad categories. One category is hydrologic data collection to provide information about hydrologic characteristics essential to planning and carrying out hydrologic appraisals and/or hydrologic research. In 1981 this type of work constitutes the major part of the Division's efforts in Alaska. A second category is hydrologic appraisals. This includes analyses of conditions in hydrologic basins, studies of areas likely to be or being affected by mineral, energy, fisheries, coastal zone, or urban development, studies of water resources in urban areas, investigations of potential hydrologic hazards and environmental impacts of pipeline construction, and other cooperative studies. The third category consists of basic and applied research in hydrologic topics unique to cold climates. Subjects being studied include surface and ground water, water quality, instrumentation, glaciers, snow and ice, ice dynamics, and limnology.

In Alaska, the Water Resources Division operates through a district office and its three subdistrict offices, in Anchorage, Fairbanks, and Juneau. Each of the subdistrict offices maintains files of data for a geographic area for which it is responsible. Site-specific information on water resources is available from the subdistrict office nearest the site in question. The District Office in Anchorage should be contacted for general information on statewide projects or activities.

FUNDAMENTAL RESEARCH IN HYDROLOGY

As part of its national program of hydrologic research, the Water Resources Division has for many years conducted fundamental investigations in Alaska on several aspects of arctic hydrology. Late in 1980 an important step toward the expansion and intensification of these studies was taken with the establishment of a new Cold Regions Hydrology Project Office in Fairbanks. The Project Office will carry out basic research in such topics as glacier dynamics and fluctuations, the interaction of glaciers and volcanoes, the relationships between permafrost and ground water, the formation of and hazards presented by river-ice jams, the chemistry and ecology of arctic lakes and streams, and erosion and sedimentation by arctic streams. In addition to new knowledge provided by these studies, which will be immediately applicable in a wide spectrum of applied investigations in the Geological Survey operational programs, it is anticipated that the project staff will provide consultation and advice to management and staff of the Water Resources Division and to other elements of the Geological Survey, and, through the Bureau, to other Federal and State agencies concerned with problems related to the hydrology of cold regions.

Water-resource studies in Alaska are carried out in cooperation with a variety of Federal, State, and local agencies. The cooperators for FY 1981 are:

Federal

Department of the Interior
- Geological Survey
  - Geologic Division (pipeline-related studies)
  - Office of National Petroleum Reserve in Alaska
  - Alaska Natural Gas Transportation System
- Bureau of Land Management

Department of Agriculture
- Forest Service

[1] The Budget of the United States Government, Fiscal Year 1974, Appendix, p. 552.

Department of Defense
Army Corps of Engineers
Department of Energy
Alaska Power Administration
Department of Commerce
National Marine Fisheries
Environmental Protection Agency

State

Department of Fish and Game
Department of Natural Resources
Division of Geological and Geophysical Surveys
Division of Forest, Land, and Water Management
Department of Environmental Conservation
Department of Transportation and Public Facilities
Alaska Power Authority

Local

Kenai Peninsula Borough
Thomas Bay Power Commission
Fairbanks North Star Borough
Municipality of Anchorage
City and Borough of Juneau
City of Craig
Matanuska Susitna Borough

Alaska's water resource investigations are part of several national programs. These are described briefly below.

COLLECTION OF BASIC RECORDS

The Collection of Basic Records or CBR program in Alaska entails the operation of 116 river gaging stations, 80 crest-gage stations, and 32 observation wells. The data collected at these sites appear in the annual publication "Water Resources Data for Alaska." (In addition, about 70 wells are operated for short periods for specific projects.) The CBR program is described in more detail in the appropriate projects which follow this summary.

NATIONAL WATER DATA EXCHANGE (NAWDEX)

This is a data-collection program for obtaining regional and national overviews of the quality of our streams. Water-quality data from NASQAN stations provide the information needed to: (1) account for the quantity and quality of water moving within and from the United States; (2) develop a large-scale picture of how stream quality varies from place to place; and (3) detect changes in stream quality with time. At a NASQAN station a continuous record of stream stage is obtained, from which streamflow is computed. Most of these stations are also equipped with a recorder for obtaining continuous data on water temperature. The following data are collected approximately six times per year at each site: pH, bacteria, inorganic compounds, nutrients, suspended sediment, and floating algae. Samples are collected less frequently for trace-element and organic-carbon analysis.

In Alaska, the following NASQAN stations are currently in operation: Stikine River near Wrangell, Skagway River at Skagway, Copper River near Chitina, Susitna River near Susitna Station, Nushagak River at Ekwok, Kuskokwim River at Crooked Creek, Tanana River at Nenana, Yukon River near Pilot Station, Kobuk River near Kiana, Colville River near Nuiqsut (3 samples annually), and Kuparuk River near Deadhorse.

NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN)

This is a national confederation of water-oriented organizations working together to improve access to water data. Its primary objective is to assist users of water data in the identification, location, and acquisition of needed data. For the users' convenience, NAWDEX services are available through a nation-wide network of local assistance centers. In Alaska, the NAWDEX assistance center is located in the District Office of the Water Resources Division, 733 West 4th Avenue, in Anchorage.

Through its master water data exchange, NAWDEX provides a nationwide indexing service. This computerized index identifies more than 180,000 sites for which water data are available from over 300 organizations, the geographic location of these sites, the data-collecting organization, the types of data available, the periods of time for which the data are available, the major water parameters for which data are available, the frequency of measurements, and the media in which the data are stored. NAWDEX has direct access to the computerized data files of the U.S. Geological Survey's national water data storage and retrieval system (WATSTORE, which includes several types of files and indexes such as the Ground Water Site Inventory, or GWSI). NAWDEX is also an authorized user of the storage and retrieval (STORET) system of the U.S. Environmental Protection Agency.

PROJECTS OF THE WATER RESOURCES DIVISION

STATEWIDE

Project Title: Surface-water Stations in Alaska

Chief: Robert D. Lamke

Objectives: To provide data on (1) streamflow, (2) flood discharge and stages, and (3) lake stage through a network of gaging stations. This project is part of an ongoing assessment of the Nation's water resources and is part of the Collection of Basic Records (CBR) program. The

data are used in project design and planning of water-supply and waste-disposal systems, of stream crossings and hydroelectric facilities, and of bridges, and also are useful in the assessment of environmental impacts of these and other proposed activities.

Status: This is a continuing project; all data are published in the Survey's annual series "Water-Resources Data for Alaska." The 1980 report is expected to be completed by September 1981.

Project Title: Quality-of-Water Stations

Chief: Robert J. Madison

Objectives: To provide a national bank of water-quality data for broad Federal planning and action programs and management of interstate and international waters. To provide information on the physical and chemical properties of water by: (1) determining the mineral content and biological aspects of water, thereby establishing a base line from which changes can be evaluated; and (2) determining mineral composition of water to evaluate its use for domestic, municipal, and industrial water supplies. These objectives are accomplished by operation of a network of water-quality stations. This project is part of the Collection of Basic Records (CBR) program.

Status: This is a continuing project; all data are released in the annual Geological Survey publication "Water-Resources Data for Alaska."

Project Title: Sediment Stations

Chief: Patsy J. Still

Objectives: To provide a national bank of sediment data for broad Federal and State planning and action programs and for Federal management of interstate and international waters. This project is part of the Collection of Basic Records (CBR) program.

Status: Data collection is continuing for 11 NASQAN sites, 13 sites for the Forest Service, 7 stations for the Corps of Engineers, at a benchmark station, and at 2 additional sites in the southcentral and Yukon subregions. Indexes of streamflow and water-quality records to September 30, 1978, have been released as Open-File Reports 80-551, -552, -553, -554, -600 and -698. Each year's data are reported in the annual publication "Water-Resources Data for Alaska."

Project Title: Collection, Recording, and Management of Basic Ground-Water Data in Alaska

Chief: Gary Deeter

Objectives: To collect, compile, and publish basic ground-water data acquired throughout Alaska, with emphasis on areas not being covered by specific Division projects; and to develop mutually beneficial exchanges of information with well drillers, contractors, related-science professionals, and engineers that will expand knowledge of ground-water occurrence and potential development assets or problems.

Status: Entry of ground-water data into the Survey's national computer storage system has continued, and data from approximately 650 new sites from throughout Alaska were entered in 1980. Processing of data from 600 wells is planned for 1981. Computer-generated retrievals in table format of verified entries were obtained for the Eagle River-Chugiak, King Salmon-Naknek, and Dillingham-Aleknagik areas. Similar data compilations are planned for the North Kenai, Kasilof-Happy Valley, and Homer areas in 1981. The data-collection phase of this project relies heavily upon well-log transmittals from the cooperator, Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys.

Data collection sites are shown in figure 9.

Project Title: Alaska Water-Use Data Program

Chief: Leslie D. Patrick

Objectives: To develop an orderly and systematic method to collect, store, and disseminate detailed water-use data for policy planning, budgeting, and management of Alaska's water resources. This system will support the National Water-Use Data System and Alaska's water rights program.

Status: A task force has been formed within the Alaska Department of Natural Resources (DNR) to design and develop the Alaska Land and Resource System (ALARS). This system will be capable of managing the land and resource data of DNR. Water-use information will be an integral part of this system.

Water rights and some water-use information from several thousand DNR case files has been entered into a temporary computer file. DNR is writing improved retrieval programs to access this file. Hydroelectric water-use data from 1979 has been compiled and is planned for entry into the National Water-Use Data System. A data-collection program for other uses is being formulated; water use by seafood processing is a primary target for FY 1981.

The Alaska Division of Forest, Land, and Water Management is increasing its staff to better manage the collection and storage of the State's water-use data.

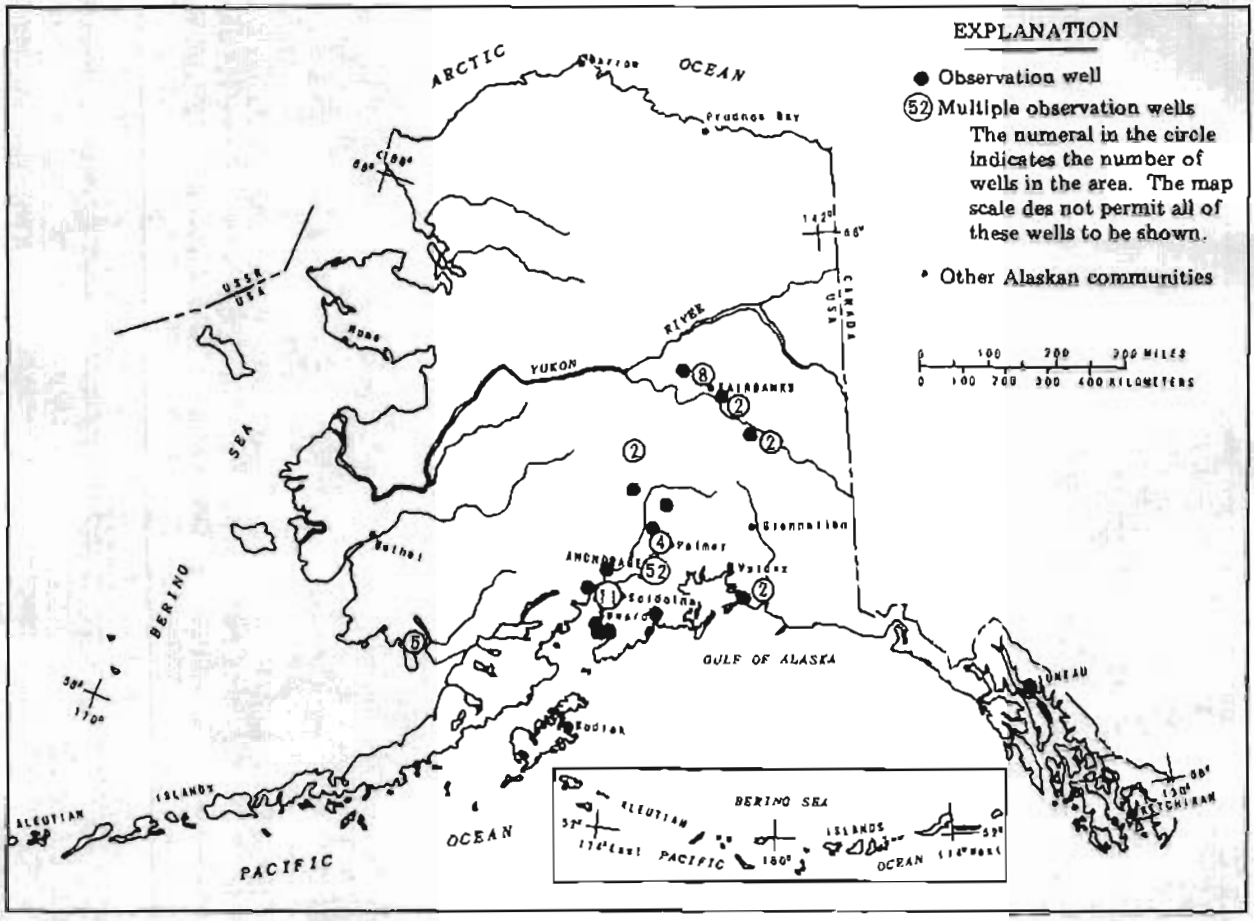


Figure 9.– Location of ground-water observation wells.

Project Title: Ground-water Stations in Alaska

Chief: Robert D. Lamke

Objectives: To maintain a network of observation wells to provide data on ground-water level fluctuations in Alaska. For selected aquifers, these data will indicate the status of ground water in storage, changes in levels due to development (pumping), probable effects of current or planned land use or water-supply development, and probable base flow of hydraulically connected streams nearby. The network will provide long-term records for regional studies that, in turn, serve as a basis for correlation of short-term hydrologic records for specific purposes.

Status: This is a continuing long-term project. In 1980, the areal coverage of the observation well network was revised by discontinuing several stations and by establishing new observation wells (particularly in Valdez). Water-level records collected at 32 federally funded Collection of Basic Records (CBR) wells will be published in the 1980 annual Survey report "Water-Resources Data for Alaska." Data for other network wells are published infrequently in reports on specific water-resource studies.

Project Title: Water, Ice, and Energy Balance of Snow and Glaciers, and Snow and Ice Physics

Chief: Mark P. Meier

Objectives: To improve understanding of aspects of snow accumulation, melt, and runoff processes on glaciers and in high mountains, the mechanics of water flow through and under glaciers, and the dynamics of glaciers, and to apply this understanding to certain problems such as the nature of glacier surges and the stability of iceberg-calving glaciers.

Status: Work on Columbia Glacier, near Valdez, culminated in 1980 with the release of Open-File

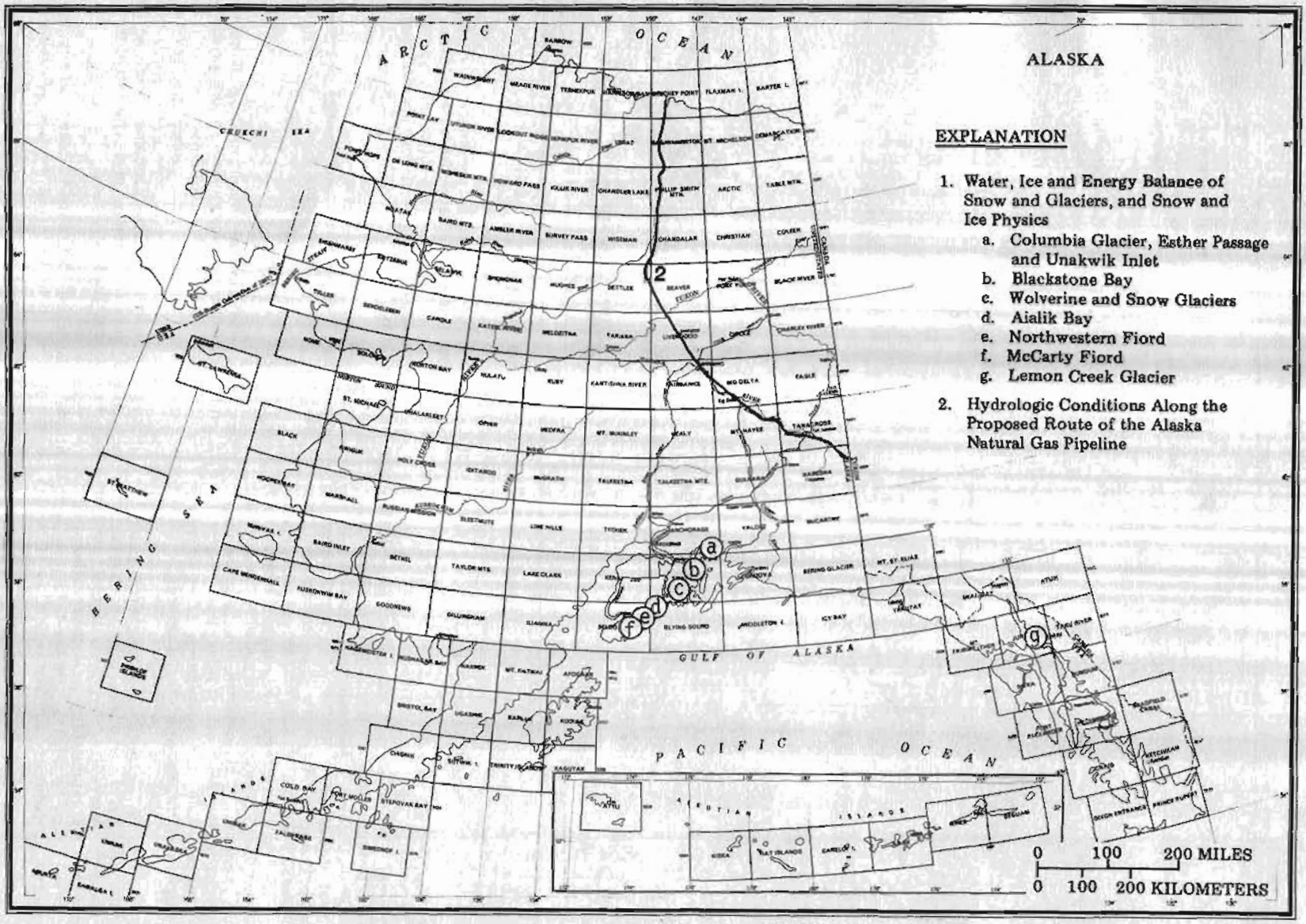


Figure 10.--Locations of selected Statewide Water Resources Division investigations.

Report 80-582, "Predicted timing of the disintegration of the lower reach of Columbia Glacier, Alaska", by M. F. Meier and others. This report gives a quantitative prediction of increases in the rate of retreat and the rate of iceberg discharge through 1986. It uses basic data contained in the 1980 open-file reports by Austin Post on bathymetry and Neoglacial changes of Northwestern Fiord, Blackstone Bay, Aialik Bay, McCarty Fiord; bathymetry of Esther Passage and Unakwik Inlet; and Hydrologic Investigations Atlas 619 by W. G. Sikonia and Austin Post, "Columbia Glacier, Alaska: Recent ice loss and its relationship to seasonal terminal embayments, thinning, and glacier flow." Other basic-data reports are in preparation. Research continues on the transient, dynamic response of this glacier, and on the Neoglacial history of many fiord areas in south-central and southwestern Alaska. As part of a climate program, detailed maps of Lemon Creek and Wolverine Glaciers were produced to determine ice-volume changes. Reconnaissance air photography of glaciers was continued.

The project location is shown in figure 10.

Project Title: Hydrologic Conditions Along the Proposed Route of the Alaska Natural Gas Pipeline

Chief: Charles E. Sloan

Objectives: To provide assistance to the Department of the Interior to resolve hydrologic questions about the alignment of the Alaska Natural Gas Pipeline and its relation to the oil pipeline (TAPS) and the pipeline haul road.

Status: Since this project began in September 1979, there has been active participation by Sloan on the Alaska Natural Gas Transportation System Working Group, on the Interagency Fish and Wildlife Task Force, and on the Executive Coordinating Committee.

The project location is shown in figure 10.

Project Title: Water-Quality Data Reduction and Evaluation for Yukon Hydrologic Subregion

Chief: Patsy J. Still

Objectives: (1) Statistically and graphically to reduce the historical water-quality records and develop relations between the reduced data and stream type, region, or other physical basin parameters. (2) To present the reduced data and evaluation of water quality in a series of reports by hydrologic subregion in a form useful for interpretation, planning, or management decision making. (3) To evaluate the adequacy of the historical data base to meet the needs of water-data users in the State for various levels or types of interpretation or planning. (4) To provide a network design for long-range data collection which will fill the information gaps identified in (1)-(3) above.

Status: In FY 1981 data reduction and evaluation continue for the hydrologic subregion. It is proposed that data for other subregions will be treated in the same manner on successful completion of this project.

The location of the project is shown in figure 11.

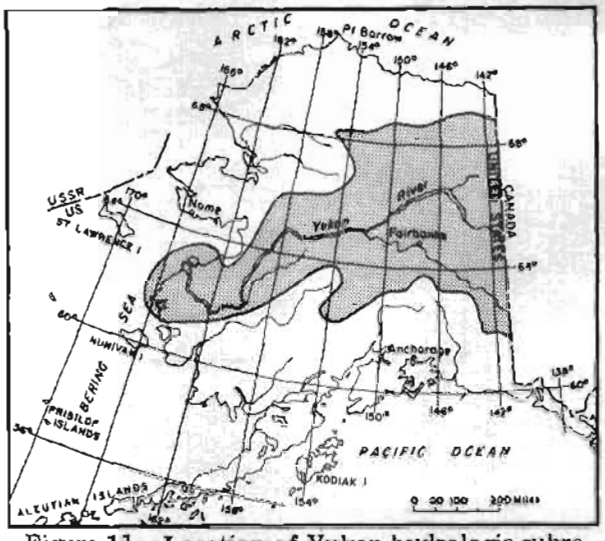


Figure 11.– Location of Yukon hydrologic subregion.

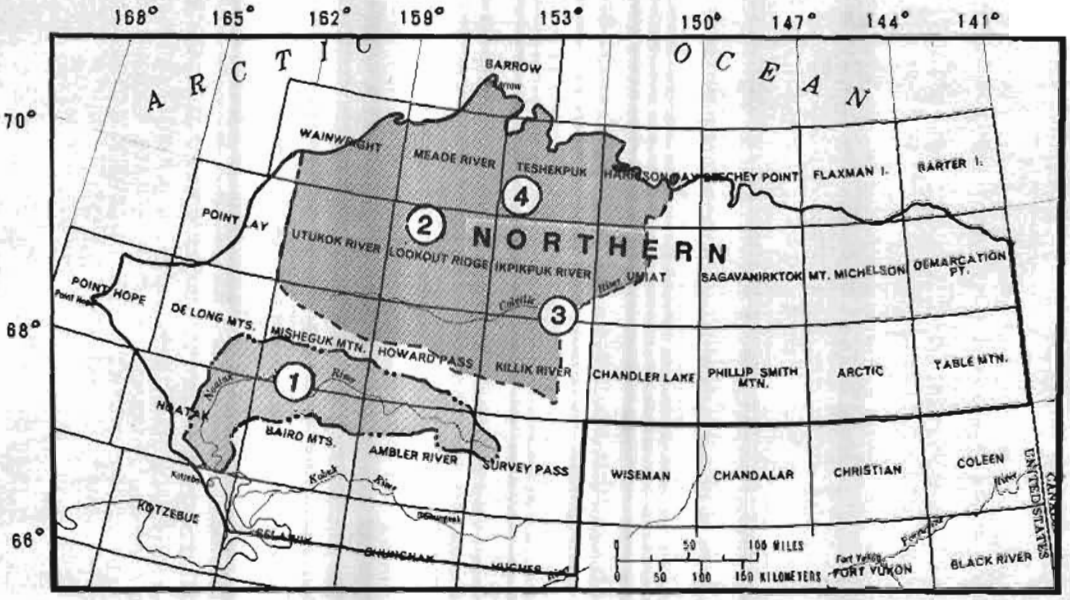
Project Title: Arctic Water Resources and Environmental Studies

Chief: Joseph M. Childers

Objectives: To describe hydrologic hazards (floods, icings, glaciers, channel erosion) and characteristics of water resources (streams, lakes, springs) in frontier areas of Alaska where development requires such information. To develop and use hydrologic reconnaissance techniques or short-cut methods to accomplish the objectives of this project.

Status: The results of hydrologic reconnaissance surveys have been reported for streams and springs in the eastern Brooks Range, the eastern North Slope, and western Arctic Alaska. Hydrologic conditions along the Trans-Alaska Pipeline Haul Road and the pipeline during preconstruction and construction periods have been described in open-file reports. Surveys of the Noatak and Kobuk Rivers in northwestern Alaska have been completed, and reports are in preparation. A survey of the Togiak River in southwestern Alaska is underway.

The project location is shown in figure 12.



EXPLANATION

1. Arctic Water Resources and Environmental Studies
2. Geochemistry of Oilfield Waters, National Petroleum Reserve in Alaska.
3. Nutrient Limitation in Two Arctic Lakes near Umiat
4. National Petroleum Reserve Hydrology

Figure 12.--Water Resources Division activities in northern Alaska.

NORTHERN REGION

Project Title: Geochemistry of Oilfield Waters, National Petroleum Reserve in Alaska

Chief: Yousif K. Kharaka

Objectives: To study the chemistry and controls on the chemistry of oilfield waters in the National Petroleum Reserve. To provide geochemical data and interpretation that will aid in assessing the migration and accumulation of petroleum in this area. The chemical data are also necessary to understand the diagenesis in the reservoir rocks and to identify potential pollution, waste disposal, and corrosion problems associated with production.

Status: The project is in its fourth year. Gas and water samples have been collected from the Prudhoe oil field and the Barrow gas field. Sample collection continues in conjunction with test-well drilling and at existing wells. Detailed chemical and isotopic analyses are being made of those samples available. However, few wells have produced water, and data are thus incomplete. If water is produced during the drilling this fiscal year, more samples will be gathered. Results have been discussed at several conferences. A paper on geochemistry of formation waters from the North Slope of Alaska is being prepared for inclusion in a Professional Paper whose title will be "Geology of National Petroleum Reserve in Alaska."

The project location is shown in figure 12.

Project Title: Nutrient Limitation in Two Arctic Lakes Near Umiat

Chief: George A. McCoy

Objectives: To determine the limiting nutrients in two arctic lakes. A hypothesis was developed using the batch culture bioassay technique. Subsequently the hypothesis was tested by direct fertilization of one of the lakes. A secondary objective of this study is to determine the suitability of the batch culture bioassay for determining nutrient limitation in these lakes.

Status: All data collection, data reduction, and analysis are complete. Reports are in review.

The project location is shown in figure 12.

Project Title: National Petroleum Reserve in Alaska (NPRA) Hydrology

Chief: Charles E. Sloan

Objectives: To collect and provide hydrologic information to the Office of National Petroleum Reserve in Alaska (ONPRA) regarding water resources, and on snow depth, density, and distribution; and to evaluate lake depth by means of remote sensing.

Status: A reconnaissance snow survey was made in late April 1979 after much of the snow cover had melted. Water-Resources Investigations 80-49, presenting the results of that survey, was printed in 1980. A final report on water resources of NPRA is being prepared as a section on a Professional Paper on the geology of NPRA. The project will be concluded in FY 1981.

The project location is shown in figure 12.

EAST-CENTRAL REGION

Project Title: Geohydrology of the Fairbanks North Star Borough

Chief: Andrea P. Krumhardt

Objectives: To provide basic hydrologic data for land-use planning by (1) studying the surface- and ground-water flow system to define water availability; (2) mapping and describing the water table in the uplands and the artesian zone; (3) defining water quality with special attention to high nitrate and arsenic concentrations in ground water; and (4) assisting residents, officials, and consultants concerning hydrologic problems.

Status: Since the start of the program in 1975, most of the emphasis has been on upland hydrology and the setting up of long-term monitoring programs such as observation wells and a low-flow network. A test drilling program was conducted in 1977 to determine if there were subsurface controls on the migration of arsenic-contaminated water.

In 1980, Open-File Report 80-49, "Arsenic, Nitrate, Iron, and Hardness, Chena Ridge Vicinity, Alaska", was published.

Emphasis now is directed to the lowland areas, in particular the water-resource potential and ground-water flow, and to the continuation of well canvassing in developing upland areas.

The project location is shown in figure 13.

Project Title: Sediment Transport in the Tanana River in the Vicinity of Fairbanks, Alaska

Chief: Robert L. Burrows

Objectives: To facilitate design and operation of engineering structures on the Tanana River and quarrying of gravel from the river in the vicinity of Fairbanks, the U.S. Army Corps of Engineers, Alaska District, requested that the U.S. Geological Survey collect and evaluate sediment-transport and river-hydraulic data during periods of principal runoff, beginning in 1977. This part of a cooperative effort, the Tanana River Monitoring and Research Program, is administerd by the Cold Regions Research and Engineering Laboratory, Alaska Project Office, in Fairbanks. U.S. Geological Survey objectives are to provide suspended- and bedload-sediment, hydraulic, and channel-geometry data for use of cooperators on an annual basis, to determine sediment-transport characteristics and related hydraulics, and to evaluate both short- and long-term trends.

Status: Data collection began in 1977. Open-file reports were published in 1978 and 1979. Compilation and analysis are underway for the 1980 data, and reports including 1977-79 data are in review. An interpretive report analyzing characteristics indicated by these data is in process. Intensive data collection will continue through 1983, and interpretation and further analysis will continue as the data base allows.

The project location is shown in figure 13.

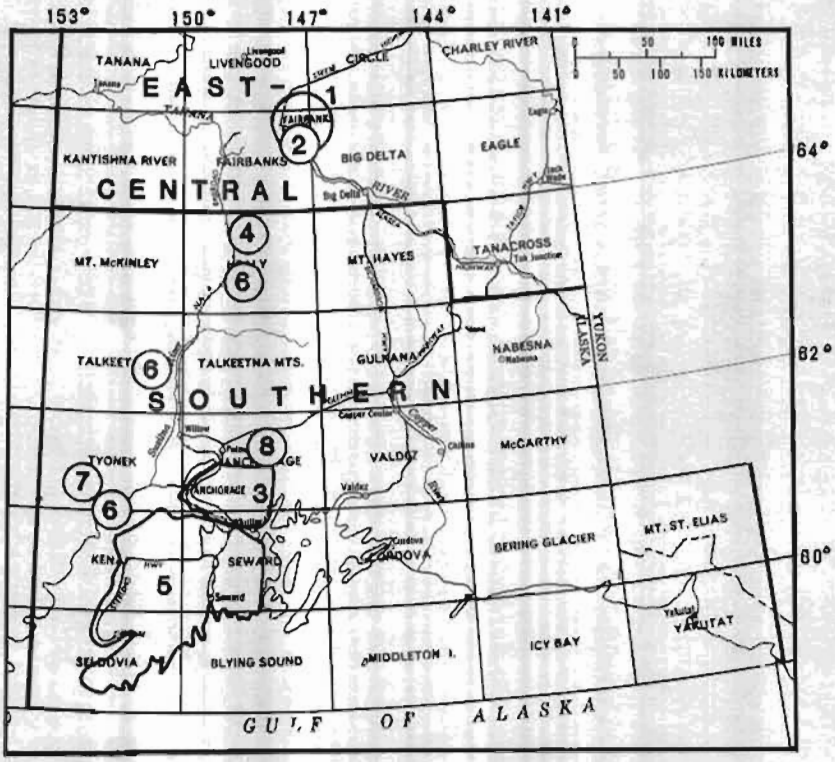
SOUTHERN REGION

Project Title: Trace Metals in Surface Water in Healy and Lignite Creek Basins

Chief: Dorothy E. Wilcox

Objectives: (1) To determine the concentration and distribution of selected trace elements in surface water in the coal-rich Healy and Lignite Creek basins, and (2) to assess the sources of trace elements in these waters.

Status: Four trips were made to sample water quality and bottom sediment at three sites in the Healy Creek basin and three sites in the Lignite Creek basin. The four sets of water samples collected were analyzed for suspended-sediment concentration and 12 dissolved and total-recoverable trace elements. The trace elements of interest in the water samples are aluminum, arsenic, barium, chromium, cobalt, copper, iron, lead, manganese, nickel, uranium, and zinc. An attempt will be made to analyze the whole water samples for percent coal. Two of the sets of water samples were also analyzed for dissolved major ions. Four sets of bottom-sediment samples were collected, and the less-than-2-mm portion was analyzed for total-recoverable amounts of all the above metals except uranium and for percent



EXPLANATION

1. Geohydrology of the Fairbanks North Star Borough
2. Sediment Transport in the Tanana River
3. Geohydrology of the Anchorage Area
4. Trace Metals in Surface Water of Healy and Lignite Creek Basins
5. Water Resources of the Kenai Peninsula Borough
6. Hydrologic Effects of Development of Alaska's Coal Resources
7. Hydrology of the Capps Creek Coal Area
8. Knik Glacier

Figure 13.-- Water Resources Division activities in east-central and southern Alaska.

coal. Preliminary analytical results show higher concentrations of trace metals in the two sites in the Lignite Creek basin for which results were received than for the three sites in the Healy Creek basin. Data collection and analyses will continue through FY 1981.

The project location is shown in figure 13.

Project Title: Geohydrology of the Anchorage Area

Chief: Derrill J. Cowing

Objectives: (1) To maintain a hydrologic data-collection network for streamflow, lake levels, and ground-water levels in the Anchorage area; (2) to maintain and update a two-dimensional digital model of the confined aquifer system in the Anchorage area to simulate the hydrologic effects of ground-water development; (3) to describe hydrologic characteristics of selected areas in Anchorage where hydrologic information is required to help make land-use planning decisions; (4) to conduct a study of the water-quality characteristics of runoff in the Campbell Creek basin; and (5) to collect water-quality information from wells at two landfill sites in the Anchorage area.

Status: The general hydrologic character of this area was described early in this 13-year-old project. Current project activities include: (1) operation of the basic-data collection network of six streamgages, 52 wells for water-level measurements, and lake-level measurements at eight lakes; (2) collection of aquifer test pumping information and ground-water withdrawals to update and operate the digital model of the confined aquifer system; (3) collection and interpre-

tation of hydrogeologic data in the Peters Creek-Eklutna area and preparation of a report on the results of the study, (4) collection and interpretation of water-quality information for Campbell Creek; and (5) continued sampling, twice a year, of wells located at two sanitary landfill sites to detect water-quality changes in ground water with time.

The project location is shown in figure 13.

Project Title: Ground-water Resources of the Middle Eagle River Valley near Eagle River, Alaska

Chief: Derrill J. Cowing

Objectives: To determine the hydrologic character of the major aquifer system in the Eagle River area and the optimum rate of ground-water withdrawal that can be developed from wells. To determine the chemical quality of the ground water.

Status: The Survey will monitor test well drilling and supervise pumping tests and data collection during this phase of the project. The assembled data will be analyzed so as to identify potential ground-water supplies. Open-File Report 80-2000 summarizes results of geophysical surveys in the project area. Additional resistivity surveys and seepage runs will be made. A final report is planned for 1981.

The project location is the northern part of item 3, figure 13.

Project Title: Water Resources of the Kenai Peninsula Borough

Chief: Gordon L. Nelson

Objectives: To monitor hydrologic conditions in the Kenai Peninsula Borough and to evaluate needs for detailed studies.

Status: The Survey has completed a major study of the water resources of the Kenai Peninsula Borough. Work in 1981 is devoted to monitoring selected wells and streams and preparing proposals for further studies. A proposal to investigate the hydrology of the Granite Point area will be finished early in 1981.

The project location is shown in figure 13.

Project Title: Hydrologic Effects of Development of Alaska's Coal Resources

Chief: Andrea Krumhardt

Objectives: To collect data that characterize present hydrologic conditions in areas of known potential for coal development and in an area of active mining. Information obtained includes: (1) quantity and seasonal distribution of water discharge; (2) seasonal and areal variations in surface-water quality, including organic and inorganic constituents, minor-element concentration, sediment, and temperature; (3) stream-basin characteristics; and (4) aquatic benthic invertebrate communities.

Status: Field investigations were started in 1975 and are complete. Open-File Report 80-1206 contains basic data from a study of the Beluga, Peters Creek, and Healy coal areas. The companion analytical report on these areas is in review.

The project location is shown in figure 13.

Project Title: Hydrology of the Capps Creek Coal Area

Project Chief: Gordon L. Nelson

Objectives: (1) To define the quality of water in Capps Creek and its tributary, North Capps Creek; (2) to investigate the benthic invertebrate community in Capps Creek before mining occurs; (3) to determine the principal aquifers of the area, their thickness, and areal distribution; (4) to determine the chemical quality of ground water; and (5) to determine the interactions of ground water and surface water.

Status: Seven wells have been drilled in the Capps Creek basin. Well water will be sampled for major ions and trace metals. Stream samples will be collected for studies of suspended sediment and benthic invertebrates. All sampling will be completed during 1981.

The project location is shown in figure 13.

Project Title: Frequency of Recurrence of Lake George at Knik Glacier

Chief: To be assigned

Objectives: To determine the mechanism that causes the formation and discharge the Lake George and the parameters that can be measured to predict that occurrence. Economic development is taking place in the flood plain of the Knik River, which has been periodically inundated by outbursts of glacial Lake George; additional development is planned. Lake George burst out annually prior to 1966, but has not formed since then. However, the glacier has not receded from the ice dam point, and outburst flooding could resume. Measurements of the Knik Glacier will be analyzed to detect annual changes in firn and ice balance, winter snow balance, glacier thickening or thinning, changes in surface gradient and propagation speed of kinematic waves moving

through the ice mass. With several years of data, an analysis of the stability of Knik Glacier can be made.

Status: A geodetic control survey and the first measurement of the glacier were made in May 1979 to serve as the baseline data for future comparisons. Results were published as Open-File Report 80-48.

Satisfactory progress is being made, largely in other glaciology research projects, toward attaining a working model of Knik Glacier by 1982 or 1983. Data collection at Knik Glacier is presently in anticipation of needs for calibrating that model. In 1980 measurements were made of snow depth, surface orientation at measurement sites, surface altitude, terminus position, snowline altitude, and glacier thickness. Snow accumulation during the winter of 1979-80 exceeded our ability to measure it by probing. Our data indicate that the glacier is growing, but the lower part of the glacier near the terminus continues to thin.

The project location is shown in figure 13.

SOUTHEASTERN REGION

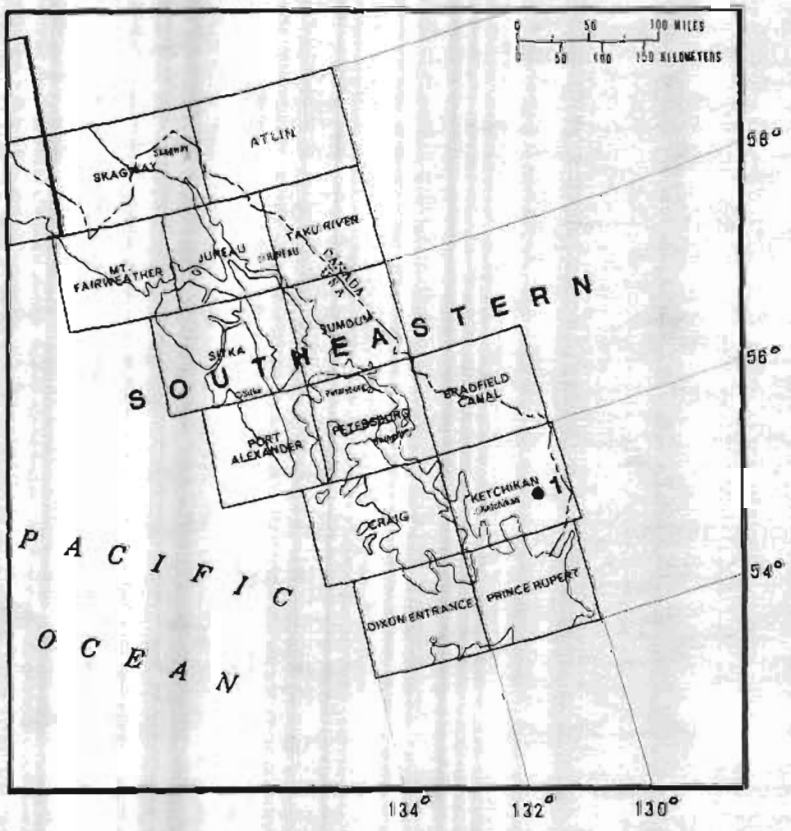
Project Title: Hydrology and Water Quality of the Keta River Basin near Ketchikan

Chief: Harold Seitz

Objectives: To collect baseline data that will characterize present hydrologic conditions in an area of known potential for molybdenum development. Information to be obtained includes: (1) quantity and seasonal distribution of stream discharge; and (2) seasonal and areal variations in surface-water quality including inorganic and organic constituents; minor elements (both dissolved and absorbed to bed material), sediment, and temperature.

Status: Stream-gaging stations are installed on Keta River and White Creek to monitor streamflow, water temperature, and specific conductance. Periodic measurements of instantaneous stream discharge and water quality were made at four other sites. Data collection in the basin is continuing. A third stream-gaging station, on Blossom River, will be installed.

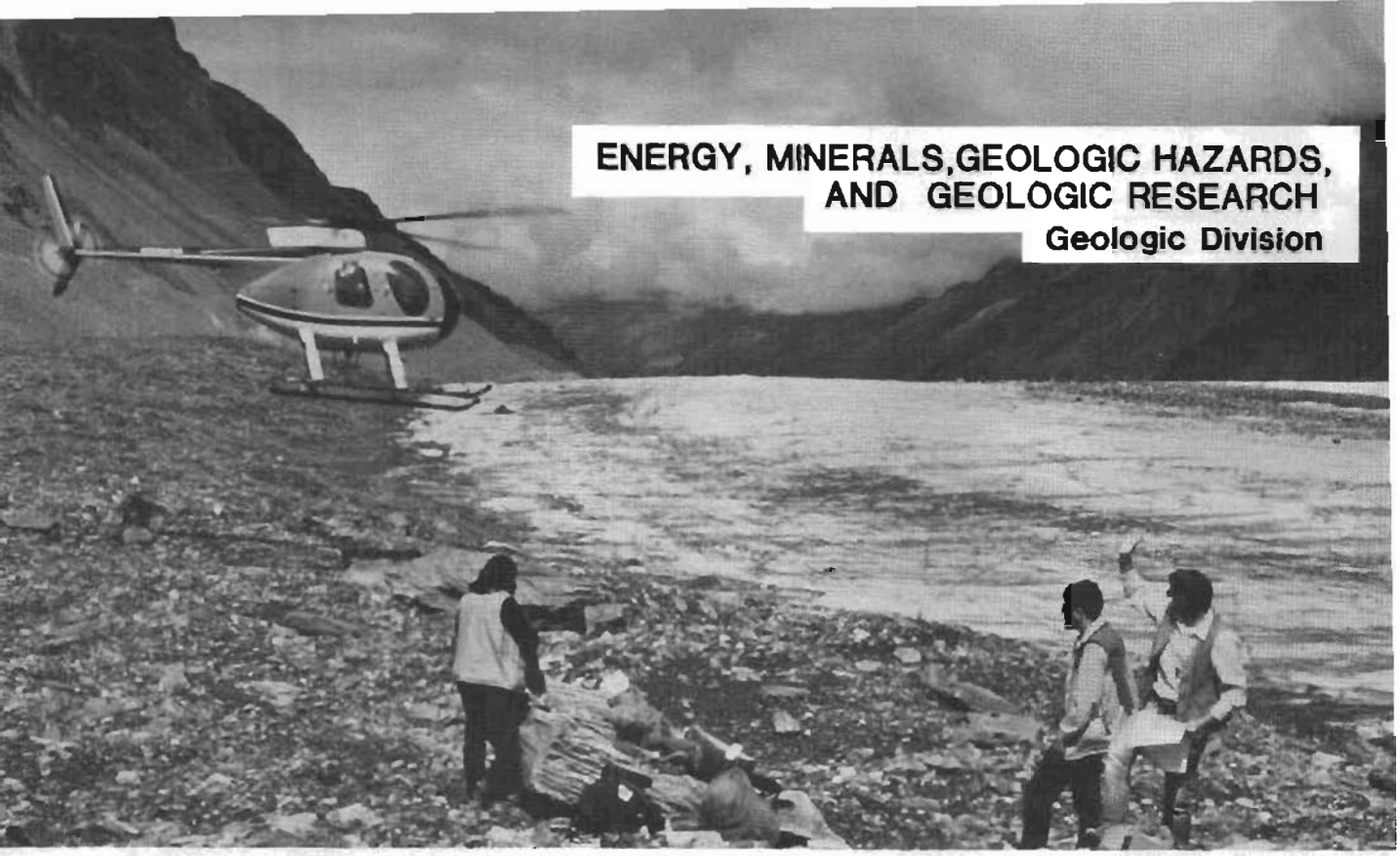
The project location is shown in figure 14.



EXPLANATION

1. Hydrology and Water Quality of the Keta River Basin

Figure 14.--Water Resources Division activities in southeastern Alaska.



ENERGY, MINERALS, GEOLOGIC HAZARDS, AND GEOLOGIC RESEARCH

Geologic Division

Survey geologists at work in the Mount Hayes quadrangle

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ENERGY, MINERALS, GEOLOGIC HAZARDS, AND GEOLOGIC RESEARCH

The current scientific program of the Geologic Division in Alaska is primarily related to mineral- and energy-resource appraisal, earthquake and geologic hazards, and geologic research conducted in support of these programs. This work includes geologic mapping and mineral-resource evaluation, primarily at scales of 1:250,000 and 1:63,360; mineral district mapping and evaluation; mineral-resource appraisal; geochemical studies and sampling, particularly related to mineral deposits; petroleum-resource surveys; aeromagnetic and gravity surveys and interpretation; engineering geology studies in urban areas and along transportation corridors; earthquake studies; isotopic age determination and interpretation; heat-flow studies; and submarine sampling, subbottom profiling, and other geologic and geophysical studies of the ocean floor.

Activities in Alaska are the responsibility of several working groups within the Geologic Division: the Branch of Alaskan Geology with headquarters in Anchorage, the Office of Earthquake Studies, the Office of Energy Resources, and the Office of Marine Geology at the Western Region Headquarters in Menlo Park, Ca.; the Branches of Regional Geophysics, Electromagnetism and Geomagnetism, Exploration Research, Isotope Geology, and Engineering Geology at the Central Region Headquarters in Denver, Co.; and the Branch of Paleontology and Stratigraphy at the National Museum in Washington, D.C. Several other branches in the Geologic Division provide services or conduct research in cooperation with these units.

The Branch of Alaskan Geology is headquartered in Anchorage at 1209 Orca Street; Branch offices are located in Fairbanks and at the Western Region headquarters in Menlo Park, Ca. The Branch of Electromagnetism and Geomagnetism maintains observatories at Fairbanks (College), Barrow, Adak, and Sitka. The College and Barrow observatories are under the direction of John B. Townshend, whose office is in Fairbanks. The Sitka Observatory is directed by Willis E. Osbakken, and David Evans is in charge of the Adak facility.

This section on the Geologic Division first describes the major mission-oriented programs in Alaska and then describes the current projects in Alaska by geographic region. Figures 15 through 25 show the locations of current division activities. ities.

The major program elements of the Geologic Division in Alaska are:

- The Alaska Mineral Resource Assessment Program (AMRAP) and related projects
- The North Slope Petroleum Program and related Alaska-wide energy studies
- The Marine Geology Program
- The Arctic Environmental Studies Program
- The Earthquake Hazards Reduction Program
- Volcanic Hazards Program
- Alaska Geothermal Research Program
- Geologic Framework and Synthesis Program
- Geologic research in support of these program elements

Most of these programs are interrelated. Several Arctic Environmental Studies projects, for example, are designed to determine and mitigate the environmental effects of oil exploration, production, and transportation in the Arctic. The Marine Geology Program, similarly, is designed to determine the petroleum potential in the continental shelf areas off the coast of Alaska and to determine geohazards related to placement of oil and mining facilities on the sea floor. The North Slope Petroleum Program is designed to assess petroleum and other mineral resources of northern Alaska.

ALASKA MINERAL RESOURCE ASSESSMENT PROGRAM

The Alaska Mineral Resource Assessment Program (AMRAP), directed by Thomas P. Miller, began in 1975. The program was developed to meet the demand by public and private interests for objective and timely information on Alaska's mineral endowment. The AMRAP program has two basic objectives: (1) To assess the State's mineral potential for long-range planning and development by systematic methods carried out by interdisciplinary teams studying the areas of the 1:250,000-scale quadrangles; and (2) to assess in the near term, on a 1:1,000,000-scale base, the State's mineral resources to provide information to Congress and the Department of the Interior for use in their efforts to classify Alaskan lands. The second objective has been realized for most of Alaska; the southeastern part of the State is being investigated in this manner at the present time.

The AMRAP program comprises projects that contribute to four levels of study. The objective of Level I is to publish statewide summaries of Alaska's mineral resources. This project is continuing and is based on past and present investigations by the Survey and by other organizations and agencies. Level II works toward identifying mineral resources likely to occur in a given large area of the State by plotting favorable areas on maps and by presenting some measure of the probable size and grade of undiscovered deposits. Level II reports incorporate summaries of the results of Level III studies, which include geologic mapping, aeromagnetic and geophysical surveys, analysis of geochemical samples, and topical studies of known deposits. Level III addresses specific 1:250,000-scale quad-

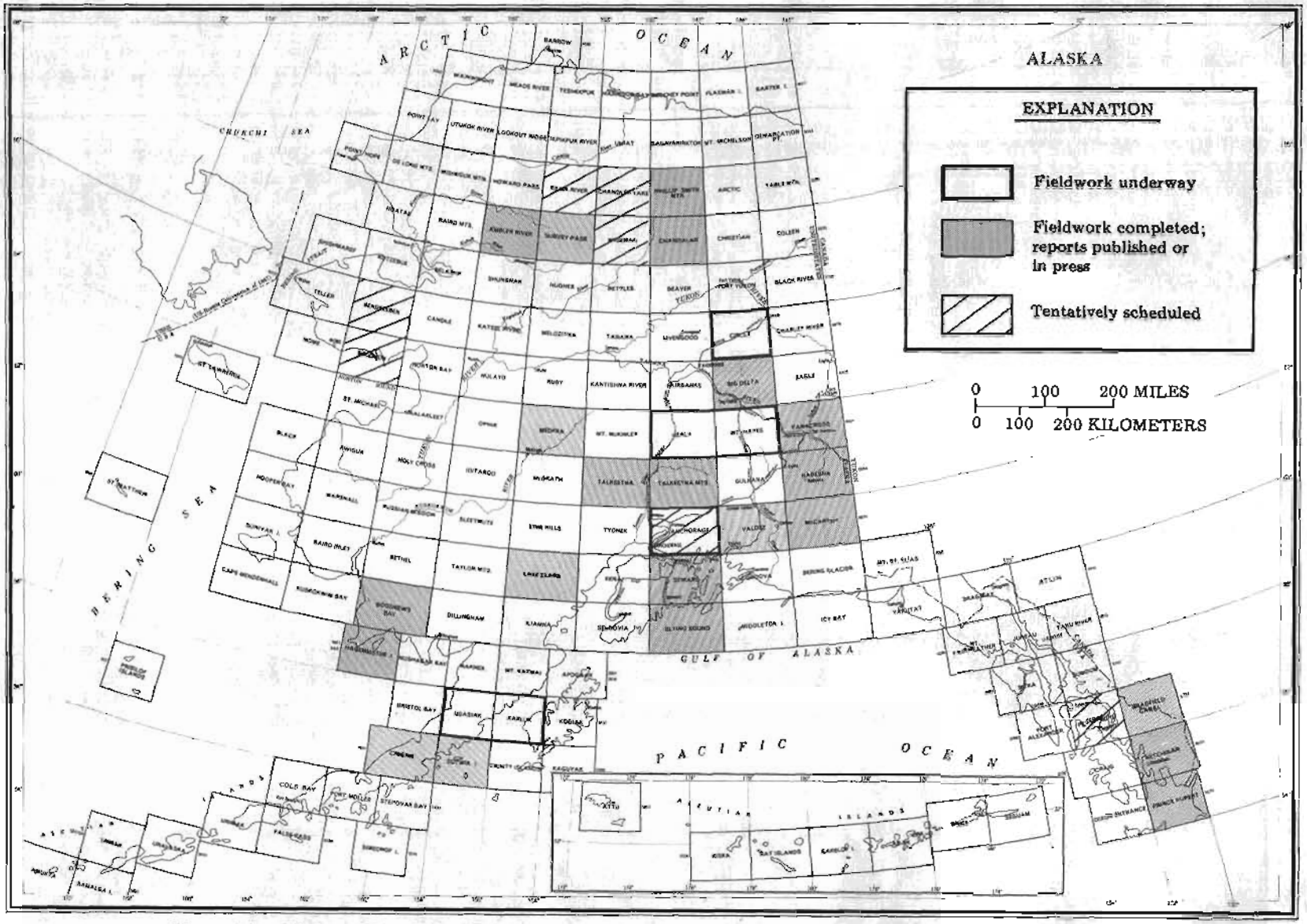


Figure 15. -- Status of Level III Alaska Mineral Resource Assessment Program (AMRAP), January 1, 1981.

rangles, each containing about 4.5 million acres. Interdisciplinary teams study each quadrangle for about 3 years to acquire more detailed information than that of Level II. Level IV investigations focus on individual mineral deposits or mining districts to determine their size, nature, and origin. Such Level IV studies are underway in southeastern Alaska, on the Aleutian Peninsula, and in the Alaska and Brooks Ranges.

Many of the AMRAP project chiefs are members of the Branch of Alaskan Geology. However, the interdisciplinary program supports activities and collaborates with projects outside that branch--for example, in the Regional Geophysics, Field Geochemistry and Petrology, and Isotope Geology Branches within the Office of Geochemistry and Geophysics; the Branch of Paleontology and Stratigraphy; the Branch of Exploration Research; and the Office of Resource Analysis. In addition, AMRAP has encouraged and supported topical studies that range from detailed studies of small areas to contributions to statewide and international projects.

The total AMRAP program area is nearly 180,000 square miles. Level III studies have been completed or are underway for about half of the area; figure 15 shows the current status of AMRAP studies. Mapping and geochemical fieldwork are scheduled for at least six quadrangles in 1981. Project work in 22 quadrangles is complete, and reports have been published or are in press for these areas.

NORTH SLOPE PETROLEUM PROGRAM

The North Slope Petroleum Program, directed by Kenneth J. Bird, consists of a number of projects whose goals are to assess the petroleum potential of the North Slope of Alaska. Specificially, the program's objectives are to determine, map, and describe, on the surface and in the subsurface, by geologic, geophysical, and geochemical methods: (1) the structural framework and regional structural trends in the Brooks Range and North Slope; (2) depositional environments and lateral relations of Paleozoic, Mesozoic, and Cenozoic facies; (3) possible hydrocarbon reservoirs and their regional trends; (4) paleontologic, lithologic, and electric log correlations across the North Slope; (5) the thermal history, hydrocarbon source potential, and relations of extracted hydrocarbons to known North Slope oils; and (6) the geologic history of the area as it relates to potential reservoirs, source and seal rocks, hydrocarbon formation and migration, and present structural trends.

Currently there are six active projects within the North Slope Petroleum Program: a project encompassing a reservoir study of the Lisburne Group and the petroleum geology of the Philip Smith Mountains quadrangle and Shaviovik area; a helium sniffer survey in the National Petroleum Reserve in Alaska (NPRA); a low-level aeromagnetic survey for detection of anomalies produced by hydrocarbon accumulations; a geochemical study of NPRA to assess petroleum source-rock potential; and a project that encompasses a comprehensive study of the Cretaceous Nanushuk Group, a reconnaissance study of the Fortress Mountain Formation reservoir potential and a study of potential hydrocarbon, uranium, and thorium resources of the William O. Douglas Arctic Wildlife Range (formerly the Arctic National Wildlife Range); and a bore-hole gravity project analyzing data from the Awuna well. Much of the program is funded by the Office of National Petroleum Reserve in Alaska.

ARCTIC ENVIRONMENTAL STUDIES PROGRAM

The Arctic Environmental Studies Program is under the direction of Oscar J. Ferrians, Jr. The program objectives are: (1) to investigate transportation corridors and other areas of development in Alaska in order to obtain base line geotechnical data needed for land-use planning and to aid in planning, designing, operating, and maintaining engineering structures so that adverse environmental impacts will be minimized; to evaluate feasibility of proposed projects; and to prepare comprehensive Environmental Impact Statements; and (2) to observe and record geotechnical maintenance and environmental problems that arise during the operation of the trans-Alaska oil pipeline in order to determine the location, character, and extent of these problems and their relation to geologic conditions and processes. These observations will allow an evaluation of the adequacy of the technical stipulations in controlling adverse environmental impacts and make it possible to improve stipulations for future engineering projects that would have a significant impact on the environment.

Continuing projects within the Arctic Environmental Studies Program include: Tanana Valley transportation-development corridor studies, eastern Arctic Coastal Plain studies, surficial geology of the Central Brooks Range, and western Arctic Coastal Plain Quaternary studies. Other major activities during 1981 include: (1) continuing surficial/engineering geologic map compilation of part of the Copper River basin; (2) continuing compilation of a new permafrost map of Alaska; (3) continuing preparation of a major report describing the present state of knowledge of permafrost conditions in Alaska; and (4) continuing compilation of a comprehensive permafrost bibliography.

MARINE GEOLOGY PROGRAM

The Alaskan continental shelf is larger than the combined shelves of the rest of the United States. The energy and mineral potential of this shelf area is and will continue to be a major segment of national resource programs. The

primary mission of the Survey's Marine Geology Program is to provide scientifically interpreted information about the (1) resource potential, (2) geo-environmental setting, and (3) overall geologic characteristics of the continental margin and adjacent shallow and deeper coastal areas of Alaska. The program focuses on the investigation of the regional geologic framework and on geo-environmental problems that typically require the gathering of widely spread and publicly available geophysical and geologic data. In contrast, the Conservation Division's program, described elsewhere in this circular, prepares detailed resource and geo-environmental data analysis for evaluations of specific 3-mile-square tracts. The combination of regional geologic synthesis compiled by the Geologic Division and the detailed assessments by the Conservation Division provides a comprehensive understanding of the oil and gas resource potential of an area and the geologic hazards that may affect exploration and production activities.

Although the bulk of the regional resource studies of continental margins is directed at energy deposits, investigations are also conducted to determine mineral resources, both hard-rock and placer deposits, and the availability of construction materials such as sand and gravel, which may bear on energy resource development. Energy resource investigations are concentrated in areas proposed or that have potential for leasing activity.

The geo-environmental program involves seafloor characterization studies, analyses of processes active on the seabed, and geo-hazard assessments. In Alaskan areas, the studies are designed first to determine the regional relations and then to focus on the specific geo-hazards and the processes that form them. Geo-hazards include recent or active faulting, seabed erosion or scour, sediment transportation and deposition, slumping and related mass-sediment movement, gas accumulations in the shallow subsurface, and ice-gouging of the seafloor.

These studies also involve basic or applied research needed to improve our ability either (1) to collect or interpret scientific data or (2) to understand processes that shape or modify the seabed and its underlying rocks. The theoretical and technological results of these endeavors bolster our resource and geo-environmental programs, as well as enrich the Nation's storehouse of scientific knowledge.

The Marine Geology Program is coordinated by H. Edward Clifton. The projects are described under the regional heading Offshore.

EARTHQUAKE HAZARDS REDUCTION PROGRAM

Earthquakes pose serious hazards to life and property in Alaska. Severity of the hazard was amply illustrated by the great Alaska earthquake of 1964. More earthquakes occur in Alaska than in the rest of the United States. Accordingly, the State is a fertile natural laboratory for investigations into the cause and geologic effects of earthquakes. On the basis of patterns of historic earthquake activity, large earthquakes (magnitude 7 or greater) are expected to occur in the Shumagin Islands and Yakataga region with the next few decades. The program in Alaska is part of a national program mandated by the Earthquake Hazards Reduction Act of 1977 (Public Law 95-124). Under the act, the responsibility for research on earthquake hazards is divided between the Survey and the National Science Foundation (NSF). The Survey is responsible for research related to prediction, induced seismicity, and hazards assessment. The NSF is responsible for engineering and research for utilization of mitigating procedures. Much of the funding in the national overall program goes to universities, private groups, and other government services in addition to the Survey's program. As a result, the Survey closely coordinates its program in Alaska with the Geophysical Institute of the University of Alaska in Fairbanks and with the National Oceanic and Atmospheric Administration (NOAA). Observatories are maintained in Adak, Sitka, and Barrow, in addition to the Fairbanks facilities. The program in Alaska is coordinated by Robert D. Brown.

In addition to the projects listed by region in the pages that follow, the Survey supports several projects at institutions or in agencies outside the Federal Government. They include those listed below:

Earthquake Hazards Studies

Strong ground motion in two seismic gaps: Shumagin Islands, Alaska, and northern Lesser Antilles, Carribean Sea.--This project, under the direction of Klaus H. Jacobs and William R. McCann of the Lamont-Doherty Geological Observatory at Columbia University, is in its second year. Ten more accelerometers will be added to the existing network in FY 1981. Signals from the accelerometers will be fed by telemetered seismic networks to instruments that will record trigger times and hypocenter locations. This timing will help to identify seismic phases associated with strong ground motion. The instruments also help monitor the buildup of tectonic stresses.

Geotechnical soils investigations, Upper Cook Inlet area.--This study involves determination of the susceptibility to clay failure and liquefaction of Quaternary soils in response to a seismic event, mapping of soils units, and establishing a soils data bank. The project chief is Randall Updike of the Alaska Division of Geological and Geophysical Surveys in Anchorage. To date, data from several thousand sites in the study area have been stored, and studies of slope-indicator casings continue. Publications on

the distribution of soils types and the strain history of the area are in preparation.

Earthquake Prediction Studies

Crustal deformation measurements in Alaskan seismic gaps: Yakataga and the Shumagin Islands.--The project chiefs are Roger Bilham and John Beavon of the Lamont-Doherty Geological Observatory at Columbia University. To date, three groups of strainmeters have been installed, and more instrumentation is planned. The project's objective is to test whether precursory strain changes in an epicentral region can be used to predict time of rupture.

Field study of earthquake prediction methods in the centeral Aleutian Islands.--Project chiefs are Carl Kisslinger and Selena Billington of the University of Colorado in Boulder. A goal of the project is to develop the capability to predict earthquakes of magnitude 5 or greater. Data are provided by a seismograph network and by measurements of tilt, gravity, mean sea level, vertical line levelling and long-term tectonic stability.

VOLCANIC HAZARDS PROGRAM

This nationwide program involves geologists, geochemists, geophysicists, and hydrologists in assessment of the hazards to life associated with volcanic eruptions and in prediction of those eruptions. Study of existing volcanic deposits to determine the history of the volcanoes and monitoring of geophysical and geochemical activity are central to the program. In Alaska, studies are underway on four volcanoes in Cook Inlet. Studies of Mt. Edgecombe and the Wrangell Mountains are planned, but projects have not yet been defined. For information about this program, contact Alison B. Till of the Geologic Division office in Anchorage.

GEOTHERMAL RESEARCH PROGRAM

The Geothermal Research Program of the U.S. Geological Survey is a multidisciplinary program with the goal of understanding the nature, distribution, and energy potential of the Nation's geothermal resources. The program is administered by the Geologic Division and consists of geologic, geochemical, geophysical, and hydrologic studies that are conducted within the Geologic Division and the Water Resources Division. Much of the information produced by the Geothermal Research Program bears directly on the activities of the Conservation Division that are related to classification, evaluation, and leasing of Federal lands for geothermal development.

Individual projects fall into one of six topical categories, which are: (1) general studies of geothermal systems and of the transfer and storage of geothermal heat; (2) regional geothermal investigations; (3) studies of hydrothermal systems and fluid geochemistry; (4) studies of volcanic systems and magma chambers; (5) studies of geopressurized systems; and (6) development of geophysical and geochemical techniques for geothermal exploration and assessment.

Participation by the Branch of Alaskan Geology in the Geothermal Research Program is through regional geothermal investigations. One geothermal project is currently active in the State. James Riehle of the Geologic Divison in Anchorage is overseeing program activities in Alaska.

GEOLOGIC FRAMEWORK AND SYNTHESIS PROGRAM

This program is designed to develop and synthesize basic information on the geologic framework of the Nation. The program performs the dual function of acquiring baseline earth science information for subsequent support of mission activities of the U.S. Geological Survey such as resource assessment or mitigation of geologic hazards, and synthesizing geologic information gathered by other programs to develop new geologic concepts or up-to-date syntheses of regional geology. Three principal subelements constitute the program: (1) Geological, geochemical, and geophysical surveys to determine the distribution and properties of rocks and unconsolidated materials; (2) studies to determine the ages of those materials in order to determine rates and frequencies of particular geologic processes; and (3) studies of geologic processes responsible for the formation, modification, and distribution of those materials within and at the surface of the earth.

Activities of the Geologic Framework and Synthesis Program in Alaska are directed toward understanding the tectonic and intrusive igneous history of parts of the State. Geologic investigations in south-central and southeastern Alaska are studying the distribution and ages of "suspect" terranes, belts of rocks that may have moved thousands of kilometers northward to their present sites in Alaska. Geophysical studies in the program are measuring the orientations of week remanent magnetic fields in rock of these "suspect" terranes in order to identify the original position of the rocks with respect to known ancient positions of the Earth's magnetic poles. Other projects in the program are investigating distribution, compositions, ages, and origin of igneous plutons in the Brooks and Alaska Ranges. These projects will contribute to understanding the evolution and crustal framework of these areas and the relations between igneous intrusions and mineral deposits there. Finally, several investigations in the program are providing critical age determinations of rocks throughout Alaska, using paleontologic and isotopic techniques.

Further information about this program is

available from, Mitchell W. Reynolds, 910 National Center, Reston, Va. 22092; Tel. (703) 860-6544.

PROJECTS OF THE GEOLOGIC DIVISION

STATEWIDE

Project Title: Alaska Geothermal Project (Geothermal Research Program)

Chief: James R. Riehle

Objectives: To make a reconnaissance evaluation of the geothermal resources of the State of Alaska. Particular emphasis is now being given to the young volcanic rocks of the Alaska Peninsula, eastern Aleutian Islands, and the Wrangell Mountains. Studies of the geology, chemistry, and volcanic history of selected volcanic centers are being conducted in order to determine the possible existence of high-level heat sources or reservoirs.

Status: Much of the reconnaissance study of the volcanic rocks of the Aleutian volcanic arc and the Wrangell Mountains is now complete and in the report preparation stage. Present research consisting of geologic mapping plus petrologic and geochronologic studies of Peulik, Ugashik, Chiginagak, and Aniakchak Volcanoes represents a somewhat more detailed phase of the project.

The project location is shown in figure 16.

Project Title: Uranium in Alaska

Chief: Thomas P. Miller

Objectives: To make a reconnaissance study of the uranium and thorium potential of plutonic rock terranes in Alaska in terms of their geologic setting, petrologic characteristics, and associated uranium-thorium deposits.

Status: Reconnaissance geologic studies have been conducted on uraniferous plutonic rocks in the eastern Seward Peninsula, west-central Alaska, and the northern Alaska Range. Similar studies will continue in the Alaska Range and in east-central, southwestern, and southeastern Alaska. Several reports describing uranium-thorium distribution and mineralization have been published, and several more are in the report preparation stage.

The project location is shown in figure 16.

Project Title: Alaska Geologic Earthquake Hazards

Chief: George Plafker

Objectives: To study and evaluate risk in Alaska from tectonic displacement, seismic shaking, and secondary geologic effects. A more general goal is to gain insight into tectonic processes within the seismically active zones of Alaska, with special emphasis on south-central Alaska.

Status: Fieldwork is largely complete. The project has included reconnaissance studies of known or suspected active faults in Alaska and evaluation of marine terrace sequences in the Gulf of Alaska region. During 1981 a study will be made of post-seismic displacements related to the 1964 Alaska earthquake in the Prince William Sound region.

The location of project emphasis is shown in figure 16.

Project Title: Geochemistry and Geochronology of Igneous Rocks and Ore Deposits in Alaska

Chief: Miles L. Silberman

Objectives: To study mineralized and unmineralized plutons, stocks, and related volcanic rocks in mining districts, AMRAP quadrangles, and Chugach National Forest (RARE II) lands to ascertain: (1) the chemical and mineralogical nature of the igneous rocks; (2) the origin of the igneous rocks; (3) the relations in space and time between igneous rocks and spatially associated ore deposits as they pertain to the genesis of the ore deposits; (4) the regional history of Paleozoic, Mesozoic, and Cenozoic magmatic activity; and (5) by potassium-argon (K-Ar) and rubidium-strontium (Rb-Sr) dating, to study ages of metamorphism and relations of metamorphic processes to ore deposit genesis and plate tectonic framework. Accomplishment of these basic objectives will lead to development of criteria for ore deposit exploration. Knowledge of the role of igneous and metamorphic processes in genesis of ore deposits is vital. Recognition of areas favorable for location of new ore deposits and thorough evaluation of areas known to contain mineral deposits are hampered by lack of knowledge of how and why ore deposits form. Spatial association alone suggests an important causative relation that should be evaluated.

Status: Geochronology of the AMRAP Medfra quadrangle is complete, with preliminary report published in Circular 804-B and a summary report to be included in the folio for the AMRAP Medfra report. Rb-Sr and K-Ar dating of metaplutonic and metavolcanic rocks of the Survey Pass quadrangle is complete, and the data are included in a summary report on metamorphism in the quadrangle to be published later in a Professional Paper. These results and those on uranium-lead zircon age studies carried out by the Alaska Department of Natural Resources will be presented at a symposium on Arctic geology, to be held in Calgary, Alberta, in June 1981. K-Ar age determinations on extensionally related volcanic and hypabyssal plutonic rocks in the Cook Inlet region have been completed. When geochemical studies are complete, a geochronological-

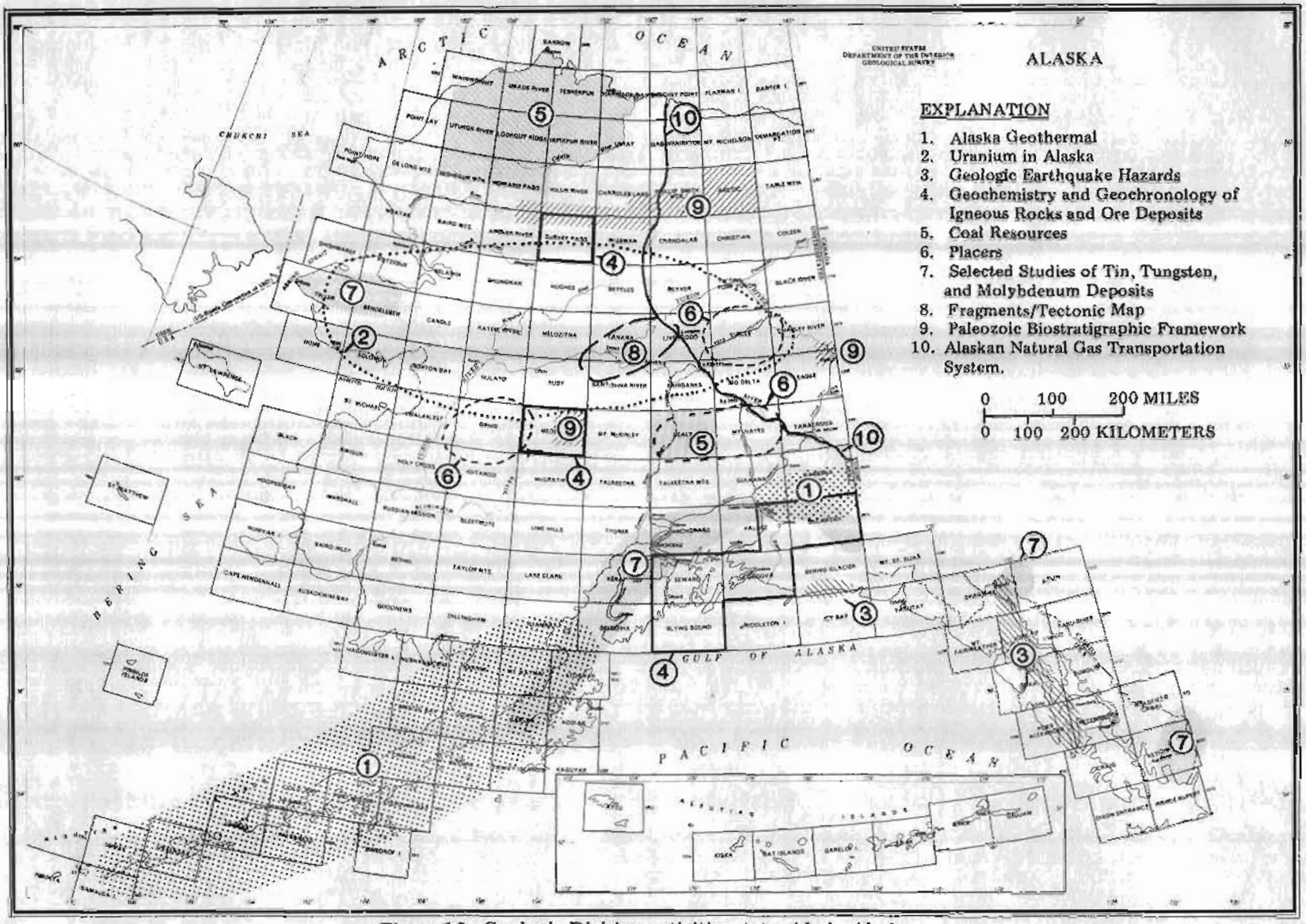


Figure 16.--Geologic Division activities statewide in Alaska.

geochemical and tectonic summary will be prepared.

Since 1979, the emphasis of this project has been on the study of tectonics and mineral deposits in the Prince William Sound region. Mapping, sampling for geochronology and geochemistry, and preliminary K-Ar and light-stable-isotope studies results from the Port Valdez and Hope-Sunrise gold mining districts have led to development of a model relating microplate accretion, metamorphism, and formation of lode gold deposits. Results have been published in Circular 823-B and in the proceedings volume of a symposium on mineral deposits of the Pacific Northwest (to be published in early 1981). Additional analytical data for isotopic and geochemical studies should be available by summer 1981. Fieldwork on lode gold districts, including Girdwood, Port Wells, and Nuka Bay, is planned for summer 1981, as is work on the Chugach RARE II project.

K-Ar ages and light-stable-isotope results for a study involving the tectonics of Wrangellia and the relations of accretion and mineralization have been completed, and preliminary results published in Circular 823-B and in more detail in Open-File Report 80-2019.

The project will be terminated after reports in preparation are completed.

The project location is shown in figure 16.

Project Title: Coal Resources of Alaska

Chief: Gary D. Stricker

Objectives: (1) To evaluate coal resources in the National Petroleum Reserve in Alaska (NPRA) and AMRAP areas of Alaska by geologic mapping, drill core data, and geophysical methods; (2) to prepare cross sections showing coal bed correlations and coal distribution in the NPRA and AMRAP areas; (3) to provide resource estimates by area and bed for selected parts of these areas; and (4) to assess coal quality by use of Btu values, sulfur and ash content, and major-, minor-, and trace-element concentrations.

Status: In 1980 fieldwork was done in the Broad Pass quadrangle where active surface subsidence over an abandoned coal mine is of environmental concern. A report on the subsidence is in preparation. Reconnaissance studies of the Mystic Creek coal basin and of an unnamed basin near Newman Creek in the northeast part of the Healy quadrangle resulted in collection of samples and measurement of sections for studies of depositional environment and coal resources. Other work for the Healy AMRAP project is essentially complete. The type and location of fieldwork in 1981 will be determined by arrangements with other projects.

The project location is shown in figure 16.

Project Title: Placers of Alaska

Chief: Warren E. Yeend

Objectives: To reassess gold placer resources of Alaska by mapping deposits and by compiling reports that show and describe: location and extent (vertical and lateral) of deposits; history of exploration; texture and lithology of gravel and heavy minerals; past production and value per cubic yard; sources of gravels and gold; resources remaining; and age of deposits and geologic history.

Status: Fieldwork is complete in the Mount Hayes quadrangle and has been started in the Circle, Healy, and Ophir quadrangles. Laboratory analysis is underway on panned samples, and maps are being compiled. Reports are being assembled for the Slate Creek, Circle, and Ophir Districts and Valdez Creek area.

An abstract describing placer gold deposits in the Mount Hayes quadrangle has been published in the Geological Society of America Abstracts with Programs volume for 1980. The project chief presented a talk describing placer gold deposits of east-central Alaska at the Alaska Miners Association annual meeting in Anchorage in October 1980.

The project location is shown in figure 16.

Project Title: Selected Studies of Tin, Tungsten, and Molybdenum Deposits in Alaska (Geologic Framework and Synthesis Program)

Chief: Travis Hudson

Objectives: To investigate the origin of intrusive rocks associated with tin, tungsten, and molybdenum deposits in Alaska. Petrology, geochemistry, and geochronology are integrated with regional geology in these studies better to understand the genesis of the deposits.

Status: Fieldwork is complete. Several reports on the tin granites of Seward Peninsula and on the intrusive rocks associated with molybdenum deposits in the Ketchikan quadrangle have been completed; others are being prepared. Laboratory work continues on the Coast Plutonic Complex near Skagway and Ketchikan and on Jurassic plutonic rocks of the Border Ranges in southeastern Alaska.

The project location is shown in figure 16.

Project Title: Alaska Fragments/Tectonic Map of Alaska

Chief: David L. Jones

Objectives: (1) To identify, characterize, and

interpret the major tectonostratigraphic terranes that form the main mass of Alaska, and to show their distribution on a tectonostratigraphic terrane map (scale 1:2,500,000); (2) to compile a tectonic map of Alaska (in quadrants at a scale of 1:1,000,000) which portrays: (a) the internal structural features of each terrane, (b) the structures produced during accretion of allochthonous terranes, and (c) structures that postdate the accretionary history; and (3) to determine by paleomagnetic methods the amount of displacement that selected terranes have undergone.

Status: A preliminary terrane map will be completed during FY 1981. Field studies in the central Alaska Range and in McKinley National Park were completed in FY 1980 and a map is being prepared. An MF map at a scale of 1:250,000 will be released in FY 1981. Compilation of the first sheet of a preliminary version of a tectonic map of Alaska is scheduled for FY 1981, as is completion of analysis of paleomagnetic data on lower Cenozoic volcanic rocks of the central Alaska Range. In FY 1981, field studies in the Rampart area of north-central Alaska will begin. The goal of this work is to establish stratigraphy and structure of the Innoko terrane.

The project location is shown in figure 16.

Project Title: Paleozoic Biostratigraphic Framework of Alaska

Chief: J. Thomas Dutro, Jr.

Objectives: To establish a biostratigraphic framework of Paleozoic sequences in three parts of Alaska: (1) Ordovician through Devonian of the eastern Medfra quadrangle, west-central Alaska; (2) Devonian of the central and eastern Brooks Range, northern Alaska; (3) Carboniferous (upper part of Ford Lake Shale and Calico Bluff Formation) of east-central Alaska.

Status: This project was initiated this FY 1980. Fieldwork has been completed for parts (1) and (3), and is continuing for part (2). The study elements have been summarized in numerous reports, and more reports are in progress.

The project location is shown in figure 16.

Project Title: Alaska Natural Gas Transportation System

Chief: John R. Williams

Objectives: To provide geologic, hydrologic, and geotechnical advice to Federal agencies responsible for reviewing plans and designs and for granting permits for construction of the Alaska Natural Gas Transportation System by Alaskan Northwest Natural Gas Transportation Company. This is done through: (1) membership on the Cold Regions Engineering Technical Committee of the Office of the Chief of Engineers, U.S. Army, established to advise the Federal Inspector, Alaska Natural Gas Transportation System, and (2) an advisory role to the Agency Authorized Officer, Department of the Interior.

Status: The Cold Regions Engineering Technical Committee meets quarterly with representatives of the Federal Inspector, the Alaskan Northwest Natural Gas Transportation Company, the gas producers, and the Trans-Alaska Pipeline System owners, as necessary, to discuss frost heave, seismic design, geotechnical problems, pipeline routing and alinement, and other problems. In addition to participating in these meetings, project personnel serve on the Committee's Field Tests and Investigations Task Group which meets for direct communication with the technical staff of Alaskan Northwest Natural Gas Transportation Company and its consulting engineers, geologists, and hydrologists four or five times per year, as required.

The project location is shown in figure 16.

Project Title: Geochemical Census of Alaska

Chief: Larry P. Gough

Objectives: To establish background values for the concentration of about 35 elements in unconsolidated surficial materials and selected native plants. Such information is valuable in the evaluation of geochemical data for (1) mineral resources, (2) environmental appraisals, and (3) the definition of broad-scale geochemical patterns. Analysis of the soil sample provides a measure of the total concentration of each element at a site, and analysis of the associated plant permits an estimate to be made of the concentrations of the elements available to biogeochemical cycling and soil enrichment. The study produced a series of state maps showing the concentration of elements in surficial materials and plants. By sampling two sites per 1:250,000 quadrangle (one site being replicated) in a projected total of about 140 quadrangles, we will obtain about 420 surficial material samples distributed so that they are separated by 80-160 kilometers.

Status: For about 5 years this effort progressed slowly on a non-funded, time-available basis. Last year the project chief attained quarter-time funding which allowed for a limited amount of fieldwork in the south-central region. The project depends, however, on the volunteer assistance of individuals going into areas where samples are needed, as funding for such an effort would be prohibitive. More than 35 persons from numerous government agencies and public and private universities have participated. The

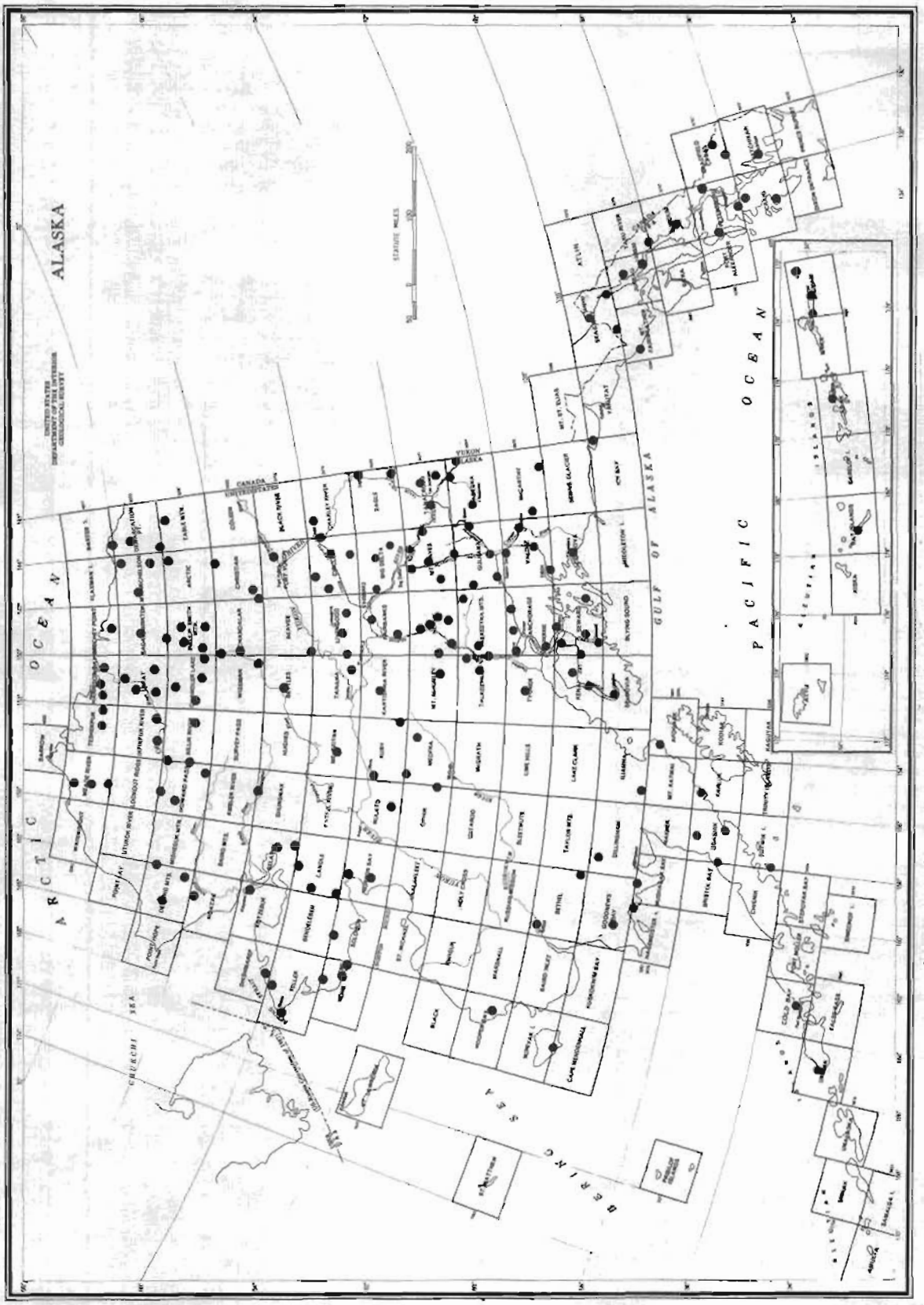


Figure 17.--Sample-site coverage for geochemical census of Alaska.

project may be completed by the end of the 1982 field season.

The areas sampled, as of January 1981, are shown in figure 17.

The locations of the projects described below are not shown on maps because the projects cover such large areas. For information on areas of concentrated study, contact the project chiefs.

Project Title: Mineral Resources of Alaska

Chief: Edward H. Cobb

Objectives: As a continuing project, to keep office studies of mineral occurrence data current and to prepare special-purpose maps, reports, and reference lists when the need arises. Most data are organized so that they are available for entry into computerized storage and retrieval banks.

Status: As this is a continuing project, percentage-of-completion data are not applicable; records are up to date as of December 31, 1980.

Project Title: Alaska Gravity Surveys

Chief: David F. Barnes

Objectives: To provide gravity data that can contribute to Alaska mineral assessments, geologic mapping, and earthquake studies. A corollary is to standardize all government, university, and industry gravity surveys in Alaska by maintaining a network of base stations that can be readily reoccupied during local surveys or after earthquakes and that are accurately tied to sites of absolute measurements.

Status: A 1:2,500,000-scale simple Bouguer anomaly map of Alaska was published in 1977. This map provided a preliminary estimate of the variation of crustal thickness, approximate boundaries of many small sedimentary basins, an indication of isostatic adjustment, and information about the regional gradients that are used in the interpretation of more detailed surveys. Most of the recent surveys have been planned as 1:250,000-scale maps designed to support mineral assessments and wilderness area investigations. However, interpretation of such larger scale maps usually requires terrain-corrected data, which have been prohibitively expensive until the recent availability of digital terrain data and development of computer techniques to handle such data.

The most detailed survey yet attempted consisted of closely spaced stations along two perpendicular profiles across a barite outcrop near the Nimiuktuk River in the western Brooks Range. These data suggested that the small outcrop is underlain by about a 1.5 million tons of barite. Gravity may also prove useful in locating other massive barite bodies, which geochemical data suggest may be abundant in the Brooks Range. Another very detailed new data set includes over 50,000 gravity measurements made along seismic lines in the National Petroleum Reserve. Analysis of these data should improve our understanding of Arctic Alaska's gravity and geologic structure.

The base station network has supplied control for many commercial surveys of both land and marine sedimentary basins. These stations were originally described in two open-file reports based on the old Potsdam network, but conversion to the new absolute (IGSN71) world net and datum has caused some confusion which will, it is hoped, be eliminated by a report in preparation.

Reoccupation of many gravity bases after the 1964 earthquake suggested mass increases by thrust fault movements and local mass decreases by elastic expansion. Continuing studies of post-earthquake elevation and gravity changes suggest models involving elastic compression.

Project Title: Landsat Imagery and Applications in Alaska (AMRAP)

Chief: James R. Le Compte

Objectives: (1) To furnish AMRAP team leaders and principal investigators with state-of-the-art Landsat materials for reconnaissance purposes, and (2) to provide unique geologic, structural, and tectonic information relative to mineral resource assessment for each AMRAP quadrangle.

The types of Landsat products used are: (1) black and white, single-band Landsat mosaics; (2) a noncomputer-enhanced, controlled, false-color Landsat mosaic; (3) photographically enhanced false-color images; (4) computer-enhanced first-derivative black and white images; and (5) computer-enhanced false-color, color ratio, and simulated natural-color images.

Status: Landsat image interpretation studies for Nabesna, McCarthy, Tanacross, Talkeetna, Goodnews (Bay), Hagemeister Island, Ketchikan, Prince Rupert, Talkeetna Mountains, Chandalar, Philip Smith Mountains, Ambler River, Big Delta, Seward, and Blying Sound quadrangles have been completed and published. Images for the Survey Pass, Medfra, Bradfield Canal (and vicinity), Healy, Chignik, Sutwik Island, Lake Clark, Valdez, Ugashik, Karluk, and Circle quadrangles are being analyzed. These quadrangle studies (all to be published in FY 1981) will conclude the Landsat interpretation program in the Branch of Alaskan Geology.

Project Title: Anchorage Geochemical Laboratory (AMRAP)

Chief: Richard M. O'Leary

Objectives: To make spectrographic and chemical analyses of geologic material collected from quadrangles that are part of the AMRAP program.

Status: The laboratory facilities in Anchorage will be primarily serving the Healy and Circle AMRAP quadrangles. In addition, some samples are expected from projects in the Ugashik, Karluk, and Anchorage quadrangles as part of continuing or new AMRAP work.

Project Title: Metamorphic Facies Map of Alaska

Chief: David A. Brew

Objectives: To compile a 1:2,500,000-scale metamorphic facies map of Alaska showing the facies, facies groups, facies series, selected isograds, and granitic rock bodies in the style of the metamorphic facies map explanation suggested by the International Union of Geological Sciences in 1967. The map is planned as a contribution to a map of the metamorphic belts of the world, which is sponsored by the Commission for the Geological Map of the World (of the International Geological Congress and the International Union of Geological Sciences), as a joint U.S. Geological Survey-State of Alaska publication.

Status: Progress to date includes preliminary compilation and review of regional metamorphic facies maps at a scale of 1:1,000,000 for all of Alaska, coding of background metamorphic mineral locality information, and start of the compilation of the final 1:2,500,000-scale map.

Project Title: Precambrian of Alaska

Chiefs: G. Donald Eberlein and Marvin A. Lanphere

Objectives: In response to the growing public demand on Earth resources and in recognition of the need for closer examination of the largely overlooked mineral resource potential of the Earth's Precambrian terranes, the Subcommission on Precambrian Stratigraphy of the International Union of Geological Sciences' Commission on Stratigraphy has established Working Groups in all parts of the world where Precambrian rocks form a significant part of the geology of the region. This program activity, with particular concern for Alaska, is one of seven that constitute the Working Group for the Precambrian of the United States and Mexico. Immediate objectives have been designated as (1) assembly and evaluation of existing pertinent geologic and geochronologic data relevant to Alaskan Precambrian terranes; (2) preparation of a summary geologic report and geochronologic chart for Alaska to be published in a single volume with similar reports for the other regions of the United States and Mexico; (3) formulation of an acceptable time scale for the Precambrian of the United States and Mexico; (4) coordination with the Working Group of Canada in an effort to formulate an acceptable Precambrian time scale for all of North America; (5) identification and designation of reference sections; and (6) revision of the American Commission on Stratigraphic Nomenclature (ACSN) code for the Precambrian.

Status: Objectives (1) and (2) have been fulfilled; the manuscript which reviews and summarizes the existing knowledge of the Precambrian of Alaska has been approved for publication as a chapter in a Professional Paper, but is being delayed pending receipt of companion manuscripts covering other parts of the United States. Objective (3) likewise has been fulfilled, and the Working Group's Precambrian time scale proposal for the United States and Mexico has been approved for publication by the ACSN. Efforts to formulate an acceptable Precambrian time scale for all of North America are continuing, but progress is being delayed because Canadian workers are having difficulties developing an acceptable proposal for that country.

Program activity is continuing on a part-time basis with the indicated Alaskan regional members of the United States - Mexico Working Group (a) keeping other members informed of developments in the understanding of the Precambrian stratigraphy of Alaska, (b) maintaining contact with Canadian counterparts to facilitate resolution of mutual problems on either side of the International Boundary, and (c) working with other members of the Working Group to encourage the definition and integration of all methods of determining the Precambrian record.

Project Title: Arctic Map

Chief: Michael Churkin, Jr.

Objectives: To complete a 1:5,000,000-scale tectonic map of the Arctic (Alaska and neighboring parts of Canada, U.S.S.R., and polar regions) that uses the concept of tectonostratigraphic terranes.

Status: A preliminary basement map of Alaska was published in the November 1980 Geological Society of America Bulletin. A preliminary map of major terranes and foldbelts in the Arctic has been published in Earth and Planetary Sciences Letters, v. 48 (1980), p. 356-362.

Project Title: Geology and Geochemistry of Tin (Geologic Framework and Synthesis Program)

Chief: Bruce L. Reed

Objectives: (1) To investigate tin resources and

make a comprehensive study of the occurrence, association, and geochemistry of tin in Alaska and tin-producing districts of the world; (2) to maintain and continuously refine quantitive appraisal of domestic and foreign tin resources; (3) to evaluate and assist ongoing projects in appraising the resource potential of tin occurrences in Alaska as they are discovered; (4) to continually review current research on the geologic processes and environments pertinent to the formation of tin deposits in order to identify environments favorable for undiscovered deposits; and (5) to consult with and offer assistance to industry and government personnel interested in tin.

Status: Work is continuing on all objectives, although no fieldwork was done in 1980. Fieldwork in 1981 is contingent upon available funds.

Project Title: Uranium Potential of Tertiary Basins in Alaska

Chief: Kendell A. Dickinson

Objectives: (1) To evaluate the uranium potential of selected Tertiary sedimentary basins and coastal regions; (2) to compile data on and locate anomalous radioactivity in Tertiary sedimentary rocks; (3) to determine the environments of sedimentation in each basin and coastal region to delineate nearshore and continental facies most favorable for roll-type uranium deposits; (4) to determine potential granitic and volcanic ash source rocks for uranium near basins and coastal plains; (5) to delineate areas of alteration favorable for uranium deposits and determine hydrology as it relates to movement of uranium-bearing ground water; (6) to evaluate paleo-geochemical conditions suitable for the preservation of potential host rocks; and (7) to define target areas for physical exploration (drilling).

Status: Fieldwork is 85 percent complete, and laboratory and work compilation 65 percent complete. In 1980, project effort was concentrated southeastern Alaska; potentially favorable areas for uranium were recognized on the west side of Zarembo Island. If funding is available, some fieldwork will be done in an interior Alaska Tertiary basin.

Project Title: Geothermal Studies

Chief: Arthur H. Lachenbruch

Objectives: To investigate heat flow and the geothermal regime of permafrost and sedimentary basins by making thermal observations in holes drilled for other purposes.

Status: The post-drilling return to equilibrium of holes drilled in the National Petroleum Reserve is being monitored. Sufficient data are now available for preliminary compilation and interpretation, which are underway. Thermal data of variable quality have been obtained from about three dozen holes elsewhere in Alaska. These are also being compiled and studied.

Project Title: Geochronological and Petrologic Studies in Central and Western Alaska

Chief: Frederick H. Wilson

Objectives: (1) To support geologic mapping projects and resource studies in Alaska through use of potassium-argon dating, and topical age studies within the framework of the other projects; (2) to build an argon extraction lab in Anchorage; and (3) to maintain a computer-based compilation of Alaskan radiometric age dates.

Status: Potassium-argon dating of rocks from the Ugashik and Circle (AMRAP) quadrangles was initiated in 1979, and the planned work is approximately 30 percent complete. The construction of the argon extraction lab may be underway in winter 1981. The radiometric age compilation is a continuing project, and percentage-of-completion information is not applicable; however, more than 1,800 dates and 249 references had been entered by fall 1979.

NORTHERN REGION

Project Title: Late Neogene and Quaternary Chronostratigraphic Framework, Northern Alaska

Chief: Kristin A. McDougall

Objectives: To understand the complex late Cenozoic history of northern Alaska through knowledge of the timing, sequence, and extent of the various transgressive-regressive cycles. The principal objective of this project is to develop a chronostratigraphic framework for the late Cenozoic by designating a series of reference (type) sections that establish the temporal sequence and nature of the glacio-eustatic sea-level cycles. Studies during the past year have therefore concentrated on chronostratigraphically significant areas (Arctic Coastal Plain and Bering Sea), as well as developing a Holocene ecological base for comparison.

Status: Both onshore and nearshore work on the Arctic Coastal Plain has led to the recognition of several faunal events diagnostic of the last interglacial-glacial cycle. Micro- and megafaunas (benthic foraminifers, ostracods, and mollusks) from Drew Point and Cape Simpson sections record environmental changes as these areas were subjected to the variable climatic conditions. Benthic foraminiferal faunas in the Sangamon (interglacial) deposits are diverse and abundant and indicate an environment of warmer and

slightly deeper water. Faunas of early Wisconsin (glacial) age are reduced in abundance and diversity and are dominated by specimens characteristic of shallow, low-salinity waters (*Elphidium albiumbilicatum* and *E. asklundi*). This faunal change is also observed in offshore boreholes. In these boreholes, the Holocene faunas are similar to those of the Sangamon but differ in the absence of several species and changes in species dominance. Earlier transgressive-regressive cycles are currently under study, as are several potential type sections, such as Skull Cliff. Studies on the Bering Sea have been concentrated on cores from Norton Sound. A Holocene ecological base was established and compared to faunas in numerous cores (Open-File Report 80-979 and a journal article in press). These comparisons indicate that a change in the faunas, sediments, and water quality occurred approximately 25,000 years before present. This change correlates with changes in the Yukon River delta and flow direction. Although work is just beginning on the earlier transgressive-regressive cycles, the absence of the early Wisconsin low-salinity interval is noted, as is the presence of abundant and diverse faunas correlative to the Sangamon faunas of the Arctic Coastal Plain.

Holocene ecological studies are still in the sample collection and preparation stages.

The project location is shown in figure 18.

Project Title: Engineering Geologic Studies in the National Petroleum Reserve in Alaska (NPRA)

Chief: Reuben Kachadoorian

Objectives: To make engineering geologic investigations and to provide geotechnical analyses needed for petroleum exploration of NPRA. Investigations include, but are not limited to, determining sources of construction materials and evaluating site locations of such facilities as airstrips, roads, drill sites, and construction camps. Project personnel consult with participants in the NPRA program on engineering geology and permafrost-related engineering problems, and on engineering geologic effects of exploration activities in the Reserve.

Status: Because the project provides engineering geologic expertise needed to fulfill responsibilities assigned to the Geological Survey through provisions of the Naval Petroleum Reserves Production Act of 1976, it will continue until these responsibilities are fulfilled.

The project location is outlined in figure 18.

Project Title: Quaternary Environments of the National Petroleum Reserve in Alaska (NPRA)

Chief: Robert E. Nelson

Objectives: To provide a record of past environments and climates in the National Petroleum Reserve in Alaska. It is hoped that the record will extend back in time at least 40,000 years, if not farther. The techniques to be used in reconstructing the record will include pollen analysis, studies of fossil insects, and studies of plant macrofossils such as seeds and fruits.

Status: The project was initiated in the summer of 1979 with a 10-week field season. The base camp was on the Titaluk River near the center of NPRA. The project chief and Robert D. Norris collected approximately 250 kilograms of vertebrate remains, pollen samples, and screen-washed concentrates of organic debris to process for recovery of fossil insects and seeds. Most vertebrate remains were not found in place, but the mammalian fauna has a typical late Pleistocene aspect and includes mammoth (found in place and carbon-dated at 28,000-40,000 years), *Bison*, horse, musk ox, and rare *Saiga* antelope remains. The analyses of pollen samples from several horizons greater than 28,000 years old indicate that the climate may have been harsher than that of the present. For example, pollen from alder and spruce, neither of which now grow in the study area, is present in modern sediments, but its absence from older sediments suggests that these plants grew even farther from the area than they do now. Insect remains from a horizon dated at 28,000 years suggest that local climatic conditions were very similar to those of the present. Increasing percentages of grass and sage (*Artemisia*) pollen in sediments younger than 28,000 years old are interpreted as an indication of increasingly arid environments, which culminated in the steppe-tundra that characterized much of Alaska and Siberia at the height of the last glaciation. Sediments of late Wisconsin (Itkillik II and III) age are apparently absent from the sections studied.

The project is scheduled to be completed by June 1982.

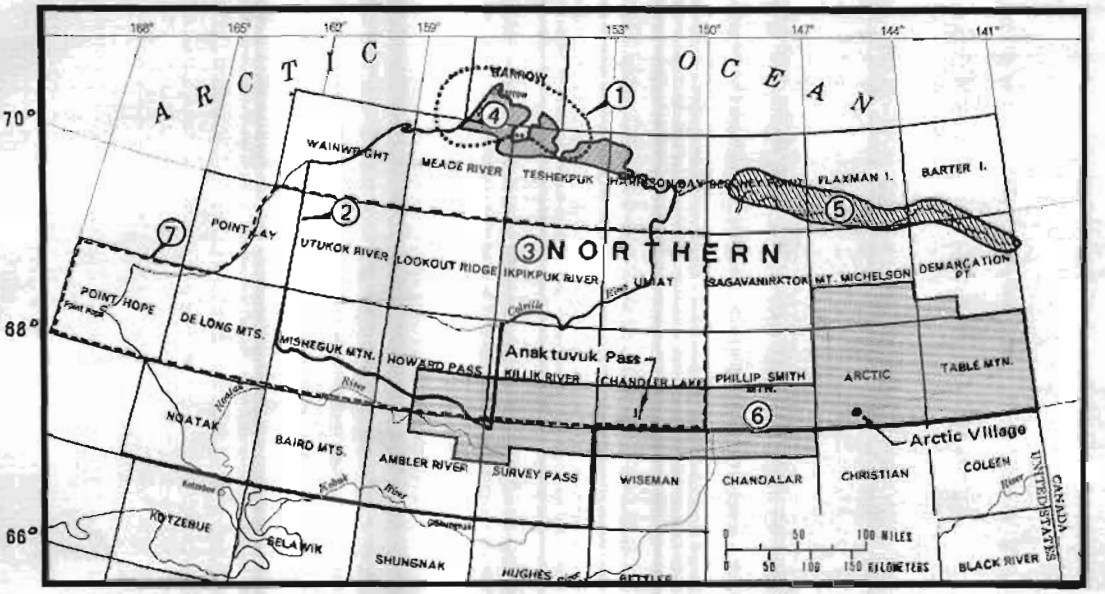
The project location is shown in figure 18.

Project Title: Helium Detection, National Petroleum Reserve in Alaska (NPRA) (North Slope Petroleum Program)

Chief: Alan A. Roberts

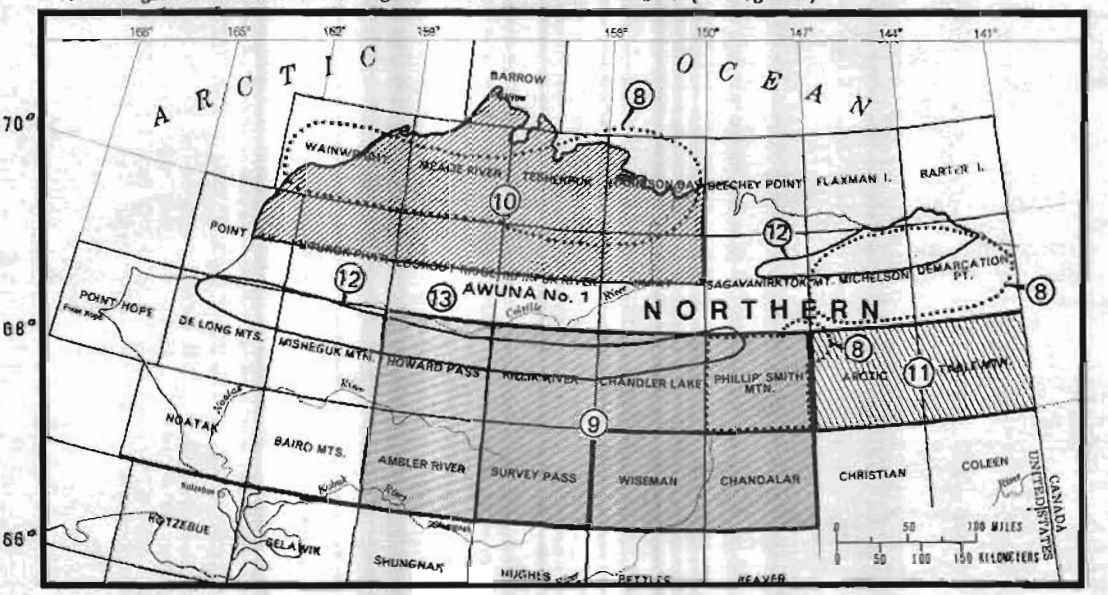
Objectives: To determine if microseepage of helium from petroleum reservoirs will result in anomalously high concentrations of helium in the near-surface permafrost and to evaluate the possible utility of helium surveys in petroleum exploration programs in permafrost environments.

Status: Four surveys of the Reserve have been run, and about 2,400 samples have now been collected. No anomalously high helium concentrations were noted near the dry well at the J.W.



EXPLANATION

1. Late Neogene and Quaternary Chronostratigraphic Framework
2. Nationnl Petroleum Reserve boundary
3. Quaternary Environments of NPRA
4. Helium Detection, NPRA
5. Northern Alaska Cenozoic
6. Brooks Range Devonian Clastic Rocks
7. Geological and Remote Sensing Evaluation of SLAR Imagery (See fig. 23.)



EXPLANATION

8. Petroleum Assessment Geology
9. Surficial Geology of Central Brooks Range
10. Western Arctic Coastal Plain Quaternary
11. Southeast Brooks Range Geology
12. North Slope Cretaceous Studies
13. Borehole Gravity Studies in NPRA

Figure 18.--Geologic Division activities in northern Alaska.

Dalton test site near Camp Lonely, but a pattern of helium concentrations was found on the Simpson Peninsula and may outline a possible petroleum prospect. In 1980 the survey of the area between Admiralty Bay and the Arctic Ocean coast to the west revealed a pattern of high helium concentrations that may be related to a petroleum reservoir in a stratigraphic trap where Jurassic sands are truncated by an unconformity.

Reports on the project's work are in progress, and the project may be terminated upon completion of the reports.

The project location is shown in figure 18.

Project Title: Northern Alaska Cenozoic

Chief: David M. Hopkins

Objectives: (1) To determine the geochronology of the sequence of sediments recovered from offshore boreholes drilled in 1976, 1977, and 1979 by using radiocarbon analysis, amino-acid racemization, paleontological determinations, and geologic correlations. (2) On the basis of this information and data gained from coastal geologic studies, to determine the history of sea level changes, lateral migration of shoreline, and other paleogeographic parameters for the Beaufort lease area during the past 120,000 years. (3) From this, to develop a model to explain and predict the distribution of shallow and deep permafrost on the Beaufort Sea shelf.

Status: About three-quarters of the geologic mapping of the coast from the Canning River to Demarcation Point is complete. Annual reports have been sent to Outer Continental Shelf offices and other collaborators. Samples are being sent to specialists for analysis.

The location of the project is shown in figure 18.

Project Title: Brooks Range Devonian Clastic Rocks

Chief: William P. Brosgé

Objectives: To determine from surface exposures the environments of deposition, the directions of sediment transport, and the present facies trends of the Upper Devonian Kanayut Conglomerate and the Lower Mississippian Kekiktuk Conglomerate, and to relate the present trends of these directional features in the rocks exposed in the Brooks Range to those in the less disturbed rocks beneath the North Slope by means of paleomagnetic studies and by regional interpretation of Late Devonian and Early Mississippian paleogeography.

Status: The project is about three-quarters completed, and all the planned fieldwork has been done. In 1978 and 1979 the Kanayut Conglomerate was mapped from the Canadian border near Arctic Village to the Howard Pass area, about 600 kilometers to the west, and was examined in detail at many localities. In addition, the Kekiktuk Conglomerate was examined north of Arctic Village and southeast of Howard Pass, and about 500 cores of Devonian and Mississippian rocks were collected from the outcrop for paleomagnetic study. In 1980 the Kanayut was examined in detail around its type area east of Anaktuvuk Pass. The regional study has demonstrated that the three fluvial members of the Kanayut Conglomerate are persistent from east to west, that the direction of transport of sediment was consistently to the southwest and west, and that the Kanayut is consistently rich in chert. On the other hand, variation in the composition and direction of transport of the sediments in the Kekiktuk Conglomerate from place to place suggests local sources. Pole positions have been determined for all the surface cores in the paleomagnetic study. These indicate that the observed magnetic orientation was reset by a Cretaceous event. An oriented core from a National Petroleum Reserve well is being studied for comparison. An Early Mississippian paleogeologic map of northern Alaska based on surface mapping and on a separate geophysical study of basement rocks in the reserve is in preparation.

A geologic map of the members of the Kanayut Conglomerate in the central Brooks Range, regional paleocurrent maps for the Kanayut and Kekiktuk Conglomerates, and a report on data from the 1978 fieldwork have been placed on open file. Final reports on the stratigraphic and paleomagnetic studies will appear as chapters in the Professional Paper summarizing recent geologic work in the petroleum reserve. A report on revision of the stratigraphy of the Kanayut is planned.

The project location is shown in figure 18.

Project Title: Geological and Remote-Sensing Evaluation of SLAR Imagery of Alaska

Chiefs: Nairn R. D. Albert, Part A; John W. Cady, Part B

Objectives: To evaluate the utility of various types of side-looking radar (SLAR) imagery acquired by Aero Service and Mars, Inc. for geologic and mineral resource investigations in the Alaska Peninsula and in northern Alaska; and to compare the geological applications and cost effectiveness of real aperture with synthetic aperture SLAR imagery and SLAR imagery with other remotely sensed data such as Landsat, aerial photography, Seasat radar imagery, and aeromagnetic maps. In northern Alaska dual look stereoscopic real aperture SLAR imagery is being evaluated, whereas in the Alaska Peninsula mainly

single look non-stereoscopic synthetic aperture SLAR imagery is being evaluated. Both dual look steroscopic real aperture and dual look stereoscopic synthetic aperture imagery are being evaluated.

Status: The project was started in February 1981 and is designed as a coordinated effort between Branch of Alaskan Geology (Part A) and the Branch of Petrophysics and Remote Sensing (Part B) that combines remote-sensing expertise with geological expertise in the study areas.

Part A emphasizes close collaboration between remote-sensing specialists and geologists with prior interest and experience in the study areas; existing geological information has been used from the outset in evaluating and interpreting the SLAR imagery. Part B initially has refrained from studying geological reports or maps in an experiment to determine what information can be obtained solely from the SLAR imagery and from the SLAR imagery combined with other remotely sensed data. When both Branches complete their preliminary independent interpretations, they will combine forces to compare their results and work toward a joint evaluation and interpretation.

Special emphasis has been focused on the Ugashik and Karluk quadrangles on the Alaska Peninsula where both real and synthetic aperture data are available and being compared. Interpretation in the Alaska Peninsula will be field checked during July 1981, in conjunction with the Ugashik-Karluk AMRAP project.

A report on preliminary results will be prepared by September. A more detailed report, including maps of selected areas, will be prepared later in the year. The project is scheduled to end in March 1982.

The project location is shown in figure 18. (See also fig. 23.)

Project Title: Petroleum Assessment Geology, North Slope Provinces (North Slope Petroleum Program)

Chief: Kenneth J. Bird

Objectives: To provide the data and interpretations necessary to assess the petroleum potential of the North Slope. Assessment requires the identification and quantitative evaluation of reservoir rocks, source rocks, and timing of petroleum generation and migration relative to trap formation. The goals are stimulation of industry exploration and improved resource assessments with a larger data base and better interpretations.

Status: The study of Lisburne Group reservoir potential in NPRA will be completed this year, and an investigation of Lisburne hydrocarbon potential in the William O. Douglas Arctic Wildlife Range will be initiated. Also scheduled for completion this year are investigations of the petroleum geology of the Philip Smith Mountains quadrangle and the nearby Shaviovik area.

The project location is shown in figure 18.

Project Title: Surficial Geology of the Central Brooks Range (Arctic Environmental Studies Program)

Chief: Thomas D. Hamilton

Objectives: To provide data for assessment of potential transportation corridors across the central Brooks Range and for other studies involving land-use analysis and land classification. This objective is being accomplished through preparation of 1:250,000-scale surficial geologic maps showing (1) character, age, and genesis of unconsolidated deposits and (2) locations of landslides, debris flows, and other hazard zones. A general stratigraphic framework, based on measured sections, radiocarbon dates, soil analyses, and geomorphic relationships, is also being developed for the region. This framework has tied together glacial and nonglacial deposits of the northern and southern Brooks Range and provides a basic structure to which other Quaternary deposits in northern and central Alaska can be related.

Status: Surficial geologic maps have been published for five quadrangles: Philip Smith Mountains (Miscellaneous Field Studies MF-878-A), Chandalar (MF-879-A), Chandler Lake (MF-1121), Wiseman (MF-1122), and Killik River (MF-1234). A comparable map for the Survey Pass quadrangle is in preparation. Completion of field mapping in the Ambler River quadrangle is scheduled for the summer of 1981, and a surficial geologic map for that area will be prepared the following year.

The location of the project is shown in figure 18.

Project Title: Western Arctic Coastal Plain Quaternary (Arctic Environmental Studies Program)

Chief: L. David Carter

Objectives: To determine the Quaternary history of the western Arctic Coastal Plain (marine transgressions, episodes of eolian activity, fluvial terrace development, paleoclimate, tectonic history, and the like) through stratigraphic and geomorphic studies, and to define relations between modern landscape attributes (topography, thaw-lake characteristics, and ground-ice distribution, among others) and Quaternary history, in order to predict the effects of natural or man-induced environmental changes.

Status: Detailed sampling of key exposures and geomorphic analyses of the terrain will be continued during the next two summers. Reports describing pingos, fossil insects, Pleistocene shorelines, and Holocene eolian deposits were published in Circulars 804-B and 823-B. Preliminary results of studies of amino-acid geochronology of Quaternary marine deposits were presented at the Ninth Annual Arctic Workshop held in April 1, 1980. The abstracts volume from the workshop, published by the Institute of Arctic and Alpine Research, University of Colorado, contains two abstracts describing this work. A report describing a Pleistocene sand sea has been published in Science (v. 211) and papers concerning marine and alluvial terraces of the Colville River delta region and the late Quaternary history of part of the Titaluk River valley are in preparation.

The project location is shown in figure 18.

Project Title: Southeast Brooks Range Geology

Chief: William P. Brosgé

Objectives: To complete geologic mapping of the Arctic and Table Mountain quadrangles at 1:250,000 scale, and to revise mapping in adjacent quadrangles.

Status: The mapping is about 60 percent completed. Fieldwork in the Arctic quadrangle was finished in 1979, and about 25 percent of the Table Mountain quadrangle has been mapped in the field. A map of the Table Mountain quadrangle based largely on interpretation of aerial photographs was placed on open file in 1976. A geologic map on the Arctic quadrangle based on the recent fieldwork should be completed for publication early in 1981. No fieldwork is planned for 1981.

The project location is shown in figure 18.

Project Title: North Slope Cretaceous Studies (North Slope Petroleum Program)

Chief: Cornelius M. Molenaar

Objectives: To study the stratigraphy, depositional environments, petrography, reservoir properties, and paleontology of Cretaceous rocks at the surface and in the subsurface of the North Slope in order to assess the hydrocarbon potential and other economic aspects of these rocks.

Status: Three seasons of fieldwork and associated surface and subsurface studies have been completed since 1977. Two seasons' work concentrated on the Nanushuk Group. Results of this and subsurface work were published in Circulars 794 and 820 in 1979, and another final circular is in preparation. In addition, summary articles are published in Circular 804-B (1979) and in Circular 823-B. Subsurface studies on this phase of the project will continue as new data are acquired from the ongoing drilling program in the National Petroleum Reserve in Alaska (NPRA). A paper summarizing the Lower Cretaceous seismic stratigraphy and depositional history of NPRA is in prepration for inclusion in a Professional Paper describing the geology of the reserve.

In 1980 fieldwork was devoted to a study of the Fortress Mountain Formation (lower Cretaceous - lower Tertiary) and the lower part of the Torok Formation (lower Cretaceous) and to the Cretaceous - lower Tertiary stratigraphy in northeastern Alaska. Preliminary results of the two projects will be published in Circular 844, and the complete report on the Fortress Mountain Formation will be published in a Professional Paper describing the geology of NPRA. A full report on the Cretaceous - lower Tertiary stratigraphy of northeastern Alaska is in preparation. In addition, studies of uranium and thorium potential of selected areas in northeastern Alaska are summarized in Circular 844. This aspect of the project is largely complete. No fieldwork is planned for 1981.

The project location is shown in figure 18.

Project Title: Borehole Gravity Studies in the National Petroleum Reserve in Alaska (North Slope Petroleum Project)

Chief: James W. Schmoker

Objective: To monitor and observe a borehole gravity survey of the Awuna test well 1.

Status: If a contract with EDCON, Inc., of Denver, Colo., is arranged, the project chief will monitor the gravity survey and review a report on the work. The project is expected to be complete in FY 1981

The project location is shown in figure 18.

Project Title: National Petroleum Reserve in Alaska Oil and Gas Source Rock Study (North Slope Petroleum Program)

Chief: Leslie B. Magoon

Objectives: To provide data and interpretations necessary to assess oil and gas source potential of various possible hydrocarbon source horizons in the National Petroleum Reserve in Alaska. Interim reports will help evaluate the present drilling program and determine the location of new drill sites as required.

Status: Analytical data needed for this study are being provided by Geochem Research, Inc., Houston, Texas, and Global Geochemistry, Canoga Park, Calif. To date, more than 20,000 analyses have been completed. Petroleum Information, of Denver, Colo., is building and maintaining the data file of these analyses and implementing graphical displays. Publications, co-authored with George Claypool, include vitrinite reflection and C_1-C_7 data for 12 wells and a study of oil types on the North Slope. Numerous additional preliminary reports are in various stages of publication.

The boundary of the project's study area is shown in figure 18.

Project Title: Low Altitude Aeromagnetic Surveys (North Slope Petroleum Program)

Chief: Terrence J. Donovan

Objectives: To determine whether hydrocarbons seeping from buried reservoirs may have sufficiently reduced iron oxides to form magnetite in shallow superincumbent rocks, permitting aeromagnetic detection.

Status: In 1981 a transverse gradiometer will be used to obtain more precise data from at least five areas of high-wave-number magnetic anomalies that were identified in 1979 by total field measurements and studied briefly in 1980. The results of the 1979 fieldwork will be included in a Professional Paper describing the geology of the National Petroleum Reserve in Alaska. Sampling and preliminary analyses of available core data suggest that rocks within anomalous areas have a relatively large remanent magnetism, and isotopic data from carbonate cement indicate the effects of petroleum microseepage. Results of work in 1981 will be published in the form of reports and maps.

The general area of the project work is shown in figure 18.

Project Title: Eastern Arctic Coastal Plain (Arctic Environmental Studies Program)

Chief: Oscar J. Ferrians, Jr.

Objectives: To complete reconnaissance engineering geologic investigations that will provide baseline geotechnical data needed for land-use planning and engineering purposes. Planned fieldwork includes engineering geologic mapping at a scale of 1:125,000. Studies of permafrost conditions and geomorphic features and other permafrost-related geologic processes important to arctic engineering will be emphasized. Potential geotechnical problems that require special consideration include: slope stability, drainage conditions, frost action, thawing of permafrost, availability of natural construction materials, swelling soils, earthquake effects, erosion, flooding, and icings.

Status: The project has been recessed in FY 1981.

Project Title: Geology and Resource Potential of the Killik River and Chandler Lake (1:250,000) Quadrangles (AMRAP)

Chief: Charles G. Mull

Objectives: To assess potential oil, gas, and other mineral resources of the Federal lands in these quadrangles, which cover a significant part of the overthrust belt of the Central Brooks Range.

Status: Assessment of the resource potential of the Federal lands is mandated in Alaska National Interest Lands Conservation Act (Public Law 96-487), enacted on December 2, 1980. In the Killik River and Chandler Lake quadrangles, two seasons of fieldwork are planned. Fieldwork will include (1) geologic mapping at a scale of 1:63,360-scale to determine the structural style and distribution of potential hydrocarbon reservoir rocks on the thrust sheets of this part of the Brooks Range; (2) compilation of a geologic map at a scale of 1:250,000, incorporating the 1:63,360 mapping and existing mapping by other workers in the Cretaceous outcrop belt in the north part of the Devonian outcrop belt in the south part of the quadrangles; (3) sampling of shale outcrops for organic geochemical analysis to determine their potential as hydrocarbon source beds; and (4) stream-sediment and bedrock sampling for geochemical assessment of mineral potential in the area.

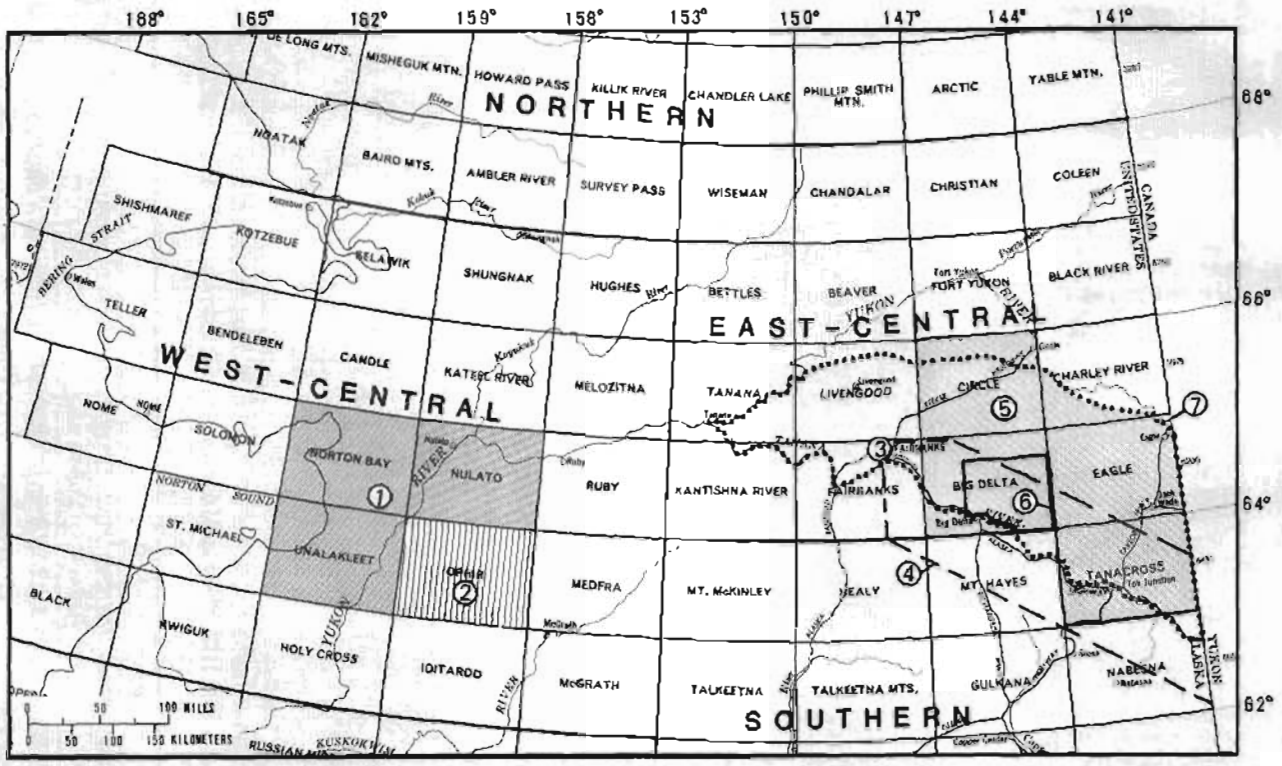
The quadrangle location is shown in figure 15.

WEST-CENTRAL REGION

Project Title: Geology and Resources of Norton Sound - Yukon Region

Chief: William W. Patton, Jr.

Objectives: To complete regional geologic framework investigations and selected detailed topical studies in order to provide basic data for appraising the mineral potential of the project area and the petroleum potential and environmental hazards of contiguous parts of Norton Sound. Project elements include: (1) completion of the regional (1,250,000-scale) geologic maps of Unalakleet, Norton Bay, and Nulato quadrangles; (2) petrologic study and geochemical sampling of the igneous and metamorphic terranes of the Unalakleet quadrangle and Kaiyuh Mountains; (3) paleoenvironmental and sedimentological studies of Cretaceous sediments at selected localities in the



EXPLANATION

1. Geology and Resources of Norton Sound-Yukon Region
2. Arctic Mineral Resources
3. College Observatory
4. Tanana Valley Transportation-Development Corridor
5. Yukon-Tanana Upland and Circle Quadrangle Studies
6. Petrographic Studies - Yukon-Tanana Upland
7. Glacial Geology of Yukon-Tanana Upland

Figure 19.--Geologic Division activities in west-central and east-central Alaska.

Norton Bay and Nulato quadrangles; and (4) examinations of Holocene features along the Kaltag fault and the Norton Sound coastline.

Status: Fieldwork is complete in the igneous and metamorphic terranes of the Kaiyuh Mountains and in the central part of the Unalakleet quadrangle. Compilation of geologic maps of the Nulato and Unalakleet quadrangles is underway. In 1981 fieldwork will focus on sedimentological studies of Cretaceous rocks at selected localities in the Norton Bay and Nulato quadrangles and on petrologic studies of Late Cretaceous and Tertiary volcanic assemblages in the eastern part of the Unalakleet quadrangle.

The project location is shown in figure 19.

Project Title: Arctic Mineral Resources (Ophir Quadrangle)

Chief: Robert M. Chapman

Objectives: To map, describe, and interpret the bedrock units, surficial deposits, and structural features in a large part of the Ruby province, and to make regional correlations and tectonic interpretations in order to provide an adequate geologic map and a base for mineral-resource and land-use evaluations of this region. Immediate objectives are (1) completion of field research and mapping in the Ophir quadrangle, and (2) research on problems pertinent to regional geologic interpretations that have been highlighted by previous work in the Tanana, Kantishna River, and Livengood quadrangles.

Status: Many results of the geologic studies prior to 1980 are presented in open-file geologic maps of the Tanana quadrangle and the west half of the Kantishna River quadrangle, and in eleven reports, some with geologic maps, on the Tanana, Kantishna River, and Ruby quadrangles that are published in Circulars 683, 700, 733, 751-B, 772-B, 804-B, and 823-B. This project's work has been coordinated with similar work in the adjacent Livengood, Beaver, Bettles, Melozitna, Nulato, and Medfra quadrangles. Compilation of 1:250,000-scale geologic maps of the Ruby and the Kantishna River-northern Mount McKinley quadrangles and minor revisions of the Tanana quadrangle are in progress. Mapping and sampling were begun in 1980 in the east half of the Ophir quadrangle, and a preliminary report on this work is complete. More research and mapping remain to be done to complete the Ophir quadrangle, and analyses of paleontologic and geochemical samples collected in 1980 are in progress. Several geologic problems and key areas, critical to regional interpretations and evaluation of mineral deposit potential in central Alaska, have been recognized as a result of work in the Ruby province during the past several years. Stratigraphic, paleontologic, geochemical, and radiometric-dating research in selected areas of the Tanana, Kantishna River, and Livengood quadrangles are proposed to gather additional data pertinent to solving these problems. Progress on this work and the completion of geologic studies in the Ophir quadrangle is dependent on the level of funding.

The project location is shown in figure 19.

Project Title: Bendeleben and Solomon Quadrangles (AMRAP)

Chief: Alison Till

Objectives: (1) To assess the mineral potential of the central Seward Peninsula by means of geologic mapping, geochemical sampling, and geophysical sampling, and geophysical reconnaissance; mapping and related studies on a scale of 1:250,000 will be supplemented by larger scale scruitiny of areas critical to understanding the mineralization, geologic relationships, and regional geologic history. (2) To decipher the metamorphic and tectonic history of the region in order to establish the basis for assessment. (3) To interpret data pertinent to regional correlation and tectonic interpretation in order to relate the geology and mineral potential of the Seward Peninsula to adjacent terranes in the Brooks Range and the Chukotsk Peninsula of Siberia.

Status: Project work starts in 1981. Detailed mapping of selected orthogneiss bodies and sampling for geochemical analyses and radiometric dating will be done. Results of these studies will provide an improved chronologic framework for the geologic history, which is essential to the project work. Geochemical reconnaissance of the Solomon quadrangle will be completed in 1981.

The project location is shown in figure 15.

Project Title: AMRAP Geochemistry, Solomon and Bendeleben Quadrangles, Seward Peninsula, West Central Alaska

Chief: Harley D. King

Objectives: To contribute to the mineral-resource assessment of the Solomon and Bendeleben quadrangles. Information and interpretation will be based on results of reconnaissance geochemical sampling of streams, with sample media consisting primarily of stream sediment and heavy-mineral concentrates of stream sediment. Resulting interpretive geochemical maps will aid in outlining both known and previously unknown mineralized areas of possible economic potential.

Status: Project fieldwork will commence during the summer of 1981.

The project location is shown in figure 15.

EAST-CENTRAL REGION

Project Title: College Observatory, Fairbanks

Chief: John B. Townshend

Objectives: To produce accurate and comprehensive data in the fields of geomagnetism and seismology and to cooperate with other scientists and organizations in making studies within the capabilities of the personnel and facilities.

Status: The College Observatory has been in continuous operation since January 1948 and under USGS authority since September 16, 1973. Its present functions include recording of all components of the Earth's magnetic field by means of various types of magnetographs, magnetometers, and other scientific instruments including: Normal Magnetograph (D, H, Z), Storm Magnetograph (D, H, Z), Rapid Run Magnetograph (D, H, Z), Digital and Analog Fluxgate Magnetometer (D, H, Z), and Digital and Analog Proton Magnetometer (F). The observatory also makes absolute and scale value observations that serve as baseline control for recording equipment and quality control for data. It operates the Barrow Observatory at the Naval Arctic Research Laboratory at Barrow and publishes a monthly "Preliminary Geomagnetic Data" Geological Survey open-file report for use by scientists in Europe, Canada, Japan, and the United States. The observatory also operates and maintains various types of seismographs for recording earth motion as follows: Short Period World Wide Standardized

Seismograph (N, E, V), Long Period World Wide Standardized Seismograph (N, E, V), and Benioff Moving Coil Seismograph. It analyzes records and makes investigations and studies associated with geomagnetism and seismology; performs experimental work on improvement and development of magnetic and seismic instrumentation; cooperates with and provides assistance to other scientists and organizations in making studies and observations; provides information and data to the public concerning Alaska earthquakes and geomagnetic events; and operates a local climatological station in cooperation with the National Weather Service.

The project location is shown in figure 19.

Project Title: Tanana Valley Transportation-Development Corridor: Fairbanks to the Canadian Border (Arctic Environmental Studies Program)

Chief: L. David Carter

Objectives: To compile a map showing the distribution of unconsolidated surficial deposits in the transportation-development corridor that extends southeastward up the Tanana River valley from Fairbanks to the Canadian border. Tables accompanying the map will include a description of lithology, topography, and geologic hazards in terms of the map units. Fieldwork includes geologic mapping at a scale of 1:125,000 in parts of Fairbanks, Big Delta, Mount Hayes, Tanacross, and Nabesna quadrangles.

Status: Existing geologic mapping has been compiled at a scale of 1:125,000. Field checking and additional geologic mapping were undertaken in 1976-78. A strip map of the surficial deposits along the proposed route of the Alcan (Alaska Highway) gas pipeline was published as Open-File Report 78-794, and a map of the surficial deposits of the project area is in preparation.

The project location is shown in figure 19.

Project Title: Yukon-Tanana Upland and Circle Quadrangle (AMRAP)

Chief: Helen L. Foster

Objectives: To carry on geologic reconnaissance mapping of the complex metamorphic and igneous terrane of the Yukon-Tanana Upland primarily at a scale of 1:250,000, and to decipher and interpret the geologic history of the area and relate it to the structural history of Alaska and Canada. This information, along with geophysical, geochemical, and other data collected, will be used in evaluating the area's mineral-resource potential. Major geologic problems of the area will be identified and worked on as time and funding permit. Areas of special interest will be mapped at a scale of 1:63,360.

Status: Reconnaissance geologic maps (1:250,000-scale) have been published for the Tanacross (1970), Eagle (1976), and Big Delta (1978) quadrangles of the Yukon-Tanana Upland, and geochemical and mineral-resource information has been made available for these quadrangles. Reconnaissance geologic mapping of the Circle quadrangle, the last unmapped quadrangle in the study area, is about 70 percent complete. Mapping in the Circle quadrangle is largely funded under AMRAP and includes geochemical sampling, geophysical interpretation, examination of Landsat imagery, and mineral-resource evaluation. Radiometric dating of both igneous and metamorphic rocks by potassium-argon and lead-uranium methods is being used as much as possible. Planned fieldwork for geophysical interpretation is about 90 percent completed. Study of the petrology of the metamorphic rocks is underway.

The project quadrangles are shown in figure 19.

Project Title: AMRAP Geochemistry, Circle Quadrangle

Chief: Richard B. Tripp

Objectives: To outline areas of known and previously unreported mineral occurrences in the Circle quadrangle by the use of reconnaissance geochemistry and interpretation of geochemical data pertaining to these areas to aid in the determination of possible economic potential. The geochemical investigations, along with geologic and geophysical data, will be available for land-use planning, as well as for mineral-resource assessments for specific areas.

Status: Stream-sediment sample collection was completed in the 1980 field season. About 10 days of fieldwork is planned for 1981, when outcrops along the roads in the western part of the quadrangle will be examined. Publication of results of the geochemical studies will be coordinated with those of the geologic studies of the quadrangle being conducted by Helen Foster.

The quadrangle location is shown in figure 19.

Project Title: Petrographic Studies--Yukon-Tanana Upland

Chief: Cynthia Dusel-Bacon

Objectives: To obtain information about the origin, age, and metamorphic history of selected rock types in the crystalline terrane of the Yukon-Tanana Upland. Mineral paragenesis, metamorphic and relict textures, mineral and bulk chemistry, isotopic data, and field relations will be used to formulate conclusions about the geologic history of these rocks. Studies of a large body of augen gneiss and a sillimanite gneiss

dome (both approximately 700 square kilometers) in the Big Delta quadrangle are underway.

Preliminary reconnaissance mapping on which these studies are based has been completed under AMRAP. Detailed petrography of the crystalline rocks of the Big Delta quadrangle was completed in March 1980. A manuscript describing the results of the sillimanite gneiss dome study (primarily petrography and garnet-biotite geothermometry) is in final draft form and is scheduled to be published as part of a Professional Paper on studies of metamorphic rocks in Alaska. Preliminary results of the augen gneiss study and related uranium-thorium-lead (U-Th-Pb) geochronologic investigations of zircons from the augen gneiss and related rocks have been published. Isotopic and geochemical study of the augen gneiss body is continuing. Several days were spent during June 1979 and 1980 collecting samples of augen gneiss and related rocks for rubidium-strontium (Rb/Sr) and U-Th-Pb dating and geochemical analysis. Additional field checking (planned for June 1981), interpretation of geochemical data, and pending Rb/Sr dating are necessary before final interpretation of the age and tectonic history of the augen gneiss can be made.

The project location is shown in figure 19.

Project Title: Glacial Geology of the Yukon-Tanana Upland (Geologic Framework and Synthesis Program)

Chief: Florence R. Weber

Objectives: To obtain information in order to compile: (1) a map of glacial deposits of the Yukon-Tanana Upland; (2) correlated stratigraphic sections of the glacial deposits; and, (3) interpretations of glacial history of the upland as it relates to glacial deposits in the Brooks and Alaska Ranges. An understanding of the glacial history bears on the origin of gold placer deposits and the development of cropland or transportation corridors.

Status: Photogeologic assessment has been partly completed for the Eagle, Big Delta, Circle and Livengood quadrangles, and many locations have been field checked. A paper on a Pleistocene vertebrate fossil site is in review. Samples are being analyzed by carbon-14 techniques.

The project location is shown in figure 19.

Project Title: Wiseman Quadrangle (AMRAP)

Chief: William P. Brosgé

Objectives: To conduct reconnaissance geologic mapping for a mineral-resource assessment of the Wiseman quadrangle. The project is in informal cooperation with the Alaska Division of Geological and Geophysical Surveys (DGGS) and will draw upon previous geologic and geochemical studies made in the area by the DGGS and the Geological Survey and upon continuing geochemical investigations directed by John B. Cathrall. (See the project description below.)

Status: The 1981 field season will be the first for this project. Results of previous geologic mapping and geochemical sampling of the State land in the southern part of the quadrangle by the DGGS are ready for publication. An aeromagnetic survey was completed in 1978 and is available from DGGS.

The quadrangle location is shown in figure 15.

Project Title: Mineral Resources of the Wiseman Quadrangle, Brooks Range, Alaska

Chief: John B. Cathrall

Objectives: To assess and appraise the mineral-resource potential of the Wiseman (1:250,000-scale) quadrangle. To accomplish this, drainage systems, geologic rock units, fault zones, altered zones, altered and/or mineralized zones, and favorable host rock will be sampled, and the geochemical results will be used in geostatistical programs and integrated with the results of the studies of geologic and geochemical and economic geologic environments of the area, as well as Landsat imagery. Maps will be prepared and interpreted, and the integrated conclusions will be prepared for publication as a series of maps and short reports.

Status: Project fieldwork will commence during the summer of 1981.

The quadrangle location is shown in figure 15.

SOUTHERN REGION

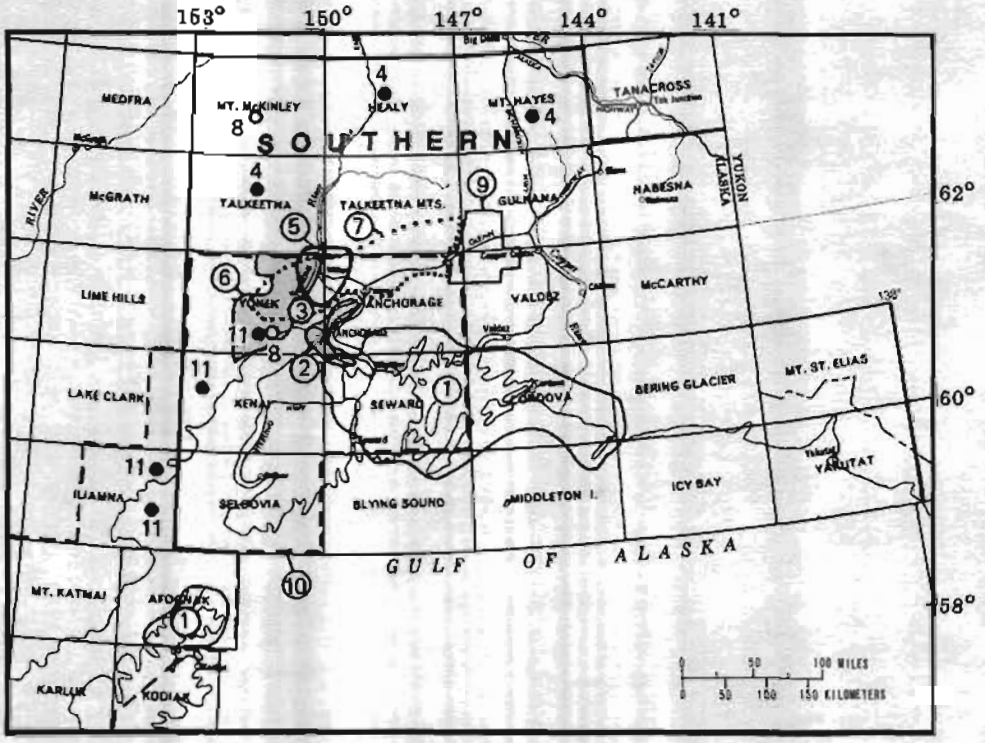
Project Title: Chugach National Forest Wilderness Study (RARE II)

Chief: Steven W. Nelson

Objectives: (1) To complete a multidisciplinary mineral appraisal of land in the Chugach National Forest that has been allocated for further planning under RARE II, and (2) to integrate detailed and reconnaissance geologic field mapping with regional and topical investigations of geochemistry, geophysics, economic geology, and mineral economics to produce a mineral-resource assessment of the study area.

Status: Reconnaissance geologic mapping was started in FY 80 and is about 30 percent com-

The Geologic Division has office space in the O'Neill Building on the Fairbanks campus of the University of Alaska.



EXPLANATION

1. Chugach National Forest (RARE II)
2. Alaska Coastal Environments, Turnagain and Knik Arms
3. Element Availability, Plants and Soils
4. Alaska Range Coal Resources
5. Earthquake Hazards Mapping
6. Regional Engineering Geology of Cook Inlet Coal Lands
7. Cook Inlet-Nelchina Stratigraphic Studies
8. Geochemical Composition, Sources and Transport of Atmospheric Dusts
9. Southwestern Copper River Basin Surficial Geology Studies
10. Petroleum Geology, Cook Inlet-Shelikof Strait (See fig. 23.)
11. Volcanic Hazards of Cook Inlet

Figure 20.- Geologic Division activities in southern Alaska.

plete. Geochemical sampling is about 40 percent complete. A 2,500-meter-thick section of interbedded volcanic and sedimentary rocks was measured on Hinchinbrook Island. Microfossil collections from five new areas within the study area may yield information on age and paleoenvironment.

The project location is shown in figure 20.

Project Title: Alaska Coastal Environments

Chief: Susan Bartsch-Winkler

Objectives: To provide needed baseline information on the sediment characteristics in the intertidal zones surrounding Anchorage. The upper Cook Inlet region, which incorporates the Anchorage and Matanuska-Susitna Boroughs, is currently being subjected to rapid industrial and population growth. This growth will impact the surrounding intertidal areas.

Status: Initial and ongoing tidal studies of Turnagain and Knik Arms and reporting on results will continue. Existing reports describe textural units, source of intertidal sediments, and effects of the 1964 Alaska earthquake on sedi-

ments of upper Turnagain Arm east of Bird Point, as well as detailed studies at Girdwood and Portage. In 1980, a textural study of Knik Arm was completed. In 1981, a textural study of lower Turnagain Arm will be made, including an examination of engineering characteristics and a facies analysis of the sediments.

The project location is shown in figure 20.

Project Title: Element Availability - Plants; Element Availability - Soils

Chiefs: Larry P. Gough (Plants) and Ronald C. Severson (Soils)

Objectives: To establish principles for predicting element concentrations in plants from the element concentrations of extracts of native and disturbed soils. The Capps Creek coal field is one of several areas covered by the cooperative efforts of these two projects. For this study area, background geochemical information on native plants and soils will be obtained prior to mining in order to provide geochemical data on the natural, undisturbed landscape. These data will be used as geochemical base lines against which changes reflecting surface mining (and the activities associated with coal extraction in general) can be compared. Information about the natural landscape will also be beneficial to those concerned with the rehabilitation potential of native soils and plants.

Status: The study area consists of sections 22, 23, 26, and 27 of T. 14 N and R. 14 W in the Tyonek B-5 quadrangle, where the first four proposed mining sites are located. Nine study sites were randomly selected within each section according to an analysis-of-variance study design. At each site channel samples of the soil most likely to be used in land rehabilitation were taken, along with specimens of diamondleaf willow (*Salix pulchra*) and bluejoint grass (*Calamogrostis canadensis*). The study design will allow us to map the concentration of elements in the materials sampled. Because the design is balanced through the 0.25-kilometer level, maps of individual elements in samples on a 250-meter grid may be possible. Future alterations in landscape geochemistry can, therefore, be relatively easily monitored. About half of the randomly located 108 sites have been sampled. An additional field season will be necessary to finish the work.

The project location is shown in figure 20.

Project Title: Alaska Range Coal Resources

Chief: Clyde Wahrhaftig

Objectives: (1) To evaluate late Cenozoic continental formations in and on the flanks of the Alaska Range, specificially the Nenana coal area in the Healy quadrangle, the Jarvis Creek coal area in the Mount Hayes quadrangle, and the Peters Hills field west of Talkeetna. (2) To study the Cenozoic history of the central Alaska Range.

Status: The project is inactive in FY 1981. Three reports are in preparation. The topics are as follows: Geology of the coal deposits in the Nenana coal field, the illustrations for which have been released as Open-File Report 73-355; a late Cenozoic orogeny in the Alaska Range and the history of the Nenana Gravel; and badland erosion in the Alaska Range, such as near Suntrana and on Lignite Creek, and its role in the denudation of basins in the Alaska Range.

The project location is shown in figure 20.

Project Title: Earthquake Hazards Mapping, Anchorage-Susitna Lowlands

Chief: Oscar J. Ferrians, Jr.

Objectives: To complete mapping of earthquake hazards in the region, with emphasis on assessing the response of surficial materials to earthquakes. The Anchorage-Susitna Lowlands, which is in an extremely active seismic zone, will experience the greatest development and population growth of any region in Alaska. As a means of providing the information needed for planning and development, an investigation of this earthquake-prone region is being undertaken to obtain the critical data necessary for indentification and evaluation of earthquake hazards.

Status: Surficial/engineering geologic mapping of the area, which includes all of Anchorage A-8, B-8, and C-8, Tyonek A-1, B-1, and C-1 quadrangles, has been completed. Work continues on subsurface engineering soils, active faults, slope mapping, seismicity, ground response, and other earthquake hazard-related studies.

The project location is shown in figure 20.

Project Title: Regional Engineering Geology of Cook Inlet Coal Lands

Chiefs: Henry R. Schmoll and Lynn A. Yehle

Objectives: To investigate the nature, location, and extent of general environmental concerns and potential problems caused by response of geologic materials (surficial deposits and bedrock) to surface and underground coal mining, facility siting, and accompanying land utilization for associated development (including transportation routes and urban development) within the Cook Inlet region.

Status: To date, most effort has been devoted to a study of the Capps Glacier-Tyonek area about

100 kilometers west of Anchorage, where an ethanol conversion plant and strip mining of coal are anticipated within the next several years. Field investigations, comprising helicopter, fixed-wing aircraft, land vehicle, and foot traverses, are presently in progress within the area of about five 1:63,360-scale quadrangles and will continue into adjacent quadrangles covering potential transportation corridors. Maps of surficial geology are compiled chiefly from aerial photographs and checked in the field. Physical properties of Tertiary sedimentary rocks and Quaternary surficial deposits are being determined in the laboratory from samples collected from outcrops and from a 1979 test hole drilled to a depth of 120 meters in the proposed Capps Creek coal field area. Data from this work are contained in Open-File Report 80-393. A stratigraphically deeper test hole of 65 meters was drilled in 1980, and further work in the Chuitna West coal field area and to the southeast is being considered for 1981.

The project location is shown in figure 20.

Project Title: Nelchina Area Stratigraphic Studies

Chief: Arthur Grantz

Objectives: To study the structure and stratigraphy of the Mesozoic and Tertiary rocks of the Nelchina area and prepare a geologic map at a scale of 1:63,360. To study the stratigraphy, structure, and tectonic development of the Nelchina area and Matanuska Valley and vicinity, south-central Alaska.

Status: Geologic mapping for the Nelchina area is complete, and preliminary geologic maps have been published. Final geologic maps are in preparation. Field stratigraphic studies of the bedded rocks and potassium-argon dating of the igneous rocks of the Nelchina area and Matanuska Valley and vicinity are underway. A report on the Arkose Ridge Formation is in preparation.

The project location is shown in figure 20.

Project Title: Geochemical Composition, Sources, and Transport of Atmospheric Dusts

Chief: Todd Hinkley

Objectives: To measure the amounts and determine the geochemical nature and sources of dusts that are transported by the atmosphere and preserved in the annual strata of glaciers. This study will provide information on the geographic patterns and temporal changes in movements of earth materials by the atmosphere. Sampling covers parts of Alaska, Colorado, Montana, California, Norway, Greenland, and Antarctica.

The ratios of major, minor, and trace metals in snow will allow the identification of specific rock and mineral components, and possibly regional sources, of dust. The study will provide geologically oriented data as a standard for judging the amounts, types, and pathways of industrial-source material in the atmosphere. The study complements others that have emphasized single elements or molecules. The study requires special collection techniques to avoid contaminating the ice, which contains only very small amounts of dust and atmospheric impurities. Stable isotope dilution mass spectrometry is used to determine the natural and pollutant metals present in the ice and snow. Results of this study may provide data for future monitoring of climatic change and are relevant to the Survey's Climate Program.

Status: Two samples were collected in Alaska by colleagues in 1980, but analytical data for these and other samples from the State are still incomplete. Some Alaska data have been reported in Open-File Report 78-701 and in the volume of abstracts for the 1978 Toronto, Canada, meeting of the Geological Society of America. Work elsewhere continues, and the results will complement what has been learned in Alaska. Co-workers in Bern, Switzerland, in Warsaw, Poland, and at the State University of New York at Buffalo are collaborating with sampling. Analytical cooperation is being provided by Virginia Polytechnic Institute and other branches of the Survey.

Areas of project emphasis are shown in figure 20.

Project Title: Southwestern Copper River Basin (Surficial Deposits) (Arctic Environmental Studies Program)

Chief: John R. Williams

Objectives: To provide a map at a scale of 1:125,000 of the surficial deposits of the Copper River basin and bordering parts of the Talkeetna and Chugach Mountains between the Matanuska Glacier at Mile 100, Glenn Highway, and Tolsona Creek at Mile 170, northward to the latitude of the north end of Susitna Lake. Discussions of the glacial history, relation between late Wisconsinan glaciation and glacial lakes, and radiocarbon dating of the deposits will be included or prepared as separate reports.

Status: The project was begun with fieldwork in 1952-57 in cooperation with the Office of the Chief of Engineers, U.S. Army, and has resulted in reports of special interest to the cooperator. It was continued in 1978-80 as part of the AMRAP and Arctic Environmental Studies Program with work in the Valdez quadrangle, in the Talkeetna Mountains, and adjacent parts of the basin. The final map report, at a scale of 1:125,000, is approximately 30 percent complete, and office work will continue in 1981.

The project location is shown in figure 20.

Project Title: Petroleum Geology, Cook Inlet-Shelikof Strait

Chief: Leslie B. Magoon

Objectives: (1) To study and report on the Tertiary and Upper Mesozoic reservoir rocks penetrated in the lower Cook Inlet COST well 1, and (2) to study and report on key stratigraphic sections adjacent to the Shelikof Strait from Puale Bay to Kamishak Bay. The long-range objective is to provide data and interpretations necessary to assess the oil and gas source and reservoir potential of possible hydrocarbon sources and reservoir horizons in the Cook Inlet-Shelikof Strait area.

Status: During FY 1981 a report on the geology of the Cape Douglas-Kamishak Bay area is being prepared, and geologic mapping will continue. A report on the COST well will be completed this year, as will petrographic analyses of sandstones from the Alaska Peninsula. A pre-Tertiary subcrop map and a present-day geothermal gradient map are in preparation. Plans call for shooting common depth point seismic lines in the Cook Inlet-Shelikof Strait area this summer.

The project location is shown in figures 20 and 23.

Project Title: Volcanic Hazards of Cook Inlet (Volcanic Hazards Program)

Chief: Alison B. Till

Objectives: To determine the eruptive history of the four historically active volcanoes of Cook Inlet (Augustine, Iliamna, Redoubt, Spurr) and evaluate the hazards to life that eruptions would produce. Mapping, geochemistry, and geochronology will be used to establish the volcanoes' past; hazard assessments will be based on this information.

Status: A geologic map of the stratovolcano cone on Mt. Redoubt at a scale of 1:63,360 was 75 percent complete in 1980; petrographic and geochemical studies are underway. Mapping of the cone will be completed in 1981, and mapping of mudflows and flood deposits in the Crescent and Drift River drainages will be undertaken. Reconnaissance of Mt. Spurr will begin in 1981.

The project location is shown in figure 20.

Project Title: Healy (AMRAP) Quadrangle

Chief: Béla Csejtey, Jr.

Objectives: To assess the mineral potential of the Healy quadrangle through reconnaissance geologic, geochemical, and geophysical investigations, and to collect basic geologic data to help decipher the complex tectonic and igneous history of southern Alaska.

Status: The geology of approximately the southern one-third of the quadrangle has been mapped in a reconnaissance fashion. Geochemical sampling of about one-half the quadrangle has been completed. Plans for 1981 call for the continuation of geologic and geochemical investigations.

The quadrangle location is shown in figure 15.

Project Title: AMRAP Geochemistry, Healy Quadrangle

Chief: Harley D. King

Objectives: To produce geochemical maps useful in the assessment of the mineral potential of the Healy quadrangle. The objectives are to be accomplished by reconnaissance geochemical sampling of stream sediments and heavy-mineral (panned) concentrates of stream sediments. The geochemical maps will show the distribution and concentration of selected metallic elements in the sample media.

Status: More than half the geochemical sampling has been completed, and the fieldwork will be finished in 1981. Publication of results will be coordinated with those of geologic studies directed by Bela Csejtey, Jr.

The quadrangle location is shown in figure 15.

Project Title: Mount Hayes Quadrangle (AMRAP)

Chief: Warren J. Nokleberg

Objectives: To conduct reconnaissance and detailed geologic mapping and geochemical and geophysical surveys to provide data for a mineral-resource assessment of the Mount Hayes quadrangle. Fieldwork includes: (1) geologic mapping at scales of 1:250,000 to 1:1,200; (2) detailed studies and sampling of mineralized areas; (3) isotopic studies of bedrock and mineralized rocks; (4) interpretation of aeromagnetic surveys; (5) mapping and sampling of placer deposits; and (6) studies of surficial deposits.

Status: A 35-day field season is planned for 1981 with a team of 7 to 12 people. Fieldwork will concentrate on the northeastern and east-central parts of the quadrangle. Geologic mapping and bedrock sampling are almost complete in the southern and northwestern parts of the quadrangle. Sampling of stream sediments and heavy-mineral concentrates is complete for the entire quadrangle.

The quadrangle location is shown in figure 15.

Project Title: AMRAP Geochemistry, Mount Hayes Quadrangle

Chief: Richard B. Tripp

Objectives: To outline areas of known mineral occurrences and areas of previously undiscovered mineral occurrences in the Mount Hayes quadrangle by the use of geochemical maps and related data. Other objectives are to: (1) aid in the determination of the type and size of specific mineralized systems by defining the primary and secondary geochemical dispersion halos of these systems, (2) continue studies of the usefulness of various sample media for geochemical exploration in mountainous arctic terrains, and (3) provide geochemical data for mineral-resource assessments and land-use decisions.

Status: Stream-sediment collection was completed in 1980. The project chief plans to spend a few days in the quadrangle as part of his activities for AMRAP in 1981. Publication of results of this work will be coordinated with reports on geology of the quadrangle by Warren Nokelberg.

The quadrangle location is shown in figure 15.

Project Title: Valdez (AMRAP) Quadrangle

Chief: Gary R. Winkler

Objectives: (1) To evaluate the mineral resources of the Valdez 1° x 3° quadrangle through integrated geologic, geochemical, geophysical, radiometric, and telegeologic investigations; (2) to collect and integrate detailed structural, stratigraphic, and potassium-argon radiometric data from geologically disparate terranes near the Border Ranges fault system; and (3) to initiate detailed geologic and radiometric studies of the Port Valdez gold district.

Status: Fieldwork is complete, and more than a dozen components of an AMRAP folio are in preparation for release in late 1980 and early 1981. A preliminary aeromagnetic map of most of the quadrangle was released as Open-File Report 79-381, and brief topical reports on newly discovered belts of layered gabbro and blue amphibole-bearing schistose rocks in the northern Chugach Mountains are presented in Circular 823-B. Studies of the Port Valdez gold district are continuing as an adjunct to the Chugach RARE II project.

The quadrangle location is shown in figure 15.

Project Title: Valdez (AMRAP) 1:250,000-scale Quadrangle (Surficial Deposits)

Chiefs: Gary R. Winkler and John R. Williams

Objectives: (1) To prepare a map of the glacial, fluvial, and glaciolacustrine deposits of the Valdez quadrangle at a scale of 1:250,000 and a description of map units that can be used in developing the mineral resources (including sand and gravel) of the quadrangle, and (2) to prepare a map of the glacial and glaciolacustrine deposits that, with pertinent radiocarbon dates, will describe the glacial history of the quadrangle.

Status: Fieldwork was completed in 1979. The surficial deposits map (Open-File Report 80-892-C) is in press, and the map of glacial deposits and radiocarbon dates is about 80 percent complete. No other report's are planned.

The quadrangle location is shown in figure 15.

Project Title: Anchorage Quadrangle (AMRAP)

Chief: Gary R. Winkler

Objectives: To assess the mineral potential of the Anchorage quadrangle through integration of existing information and through new reconnaissance and detailed geologic, geochemical, geophysical, and geochronological investigations.

Status: Although this is a new project, considerable published and unpublished geologic information has been generated through previous Federal, State, and academic studies in parts of the quadrangle. Two 30-day field seasons are planned for the summers of 1981 and 1982 in order to complete field investigations for the entire quadrangle.

The quadrangle location is shown in figure 15.

Project Title: Geochemical Studies for the Petersburg and Anchorage AMRAP Quadrangles and Chugach (RARE II) Project .

Chief: James G. Hoffman

Objectives: To provide geochemical analyses and support for the Petersburg, Anchorage AMRAP, and wilderness-area studies.

Status: Sampling and analysis in support of the AMRAP Anchorage quadrangle project will get underway in 1981. This work is also being done in conjunction with the RARE II study of the Chugach area immediately to the east. Geochemical studies are in their second year for this wilderness area. Fieldwork planned for 1981 in the Petersburg area is expected to be the last in the 5 years of geochemical sampling and analytical work for this project. Analyses of all samples should be completed in FY 1982. (See D. A. Brew, Petersburg 1:250,000-scale quadrangle project, southeastern region.)

The areas in which project work takes place are shown in figures 15 and 24.

Project Title: Alaska Seismic Studies

Chief: John C. Lahr

Objectives: To develop an understanding of the current tectonic processes that are generating earthquakes in Alaska in order to evaluate the hazards that pose a threat to the safety of present and future development. Of particular importance is the search for premonitory phenomena and physical conditions prior to moderate and large earthquakes.

Status: Seismic data are collected from a network of stations that extends from the western shore of Cook Inlet to Juneau and north to the Talkeetna Mountains. Coastal stations east of Kayak Island (in the Middleton Island quadrangle) are supported by the National Oceanic and Atmospheric Administration; additional instrument stations are being established in a cooperative study with the Corps of Engineers. Recent seismic activity has been recorded near Icy Bay and northwest of Anchorage. Study emphasis is being placed on the Yakataga seismic gap, where new strong-motion instruments have been installed. A new station at Juneau monitors the area between Yakutat and Sitka. Five reports are in preparation.

Seismic instrument locations are shown in figure 21.

Project Title: Earthquake Activity and Ground Shaking in and along the Eastern Gulf of Alaska

Chief: John C. Lahr

Objectives: To tabulate location, depth, and magnitude of earthquakes greater than magnitude 2.5 in the study area; (2) to document the nature of strong ground shaking associated with large earthquakes in an outer continental shelf area; (3) to prepare focal mechanism solutions; (4) to identify onshore and offshore faults capable of generating earthquakes; (5) to evaluate observed seismicity in cooperation with other researchers as input to analyses of seismic risk; and (6) to compile and evaluate frequency-versus-magnitude relations for seismic activity in and near the study area.

Status: This project is in its first year. Data from 27 stations between Prince William Sound and Juneau are being used to monitor seismic activity, although not all will be involved in this project because funding is reduced. Selected seismic events will be analyzed. The project personnel will obtain improved relative location data by using a master-event technique to relocate hypocenters. Seismic velocity structure of the region will also be studied.

Instrument sites are shown in figure 21.

Project Title: Seismicity and Earthquake Source Properties in the Yakataga Seismic Gap

Chief: Robert A. Page

Objectives: (1) To construct a reliable earthquake history of the study area; (2) to refine the seismotectonic model and define the rupture surface(s) for a gap-filling earthquake; (3) to examine patterns of seismicity through time to reassess forecasts for a gap-filling earthquake; and (4) to search for changes in characteristics of the region that might aid in predicting seismic activity.

Status: The project is in its second year. Analysis of data continues, and reports may be ready in late 1982.

The project location is shown in figure 21.

Project Title: Tilt Operations in the Yakataga Seismic Gap

Chief: Carl E. Mortensen

Objectives: To monitor crustal deformation associated with strain accumulation prior to earthquakes in the Yakataga seismic gap.

Status: The project investigators continued to operate a tiltmeter array in Alaska that consists of doubly instrumented sites at Cape Yakataga, Yakutat, and Icy Bay. Data analysis continues.

The project area is shown in figure 21.

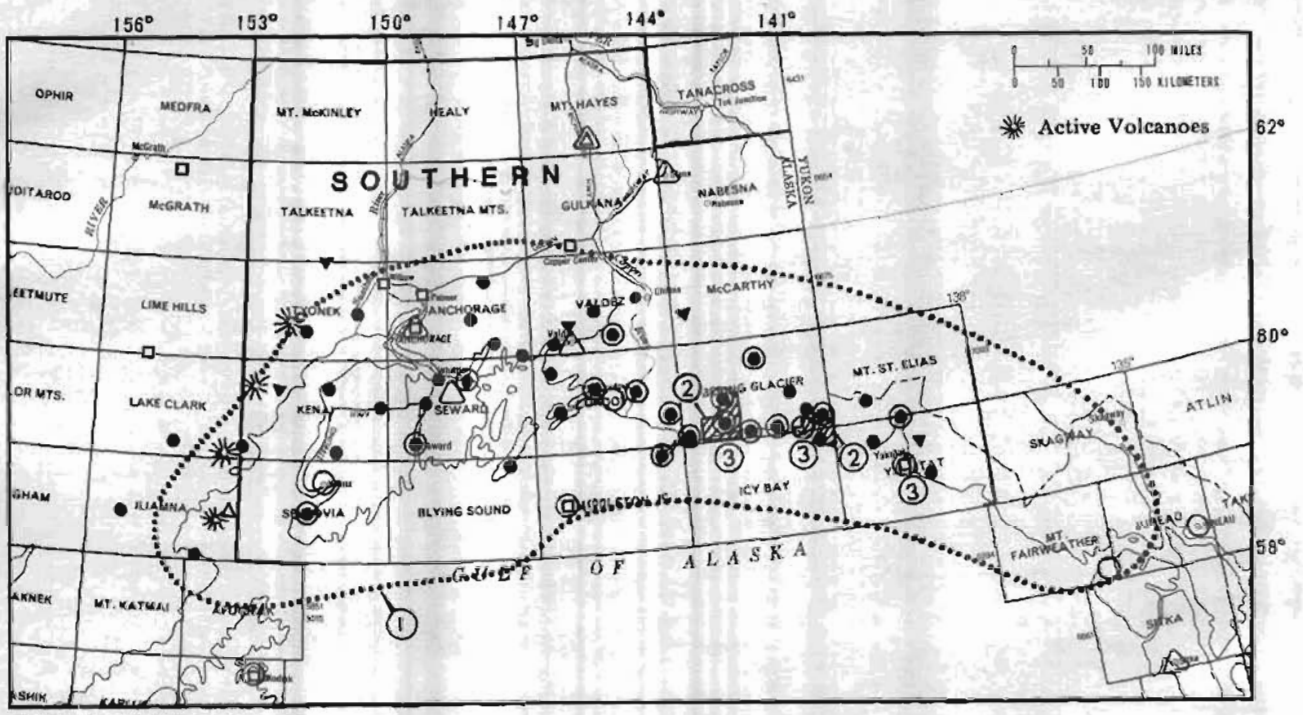
Project Title: Crustal Strain in the Yakataga and Shumagin Island Seismic Gaps

Chief: James C. Savage

Objectives: To measure strain accumulation in the Yakataga and Shumagin Islands seismic gaps.

Status: A survey in 1980 showed no significant strain accumulation in the Shumagin Island seismic gap since 1917. A geodolite network was established in the the Yakataga seismic gap. Comparison of 1959 and 1979-80 surveys indicates that the west edge of that network has been displaced several meters to the southeast relative to the east edge, possibly owing to effects of the 1964 earthquake. Two reports on Alaska data were published in 1979.

The project location is shown in figure 21.



EXPLANATION

1. Seismic Studies

Sensitive Seismographs
- ● USGS Vertical Component
- ▼ USGS 3 Component
- □ NOAA
- △ University of Alaska

Strong Motion Instruments
- ○ OCSEAP Support
- △ USGS Support

2. Tilt Operations
3. Crustal Strain Study

Figure 21.--Geologic Division earthquake and seismic studies in southern Alaska.

Project Title: Tectonic Tilt Measurements Using Lake Levels, Intermountain Seismic Belt and Southern Alaska

Chief: Spencer H. Wood

Objectives: To monitor tectonic tilt in areas that have a potential for large to moderate earthquakes.

Status: Water levels in Iliamna, Naknek, Kontrashibuna, Kenai, Skilak, Tustumena, Tazlina, Klutina, Eyak, and Bering Lakes in Alaska and Kluane Lake in Yukon Territory were measured in 1964, 1966, 1979, and 1980. Harlequin Lake in southeastern Alaska was added to the study in 1980. Results of the study indicate that records of lake levels will not easily detect small land surface tilt that develops over periods of several months to a year, but small tilt rates over several years may be resolved. Some downtilting to the southwest has been detected at Klutina and Kenai Lakes.

The project location is shown in figure 22.

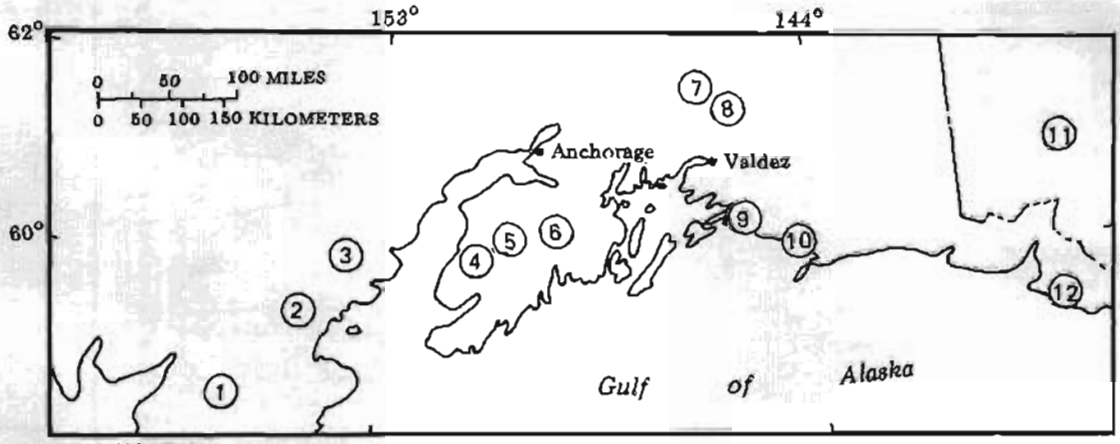
SOUTHWESTERN REGION

Project Title: Tikchik Lakes-Taylor Mountains Quadrangle Area

Chief: Joseph M. Hoare

Objectives: To complete the geologic mapping of the Taylor Mountains quadrangle (recessed in 1971) and to obtain geologic and paleomagnetic data useful in interpreting the geotectonic history of southwest Alaska.

Status: A paleomagnetic study was made on a few oriented cores obtained from Lower



EXPLANATION

1. Naknek Lake
2. Iliamna Lake
3. Kontrashibuna Lake
4. Tustumena Lake
5. Skilak Lake
6. Kenai Lake
7. Tazlina Lake
8. Klutina Lake
9. Eyak Lake
10. Bering Lake
11. Kluane Lake
12. Harlequin Lake

Figure 22.--Large lakes in southern Alaska and Yukon Territory used to monitor tectonic tilt.

Cretaceous rocks in the Tikchik Lakes area in 1979, and a pilot study was done on unoriented Jurassic specimens from the lower Yukon River. Boat traverses were made on the Kuskokwim and Yukon Rivers to study the depositional environment of the rocks; 226 oriented cores from three (two Cretaceous and one Jurassic) geologic sections were obtained for paleomagnetic study. Analysis of the cores is pending.

Completion of mapping in the Taylor Mountains quadrangle will require 40-60 days of helicopter-assisted fieldwork. To develop a sound geotectonic model for southwest Alaska requires a continuation of paleomagnetic studies and geologic studies in several critical areas.

The project location is shown in figure 23.

Project Title: Mineral Resource Assessment of the Ugashik-Karluk Quadrangles (AMRAP)

Chief: Robert L. Detterman

Objectives: To appraise the mineral and energy potential of the northern part of the Alaska Peninsula, and to provide reliable geologic estimates of these resources based on geologic, geochemical, geophysical, and telegeologic mapping. These include mapping the entire area at a scale of 1:250,000 and selected and critical areas at a scale of 1:63,360; obtaining stream-sediment and pan-concentrate samples from all major streams; age determination of mineralized and altered areas by potassium-argon methods to determine the age of mineralization; a regional aeromagnetic and gravity study; and a geothermal study of the Quaternary volcanic centers.

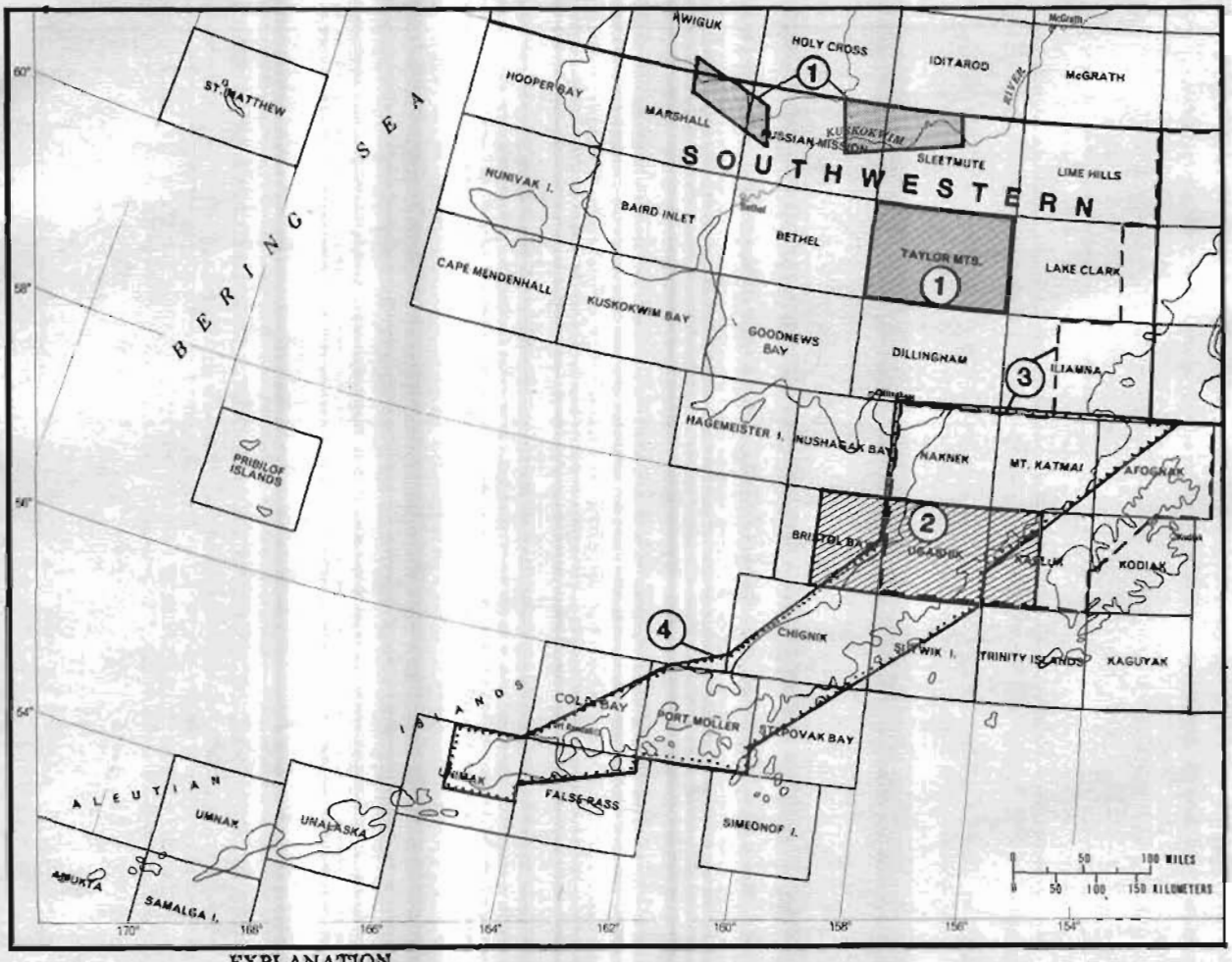
Status: Field investigations were started in 1979, continued on a limited scale in 1980, and will be completed in 1981. The geologic mapping is about 70 percent complete, and the geochemical sampling is complete. An aeromagnetic survey of part of the area was completed in 1980. Project results to date include finding: several areas of anomalous gold, silver, lead, zinc, and molybdenum mineralization by geochemical sampling; a previously unknown late Quaternary volcano; and Early Cretaceous (Albian) clastic rocks and Silurian and Devonian carbonate rocks on the northern Alaska Peninsula.

The project quadrangles are shown in figure 23.

Project Title: AMRAP Geochemistry, Bristol Bay, Ugashik, and Karluk Quadrangles

Chief: David E. Detra

Objectives: To aid in the assessment of the mineral potential in the Bristol Bay, Ugashik, and Karluk quadrangles though the interpretation of analytical results from a variety of geochemical sample media collected on a regional scale. Resulting interpretive maps and associated data from the geochemical reconnaissance sampling program will aid in the delineation of both known and previously undiscovered mineralized areas of possible economic potential and will provide a



EXPLANATION

1. Tikchik Lakes - Taylor Mountains Quadrangle Area
2. Mineral Resource Assessment of Ugashik and Karluk Quadrangles
3. Petroleum Geology, Cook Inlet-Shelikof Strait (See fig. 20.)
4. Geological and Remote Sensing Evaluation of SLAR Imagery (See fig. 18.)

Figure 23.--Geologic Division activities in southwestern Alaska.

useful basis for land-status decisions to be made by other agencies.

Status: The fieldwork and analyses are now complete. Project efforts in FY 1981 will be concentrated on completing Miscellaneous Field Study (MF) maps displaying geochemical information for these quadrangles. Publication of the maps will be coordinated with those that describe the geology. (See R. L. Detterman's project, these quadrangles.)

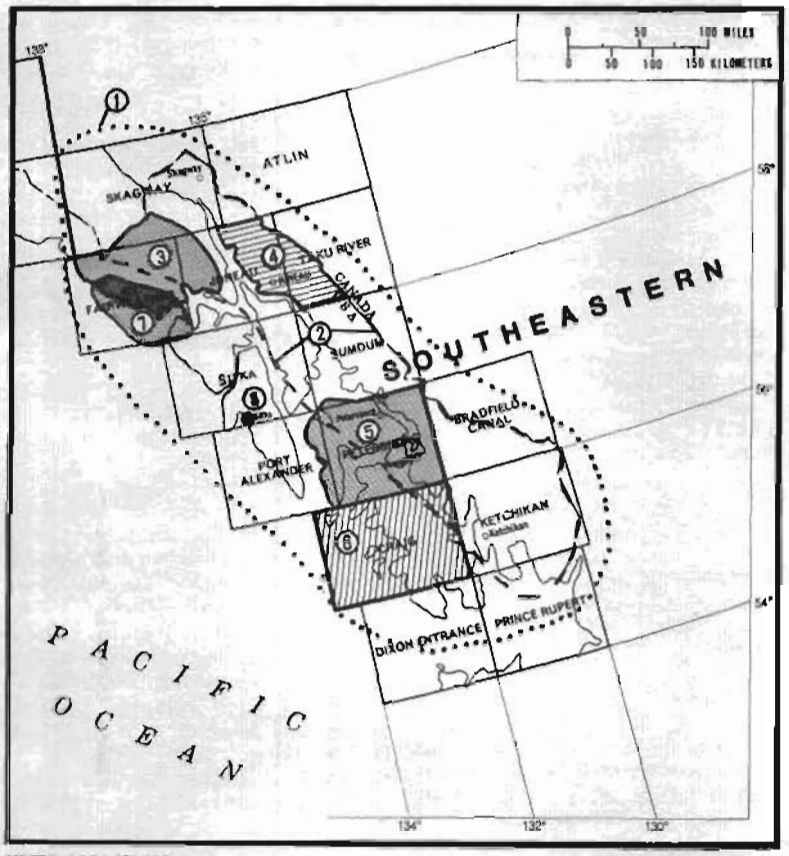
The project quadrangles are shown in figure 23.

SOUTHEASTERN REGION

Project Title: Geotectonics, Metallogenesis, and Resource Appraisal of Southeastern Alaska

Chief: Henry C. Berg

Objectives: To furnish information on southeastern Alaska's regional mineral endowment and to provide reliable geologic estimates of its undiscovered mineral resources. The project is a multidisciplinary mineral resource assessment of the southeastern panhandle that will integrate



EXPLANATION

1. Geotectonics, Metallogenesis, and Resource Appraisal of Southeastern Alaska
2. Geochronology of Southeastern Alaska
3. Mineral Resources of Glacier Bay National Monument Wilderness Study Area
4. Juneau, Alaska, Geologic Mapping and Related Investigations
5. Mineral Resources and Geology of the Petersburg Quadrangle
6. Craig Quadrangle
7. La Perouse and Related Mafic Intrusions
8. Sitka Observatory

Figure 24. -- Geologic Division activities in southeastern Alaska.

geology, geotectonics, geophysics, geochemistry, and economic geology. A new metallogenic province map incorporating current concepts of tectonostratigraphic (accreted) terranes will delineate areas that are geologically favorable for the occurrence of specific types of mineral deposits, will list the criteria used to establish these areas, and, when data permit, will include probabilistic numerical estimates of undiscovered deposits of specific types and of their contained tonnages and grades. The assessment will be published as a folio of 1:1,000,000-scale maps and accompanying tables.

Status: This project started October 1, 1979. During the past fiscal year, investigations and results included: (1) compiling of 1:1,000,000-scale maps of the study area portraying geology, mineral occurrences (with tables), and aeromagnetic profiles; (2) publishing a preliminary aeromagnetic contour map of southeastern Alaska (Open-File Report 79-1694); (3) publishing a description of Upper Triassic massive sulfide deposits near Petersburg (Open-File Report 80-527 and an article in Circular 823-B); (4) publishing a map and table describing mineral deposits in the Petersburg and eastern Port Alexander quadrangles (Open-File Report 80-793); and (5) mapping and sampling selected types of mineral deposits and analyzing their tectonostratigraphic settings.

In addition, the following findings of economic interest have resulted from studies of mines and prospects in selected tectonostratigraphic terranes in southeastern Alaska: (1) discovery of hitherto

unknown stratiform, massive zinc(-lead) sulfide deposits on Zarembo and Kupreanof Islands (Admiralty terrane); (2) discovery of Late Triassic fossils in the stratiform, massive zinc sulfide deposit on Kupreanof Island; (3) discovery of Late Triassic fossils in metamorphic strata, previously considered to be Paleozoic, hosting a barite deposit now being mined at Duncan Canal; and (4) preliminary identification of a 300-kilometer-long Triassic metallogenic province in the study area containing volcanogenic massive zinc, lead, silver, copper, and gold deposits in metamorphosed Upper Triassic strata. This newly recognized province appears to be restricted to the Admiralty and Annette tectonostratigraphic terranes and is the first metallogenic province to be identified in southeastern Alaska by integrating mineral deposit data, biostratigraphy, and regional tectonstratigraphic concepts.

The project location is shown in figure 24.

Project Title: Geochronology of Southeastern Alaska

Chief: James G. Smith

Objectives: To use radiometric (potassium-argon) dating techniques to help decipher the geologic history of the Coast Plutonic Complex, and to assist in solving other geochronology problems through consultation and dating of minerals and rocks from Alaska.

Status: No more fieldwork is planned for this project. Nearly all the samples collected have been analyzed, and the data are being compiled on three 1:250,000-scale quadrangle maps. One of these maps is in press as part of the Ketchikan quadrangle folio in the open-file report series.

The project location is shown in figure 24.

Project Title: Mineral Resources of Glacier Bay National Monument Wilderness Study Area

Chief: David A. Brew

Objectives: To appraise the mineral-resource potential of a large area of complex geology just northwest of the Alexander Archipelago, using (1) reconnaissance geologic, geochemical, and detailed mineral-occurrence information gathered in the 1966 Geological Survey study of the monument (Professional Paper 632); (2) reconnaissance geologic mapping of previously unmapped areas; (3) reconnaissance bedrock geochemical sampling; (4) reconnaissance stream-sediment geochemical sampling of previously unsampled areas; (5) aeromagnetic surveying; (6) gravity surveying; and (7) detailed examination and sampling of selected known mineral occurrences and of areas containing anomalous concentrations of selected metallic elements. The appraisal is part of the National Park Service study of the suitability of the areas for inclusion in the National Wilderness Preservation System established by the Wilderness Act of 1964.

Status: The reconnaissance geologic mapping is not satisfactorily complete. A bulletin report is in review; a "detailed-reconnaissance" geologic map and a report on the intrusive rocks are in progress; and an analysis of the stream-sediment geochemistry of the southeastern part of the monument and contiguous areas is underway.

The project location is shown in figure 24.

Project Title: Juneau, Alaska, Geologic Mapping and Related Investigations

Chief: David A. Brew

Objectives: To conduct reconnaissance, as well as detailed, geologic and geochemical mapping and a mineral-resource appraisal of a broad transect across the Coast Plutonic Complex. The transect extends from metavolcanic and metaclastic rocks of a low-grade, intermediate-pressure and -temperature facies series on the southwest through higher grade schists, gneisses, and spatially associated metavolcanic and metaclastic rocks of a low-pressure, high-temperature facies series near the United States-Canada boundary. This information will provide the regional framework for the Juneau gold belt and for mineral occurrences near the international border.

Status: Geologic mapping at 1:63,360 or larger scale has been completed for all but the easternmost and northwesternmost parts of the project area. Three 1:31,680-scale maps have been published, and four more are in progress. Several topical papers describing metamorphism, geochemistry of Mesozoic metavolcanic rocks, mineral resources, and structure have been published, and more are in progress. Samples for a detailed geochemical study and isotopic age-dating from representative units accross the transect are being analyzed.

The project location is shown in figure 24.

Project Title: Geology and Mineral Resources of the Petersburg 1:250,000-scale Quadrangle and Some Contiguous Areas (AMRAP and Geologic Framework and Synthesis Program)

Chief: David A. Brew

Objectives: To carry out reconnaissance geologic and geochemical mapping and mineral-resource assessment of the project area where diverse structural, stratigraphic, and tectonic units come together. The project will include geophysical surveys and will draw upon previous geologic

studies to the west and northwest by L. J. P. Muffler, to the south and west by A. T. Ovenshine, to the south by G. D. Eberlein and Michael Churkin, Jr., to the southeast by H. C. Berg and D. L. Jones, and to the north and east by D. A. Brew, A. L. Clark, and D. G. Grybeck.

Status: The 1980 field season was the third for this project. Geologic mapping of the southern and western parts of the project area, comprising of Etolin, Zarembo, northern Prince of Wales, and Kuiu Islands, is now largely complete. In addition, parts of Kupreanof Island and the mainland have also been mapped. Stream-sediment sampling has been completed by the related geochemistry project (J. B. Cathrall, Chief). Compilation of data from previous mapping in the area is underway, as are a major-element study of the granitic rocks and other topical studies. Aeromagnetic surveying is complete, and the results have been placed on open file. A review of known mineral deposits, as well as occurrences discovered during current fieldwork, and pertinent geochemical data, have also been open filed. An aeroradiometric survey of areas geologically favorable for uranium has been flown, and the results are being compiled.

The projected location is shown in figure 24.

Project Title: Mineral Resources of Petersburg (1:250,000-scale) Quadrangle (AMRAP)

Chief: John B. Cathrall

Objectives: The major objectives are: To appraise the mineral-resource potential and to complete reconnaissance geochemical mapping of the Petersburg (1:250,000-scale) quadrangle where diverse stratigraphic and tectonic units or terranes come together. The secondary objectives include geostatistical-geochemical studies for single elements, ratios of elements, and vector enrichments using the results of analysis of stream sediments, heavy-mineral panned concentrates from stream sediments, and rock units. To accomplish these objectives, drainage systems, rock units, fault zones, altered and/or mineralized zones, and favorable host rock will be sampled and the geochemical results integrated with the results of studies of the geologic and geophysical environments of the area; maps will be prepared and interpreted; and the integrated conclusions will be prepared for publication as a series of maps and short reports.

Status: The 1980 field season was the third for this project. To date about 1,400 panned concentrate samples, 1,425 stream-sediment samples, and 714 stream pebble samples have been collected. Areas identified as anomalous on the basis of 1978-79 analytical results were revisited in 1980. Approximately 600 stream-sediment samples have been analyzed for uranium and thorium. It is possible to identify a belt of rocks located in the Etolin-Kuiu Island complex in which uranium is enriched relative to thorium. Although the 1980 sample analyses are not complete, a pattern of copper-zinc-lead zoning is becoming defineable in the Duncan Canal-Zarembo Island area.

The project location is shown in figure 24.

Project Title: Craig Quadrangle

Chiefs: G. Donald Eberlein and Michael Churkin, Jr.

Objectives: To compile a 1:250,000-scale geologic map that shows distribution and structure of numerous new geologic formations mainly of Precambrian and Paleozoic age.

Status: A preliminary map is being compiled for open-file distribution; scheduled completion date is spring 1981. Numerous topical studies have already been published, and the following topics are the subjects of papers in press: stratigraphic reconstructions of an upward-shoaling Paleozoic island arc; dating of graptolite zones by sedimentation rates (implication for rates of evolution); paleomagnetic data showing that Paleozoic strata in the Craig quadrangle have been displaced latitudinally northward about 18° and rotated at least 25° counterclockwise about a vertical axis; and recognition of an ensimatic basement complex and its relation to the early Paleozoic volcanic-arc sequence of southern Prince of Wales Island.

The project location is shown in figure 24.

Project Title: Petrology of La Perouse and Related Mafic Intrusions

Chief: Robert A. Loney

Objectives: To study the petrology and structure of the belt of nickel-copper-bearing mafic intrusions that extends from Mount Fairweather to western Chichagof Island and to determine their petrogenesis, geologic setting, and economic potential.

Status: Most of the fieldwork has been completed in earlier related projects, and no fieldwork is planned for 1981. A final report on Brady Glacier copper-nickel deposit (Professional Paper 1195) is in press, and a final paper on the La Perouse gabbro is in preparation. Office and laboratory work continues on material from western Chichagof and Yakobi Islands.

The project location is shown in figure 24.

Project Title: Sitka Observatory

Chief: Willis E. Osbakken

Objectives: To operate seismic instruments for acquiring information on the global occurrence of earthquakes; to transmit seismic and tidal data to the Alaska Tsunami Warning Center at Palmer; and to record and measure, on a continuous basis, the various elements of the Earth's magnetic field and distribute these data either directly or through the Branch of Electromagnetism and Geomagnetism to domestic and foreign data users.

Status: This project is one of a continuing nature; the station has functioned as a geomagnetic observatory since 1902 and as a seismographic station since 1904. Besides telemetering seismic data to Palmer, the station furnishes seismic recordings to the National Earthquake Information Service for epicenter studies. As a geomagnetic station, Sitka Observatory is one of the oldest in North America and has continuous records dating back to 1902. Measurements of magnetic secular change in this area, however, date back much farther; the Russians operated a magnetic observatory in Sitka from 1842 to 1867. As a geomagnetic observatory, Sitka plays an important role in the international scientific community, being one of the 13 stations used in the derivation of K_p, the planetary geomagnetic activity index. Geomagnetic data collected at the station find a wide variety of uses, including the compiling of magnetic charts, radio propagation studies, and ionospheric studies. The observatory also operates a tide station for the Pacific Tide Party and is a cooperative observer for the National Weather Service.

The observatory location is shown in figure 24.

OFFSHORE

Project Title: Arctic Marine Sedimentary Processes (Marine Geology Program)

Chief: Peter W. Barnes, Erk Reimnitz, and Brian D. Edwards

Objectives: To define the sedimentary processes of the continental shelf off northern Alaska. Studies will concentrate on: (1) defining the source, mode of emplacement, and physical and chemical composition of bottom materials; (2) studying the present sediment-transport regime (including river effluents, ice-rafting, currents, and ice grounding); and (3) studying the historical record to provide information concerning the stability of the present regime and its behavior in the past. In all studies, processes involving sea ice will be emphasized.

Status: The character of the sea-ice regime on the shelf is apparently controlled by the morphology of the coast and sea bed. However, the causal relation between ice, shoals, and benches is not understood. The process and rates of gouging shoreward of the stamukhi (a zone of grounded ice ridges) are reasonably well understood; however, the seasonal distribution of events and the rates seaward of the stamukhi are unknown. Studies of delta-front processes have addressed the interaction of rivers and the coastal zone with only a partial understanding of the stability and potential hazards in this environment. Results from summer suspended-sediment studies and near-bottom current measurements have helped define transport vectors along the coast in summer, although rates, composition, and seasonality are poorly understood. Morphologic features on the inner part of the shelf are dynamic. Shoals, coastlines, and islands are changing, although the rates, volumes, and timing of change are not yet well understood. Fine-grained sediments become incorporated in the sea ice at freeze-up over large areas and in large quantities. The source, fate, and processes of incorporation have not been studied.

The location of the project is shown in figure 25.

Project Title: Geologic Framework and Resource Assessment, Beaufort and Chukchi Seas (Marine Geology Program)

Chief: Arthur Grantz

Objectives: To determine the geologic framework and petroleum potential of the continental shelf and slope in the Beaufort and Chukchi Seas.

Status: The reconnaissance phase of the project, which depended heavily on single-channel seismic data, has generally defined the major geologic provinces and gross structure of the Beaufort-Chukchi shelf and continental slope. The project is now acquiring, processing, and interpreting multichannel seismic-reflection data for a more detailed determination of the geologic framework and petroleum potential of the region. Gravity anomaly and seismic-refraction (sonobuoy) data have also been gathered. All planned data releases and reports covering the reconnaissance phase of the project have been published or are in press. A number of ancillary maps and reports showing the bathymetry and selected geologic features of environmental concern have also been released.

The project location is shown in figure 25.

Project Title: Geology and Resource Assessment of the Northern Bering Sea (Marine Geology Program)

Chief: Michael A. Fisher

Objectives: To study the geologic history and structure and the petroleum geology of the northern Bering Sea, including Norton Basin.

Status: Gravity data collected in 1978 have been

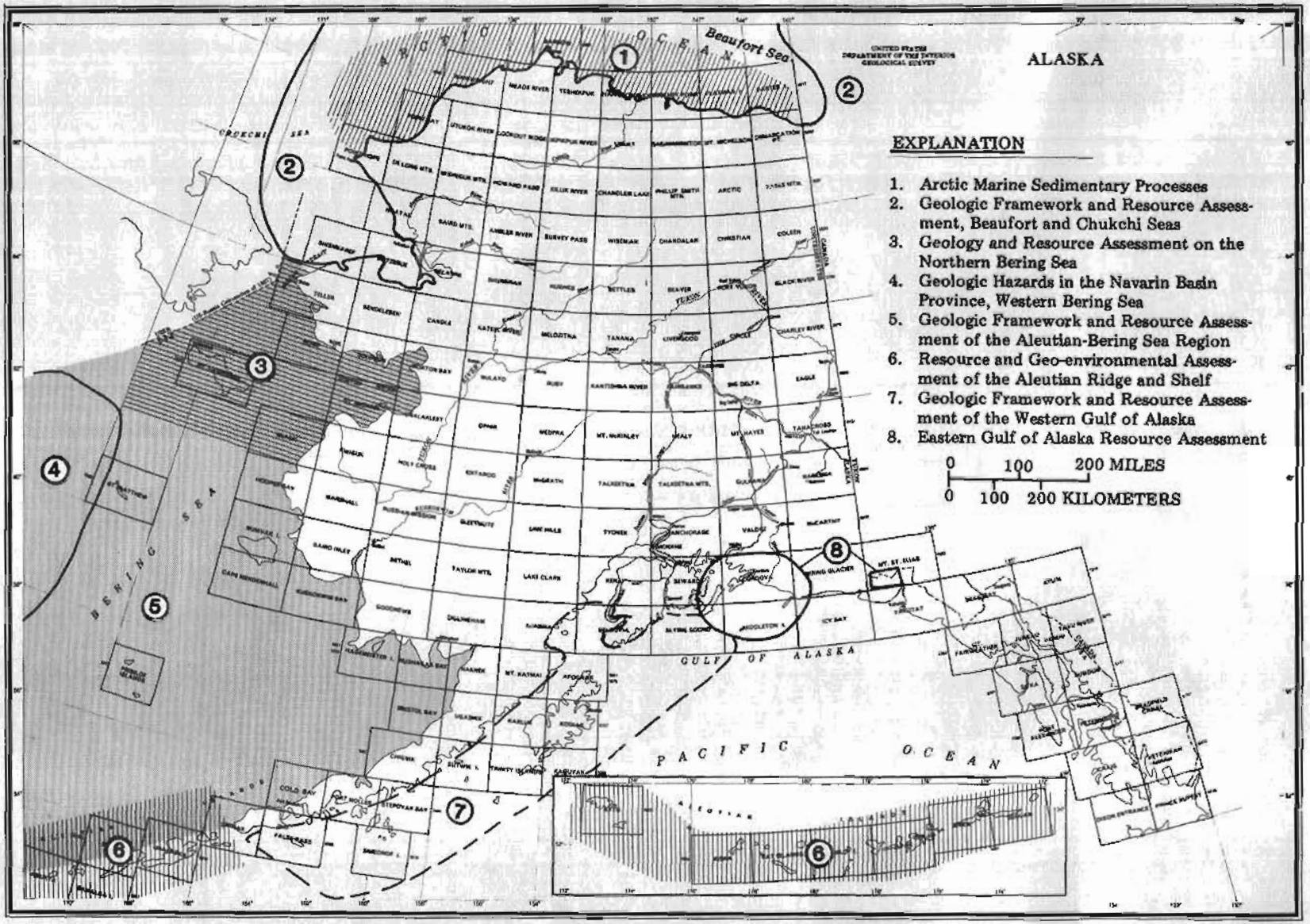


Figure 25.–Offshore geologic activities in Alaska, Marine Geology Program.

published in preliminary map form, and 24-channel seismic data have been interpreted. The map of basin structure, derived from the seismic data, will be modified on the basis of information collected during a cruise in 1980. The new information includes about 800 kilometers of 24-channel seismic, 1,000 kilometers of gravity, and 400 kilometers of magnetic data. Data also were collected from 35 sonobuoys. These recently acquired and 1977-78 data will be coordinated during interpretation.

The project location is shown in figure 25.

Project Title: Geologic Hazards in Navarin Basin Province, Western Bering Sea (Marine Geology Program)

Chiefs: Paul R. Carlson and Karl A. Herman

Objectives: To determine the type, areal extent, age, degree of activity, and potential problems of seafloor geologic hazards in the Navarin Basin province. Types of hazards anticipated include faults, submarine slides, gas-charged sediments, active bedforms, and ice gouging.

Status: The 6-week cruise on the National Oceanic and Atmospheric Administration ship *Discoverer* in 1980 was the first in this extensive sedimentary basin that was aimed specifically at the problem of seafloor hazards. Data being processed for analyses include 3.5-kilohertz, minisparker, and airgun reflection profiles, suspended-sediment samples, and gravity cores. Plans are underway for a second 6-week cruise in 1981 that will complete a reconnaissance-level regional grid of the Navarin Basin province, an Outer Continental Shelf area scheduled for leasing in late 1984.

The project location is shown in figure 25.

Project Title: Geologic Framework and Resource Assessment of the Aleutian-Bering Sea Region (Marine Geology Program)

Chief: Michael S. Marlow

Objectives: To evaluate the resource potential, including possible oil and gas deposits, of the Bering Sea region, and to ascertain the regional tectonic and geologic framework of the Bering Sea in relation to Alaska, Siberia, and the North Pacific.

Status: Since 1975 approximately 4,500 miles of 24-channel seismic-reflection data has been collected over the eastern Bering Sea shelf and the adjacent abyssal Aleutian Basin. The 1975 and 1976 data sets have been published, and copies of the records are available from the National Oceanic and Atmospheric Administration. The 1977 multichannel data were published in late 1980. Preliminary descriptions and ages for dredge samples collected in 1978 have been published in an open-file report. During 1980, we collected about 1,700 miles of multichannel seismic-reflection data in the north end of Navarin Basin and throughout the Gulf of Anadyr, which is underlain by Anadyr Basin. The data from the 1980 cruise are currently being reduced and interpreted. Resource reports on Bristol Bay and Navarin Basin have been prepared for the Bureau of Land Management and the Department of State.

The project location is shown in figure 25.

Project Title: Resource and Geo-environmental Assessment of the Aleutian Ridge and Shelf (Marine Geology Program)

Chiefs: David W. Scholl and Tracy L. Vallier

Objectives: To gather and interpret geophysical and geologic data and to study seafloor processes. These investigations are needed to assess the regional petroleum and mineral resources and geo-environmental hazards of the frontier areas of the Aleutian Ridge and Shelf. Marine geophysical data (including reflection and refraction seismic data), as well as gravity and magnetics data, are used in conjunction with geologic information obtained by investigating the insular geology, submerged bedrock outcrops, sediment samples, and cores from test wells in order to prepare resource and environmental assessments. The same data base is used to determine the tectonic and geologic histories of the Aleutian Ridge, which is a complex magmatic arc that in many places includes thick masses of Cenozoic sedimentary deposits.

Status: Two short field seasons of data collection are completed. In 1979, single-channel seismic-reflection profiles and dredge hauls were collected during the R/V *Sea Sounder* cruise along the Aleutian Ridge. We also sampled rocks on Amlia and Atka Islands. In 1980, about 450 miles of multichannel seismic profiles were collected on the R/V *Lee* over the Aleutian Ridge near Amlia Island. The seismic profiles and rocks are currently being analyzed.

Figure 25 shows the project location.

Project Title: Geologic Framework and Resource Assessment of the Western Gulf of Alaska (Marine Geology Program)

Chief: Roland von Huene

Objectives: To map the Neogene tectonic framework of the Outer Continental Shelf between Middleton and Chirikof Islands. An understanding of the geologic history will be developed to

predict where geologic events have been conducive to the formation of hydrocarbon resources. Both the geologic and kinematic history are keys to exploration strategy. A regional synthesis will be the end product.

Status: Approximately half the geophysical fieldwork and one-third of the sampling have been accomplished. Preliminary reports and maps have been prepared showing these data, and the results of studies of the data have appeared in open-file reports and scientific journals. A cruise to accomplish about half the remaining work is planned for the summer of 1981.

The project location is shown in figure 25.

Project Title: Eastern Gulf of Alaska Resource Assessment (Marine Geology Program)

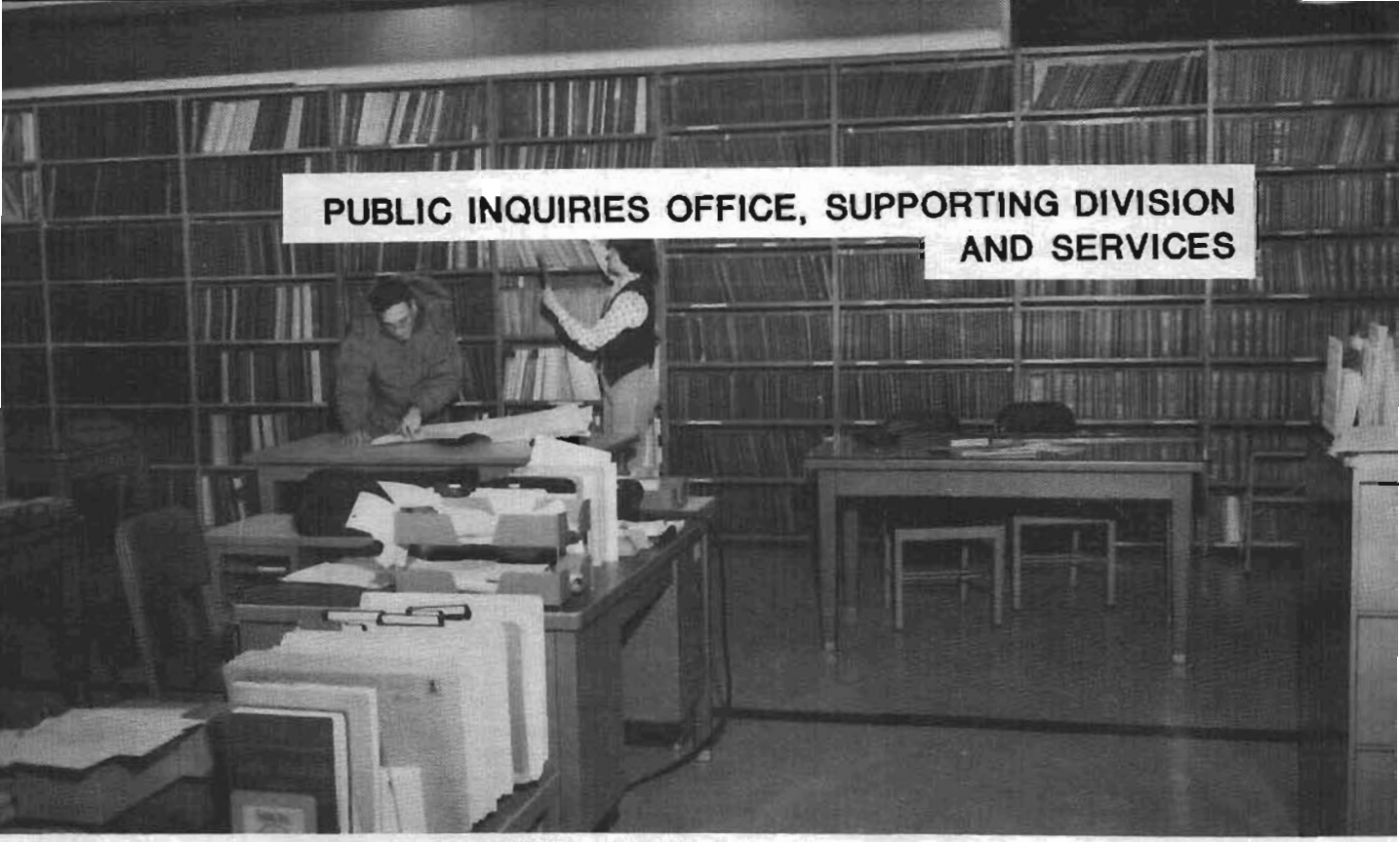
Chief: George Plafker

Objectives: To evaluate the tectonic framework, petroleum potential, and geologic hazards of the eastern Gulf of Alaska Outer Continental Shelf and contiguous areas.

Status: Acquisition of marine geophysical data is complete. Maps and reports on the structure, magnetics, stratigraphy, gravity, and bathymetry of the region are in various stages of preparation or have been published. During 1981 a detailed field study will be conducted in the Samovar Hills area of the Mount Saint Elias quadrangle to compare the petroliferous Paleogene sequence in outcrop with coeval rocks dredged from the Yakutat continental slope.

The project location is shown in figure 25.

PUBLIC INQUIRIES OFFICE, SUPPORTING DIVISION AND SERVICES



Public Inquiries Office, Anchorage

PUBLIC INQUIRIES OFFICE

The Public Inquiries Office (PIO) in Anchorage serves as a contact for obtaining information about the activities and products of the Survey and provides referral services for individuals seeking technical information about the Survey's programs and work. The office keeps a stock of Alaska maps for over-the-counter sales and, as an agent of the Superintendent of Documents, sells Geological Survey books relating to Alaska. (Information about publications is given in the introductory pages of this Circular.) The PIO is part of the National Mapping Division and is under the direction of the Office of Public Inquiries headquartered at the National Center in Reston, Va. The PIO in Anchorage is at Room 108, Skyline Building, 508 Second Avenue, Tel. (907) 277-0577.

The Alaska Distribution Section in Fairbanks distributes Survey maps, indexes, and leaflets over the counter to the public and to Federal and State agencies, and it supplies maps to 35 commercial dealers in the State. The Alaska Distribution Section is under the direction of the Distribution Branch in Denver, which, in turn, is part of the National Mapping Division. The Alaska office is supervised by:

Natalie A. Cornforth
Federal Building, Box 12
101 12th Avenue, Room 126
Fairbanks, Alaska 99701
Tel. (907) 456-7535

ADMINISTRATIVE DIVISION

The Alaska Field Office of the Administrative Division provides service and supply support to the Survey offices and personnel in Alaska. The office is supervised by:

Betty J. McIntire
204 Skyline Building
218 E Street
Anchorage, Alaska 99501
Tel. (907) 271-4145

A warehouse for Survey equipment is located just inside the Elmendorf Air Force Base to the east of Anchorage. The warehouse is under the immediate supervision of:

Harvey Haynes
5500 Oilwell Road
Elmendorf Air Force Base
Anchorage, Alaska 99506
Tel. (907) 752-3834

A warehouse for the Fairbanks area is located at Fort Wainwright but is not staffed. The telephone number at Fort Wainwright is (907) 353-4219.

A radio network is operated during the field season for communication among the field camps and with Anchorage or Fairbanks. The official Survey frequencies are 5380 (USB 5381.5) and 3211 (USB 3212.5) kHz. The Anchorage base station (KWA 351) is located at 218 E Street and

monitors 5380 during office hours, or other hours by arrangement. Commercial stations WKD 22 in Anchorage and KGA 85 ("Broadmoor") in Fairbanks, both of which monitor 5167.5 (USB 5168.9), handle non-routine Survey messages. For further information about the Survey's radio operations, contact:

Florence R. Weber
P.O. Box 80586
Fairbanks, Alaska 99708
Tel. (907) 479-7245

The Administrative Division office also handles emergency messages to or from Survey offices or families of employees. During regular hours, the Anchorage office can be contacted; at other times Betty McIntire can be contacted at (907) 272-5398, and/or Pat Carroll at 243-3515.

ALASKA CORE LIBRARY

The Core Library preserves and makes available for study the Survey's large collection of Alaskan well cores. Most of these cores are from the National Petroleum Reserve in Alaska (NPRA), formerly known as the Naval Petroleum Reserve No. 4 (NPR-4); the nucleus of the library is about 25,000 feet of cores taken during exploration of the Reserve in the 1940's and 1950's. The library also includes some cores and a large amount of ditch cuttings from wells drilled on Federal land in other parts of Alaska. The library is currently receiving and storing core from the Survey's NPRA operations.

The Alaska Core Library is housed in three buildings at the corner of Boyd and Manor Streets, Government Hill, in Anchorage. The library is managed by the Branch of Alaskan Geology, Branch of Oil and Gas Resources, Conservation Division, and Office of National Petroleum Reserve in Alaska.

The director of the library's activities is:

W. L. (Doc) Adkison
2525 C Street, Suite 400
Anchorage, Alaska 99503
Tel. (907) 276-7422
Library: (907) 274-1345

TECHNICAL DATA UNIT

The Alaska Technical Data Unit (Tech. Data) provides information on earth science literature for Alaska with emphasis on U.S. Geological Survey, Alaska Division of Geological and Geophysical Surveys, and U.S. Bureau of Mines publications. In addition to serving as depository for Alaskan Geology Branch project files and related materials, Tech. Data maintains a small reference library, prepares a monthly list of Alaskan publications, and performs various procurement and publication services for Branch personnel. For further information contact.

Ellen R. White
Technical Data Unit
U.S. Geological Survey
345 Middlefield Road, MS 48
Menlo Park, California 94025
Tel. (415) 323-8111 ext. 2342 or 2684

In preparing for the unit's move to Anchorage headquarters, Tech. Data has recently undertaken compilation of a computerized index. The index will provide rapid identification of and access to published Alaskan earth science literature and various types of published materials in Tech. Data files (currently an estimated 15,000 items and growing at the rate of more than 600 items annually).

The Tech. Data index data base, in part derived from the AKBIBLIO bibliographic files established by M. Elizabeth Yount in 1976 (Project: Alaskan Branch information processing; U.S. Geological Survey Circular 732, p. 19), is being implemented in the SPIRES data base system of Stanford University.

To date, development of the data definition and data base schema by Bruce B. Salem has resulted in a usable but very small test data base whose design is being refined.

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work.

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Albert, N. R. D., and Cady, J. W.	--	Geologic	Northern & Southwestern	Comparison of radar-image-based mapping techniques	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2435 (Albert) Branch of Petrophysics and Remote Sensing Denver Federal Center, Box 25046 Lakewood, CO 80225 (303) 234-5021 (Cady)
Barnes, D. F.	Morin, R. L. Ponce, D. A. Burns, L. E.	Geologic	Statewide	Gravity studies and standardization of gravity surveys	Branch of Regional Geophysics 345 Middlefield Road, MS 18 Menlo Park, CA 94025 (415) 323-8111 x 2249
Barnes, P. W., Reimnitz, Erk, and Edwards, B. D.	Kempema, E. W. Minkler, P. W. Rearic, D. M. Reiss, T. E.	Geologic	Offshore	Studies of Arctic marine sedimentary processes and hazards, Beaufort and Chukchi Seas	Branch of Pacific-Arctic Geology 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 856-7008
Bartsch-Winkler, Susan	--	Geologic	Southern	Determining sediment transport and deposition in the coastal region near Anchorage	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Berg, H. C.	Decker, J. E. (State of AK) Coney, P. J. (Univ. of AZ) Saleeby, Jason (Cal. Tech.)	Geologic	Southeastern	Studies of geotectonics, metallogenesis, and resource appraisal	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2231
Bird, K. J.	--	Geologic	Northern	Petroleum resource studies	Branch of Oil & Gas Resources 345 Middlefield Road, MS 99-B Menlo Park, CA 94025 (415) 323-8111 x 7634
Bolm, J. G., and Lyle, W. M. (State of Alaska)	--	Conservation	Southern	Integration of onshore and offshore geologic data, lower Cook Inlet	880 A Street Anchorage, AK 99501 (907) 271-4361 (Bolm) Division of Geological and Geophysical Surveys 3001 Porcupine Drive Anchorage, AK 99501 (907) 277-6615 (Lyle)
Bowsher, A. L.	--	ONPRA	Northern	Geophysical exploration of the National Petroleum Reserve	ONPRA Casa Mills 200 Middlefield Road, MS 87 Menlo Park, CA 94025 (415) 323-8111 x 2917

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Brew, D. A.	--	Geologic	Southeastern	Glacier Bay Wilderness study	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4127
Brew, D. A.	--	Geologic	Statewide	Compilation of map of metamorphic facies	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4127
Brew, D. A.	Berg, H. C. Campbell, J. A. Dickinson, K. A. Ellersieck, I. F. Ford, A. B. Grybeck, D. G. Hunt, S J. Karl, S. M. Lanphere, M. A. Le Compte, J. R. Loney, R. A. Sonnevil, R. A. (Nat. Park Service)	Geologic	Southeastern	Mineral-resource appraisal near Petersburg	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4127
Brew, D. A.	Ford, A. B. Karl, S. M. Sonnevil, R. A. (Nat. Park Service)	Geologic	Southeastern	Mapping and mineral-resource appraisal near Juneau	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4127
Brosgé, W. P.	Nilsen, T. H. Dutro, J. T., Jr. Moore, T. E. Balin, D. F. Gromme, C. S. Hillhouse, J. W.	Geologic	Northern & East-central	Direction of sediment transport, facies trends, Devonian clastic rocks, Brooks Range	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 2121
Brosgé, W. P.	Personnel as assigned	Geologic	East-central	Mineral-resource assessment of Wiseman quadrangle	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 2121
Brosgé, W. P.	Reiser, H. N. Dutro, J. T., Jr.	Geologic	Northern	Geologic mapping, southeast Brooks Range	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 2121
Burrows, R. L.	Emmett, W. W. Wilcox, D. E.	Water Resources	East-central	Sediment transport in the Tanana River near Fairbanks	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 x 214

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Cady, J. W.	(See Albert, N. R. D.)				
Callahan, J. E.	--	Conservation	Northern	Determination of coal resources, NPRA	800 A Street Anchorage, AK 99501 (907) 271-4356
Carlson, P. R., and Herman, K. A.	Fisher, J. M. Johnson, K. A. Lamb, B. M.	Geologic	Offshore	Studies of geologic hazards, Navarin Basin	Branch of Pacific-Arctic Geology 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 856-7021 (Carlson) -7053 (Herman)
Carneggie, D. M., and Fleming, M. D.	Krebs, P. V. (BLM) Spencer, Page (BLM) Robus, Mathew (BLM) Swanson, J. B. (SCS) Kinney, Mark (SCS) George, T. H. (Univ. of AK)	EROS Field Office	Statewide	Operation of IDIMS for vegetation classification	218 E Street Anchorage, AK 99501 (907) 271-4065
Carter, L. D.	Galloway, J. P.	Geologic	East-central	Mapping surficial geology in Tanana Valley corridor	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2682
Carter, L. D.	Galloway, J. P.	Geologic	Northern	Studies of Quaternary history, western Arctic Coastal Plain	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2682
Carter, R. D.	(See Lantz, R. J.)				
Carter, R. D.	Page, L. S.	ONPRA	Northern	Maintaining open-file data for NPRA	ONPRA Casa Mills 200 Middlefield Road, MS 87 Menlo Park, CA 94025 (415) 323-8111 x 2136
Cathrall, J. B.	--	Geologic	East-central	Mineral-resource appraisal and geochemical mapping of the Wiseman quadrangle	Branch of Exploration Research Denver Federal Center, Box 25046 Lakewood, CO 80225 (303) 234-4813
Cathrall, J. B.	Day, G. W. Hoffman, J. D. Risoli, D. A.	Geologic	Southeastern	Mineral-resource appraisal and geochemical mapping of the Petersburg quadrangle	Branch of Exploration Research Denver Federal Center, Box 25046 Lakewood, CO 80225 (303) 234-4813

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Chapman, R. M.	Patton, W. W., Jr. Moll, E. J.	Geologic	West-central	Mineral-resource evaluation and mapping, Ophir quadrangle	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4131
Childers, J. M.	--	Water Resources	Statewide	Studies of arctic water resources	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Churkin, Michael, Jr.	(See Eberlein, G. D.)				
Churkin, Michael, Jr.	Carter, Claire Trexler, J. H., Jr.	Geologic	Statewide	Compilation of tectonic map of polar regions	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4116
Cobb, E. H.	--	Geologic	Statewide	Compilation of data on mineral resources	Branch of Alaskan Geology 345 Middlefield Road, MS 48 Menlo Park, CA 94025 (415) 323-8111 x 2483
Comer, C. D.	--	Conservation	Offshore	Mapping shallow geologic features, southern Bering Sea	800 A Street Anchorage, AK 99501 (907) 271-4361
Comer, C. D., Turner, B. W., and Steffy, David	--	Conservation	Offshore	Mapping shallow geologic features, Norton Basin	800 A Street Anchorage, AK 99501 (907) 271-4361
Cowing, D. J.	--	Water Resources	Southern	Ground-water resources, Eagle River valley	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Cowing, D. J.	Emanuel, R. P. Lee, M. G. Wittenberg, L. A.	Water Resources	Southern	Geohydrologic studies, Municipality of Anchorage	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Craig, J. D.	(See Thrasher, G. P.)				
Csejtey, Béla, Jr.	Cox, D. P. Stricker, G. D.	Geologic	Southern	Mineral-resource appraisal, Healy quadrangle	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2613

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Deeter, Gary	--	Water Resources	Statewide	Collection of basic ground-water data	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Detra, D. E.	Tripp, R. B.	Geologic	Southwestern	Geochemical sampling and analysis in support of AMRAP, Bristol Bay, Karluk and Ugashik quadrangles	Branch of Exploration Research 5046 McIntyre Street Golden, CO 80401 (303) 234-5178
Detterman, R. L.	Miller, T. P. Yount, M. E. Wilson, F. H. Case, J. E. Allaway, W. H. Cox, D. P. Detra, D. E. Shew, Nora	Geologic	Southwestern	Mineral-resource appraisal, Ugashik-Karluk quadrangles	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4132
Dickinson, K. A.	Campbell, J. A.	Geologic	Statewide	Evaluation of uranium potential in selected Tertiary basins in Alaska	Branch of Exploration Research Denver Federal Center, Box 25046 Lakewood, CO 80225 (303) 234-5667
Donovan, T. L.	Forgey, R. L. Hendricks, J. D. Roberts, A. A. Spence, B. A. Thompson, C. R.	Geologic	Northern	Study of hydrocarbon seepage relative to magnetite formation, North Slope area	Branch of Oil and Gas Resources 2555 North Gemini Drive Flagstaff, AZ 86001 (502) 779-3311 x 1350
Dusel-Bacon, Cynthia	Aleinikoff, J. N. Klute, M. A.	Geologic	East-central	Petrographic studies, Yukon-Tanana Upland	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4115
Dutro, J. T., Jr.	Mamay, S. H. Sohn, I. G. Gordon, M., Jr.	Geologic	Statewide	Studies of Paleozoic fossils and stratigraphy	U.S. National Museum Room E 316 1825 K Street, NW Washington, D. C. 20006 (202) 343-3222
Eberlein, G. D., and Lanphere, M. A.	--	Geologic	Statewide	Compiling map of Precambrian rocks of Alaska and formulation of a time scale as part of an international study	Office of Geochemistry and Geophysics Branch of Isotope Geology 345 Middlefield Road, MS 18 Menlo Park, CA 94025 (415) 323-8111 x 2649

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Eberlein, G. D., and Churkin, Michael, Jr.	Carter, Claire Berg, H. C. Ovenshine, A. T. Saleeby, Jason (Cal. Tech)	Geologic	Southeastern	Geologic mapping of Craig quadrangle	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4104 (Eberlein) x 4116 (Churkin)
Edwards, B. D.	(See Barnes, P. W.)				
Ferrians, O. J. Jr.	--	Geologic	Northern	Engineering geology investigations, eastern Arctic Coastal Plain	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4108
Ferrians, O. J., Jr.	Schmoll, H. R. Updike, R. G. (State of AK)	Geologic	Southern	Investigation of geologic hazards, Anchorage-Susitna lowlands	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4108
Fisher, M. A.	Holmes, M. L. Patton, W. W., Jr.	Geologic	Offshore	Assessment of resources and study of geologic history, northern Bering Sea, including Norton Basin	Branch of Pacific-Arctic Geology 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 856-7108
Fleming, M. D.	(See Carneggie, D. M.)				
Fleming, M. D., and Wright, G. R., Jr. (Nat. Park Service)	--	EROS Field Office	Southern	Classification of vegetation of sheep/goat habitat	218 E Street Anchorage, AK 99501 (907) 271-4065
Fleming, W. D.; LaBau, V. J., Setzer, T. S. (Forest Service)	Winterberger, K. C., Meade, D. R. (Forest Service)	EROS Field Office	Southern	Vegetation classification from Landsat data	218 E Street Anchorage, AK 99501 (907) 271-4065
Fordham, R. E.	--	National Mapping	Northern, East-central	Production of orthophotoquads and other maps (6 projects)	Eastern Mapping Center 559 National Center Reston, VA 22092 (203) 860-6352
Foster, H. L.	Weber, F. R. Laird, Jo Cushing, G. W. Menzie, W. D. Crim, W. D. Cady, J. W. Kieth, T. E. C. Wilson, F. H. Aleinikoff, J. N. Churkin, Michael, Jr. Trexler, J. H., Jr.	Geologic	East-central	Geologic mapping and studies in Yukon-Tanana Upland	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4108

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Gaydos, L. J.	Acevedo, W. Morrissey, L. A.	National Mapping	Northern	Production of land cover maps from Landsat data	Geographic Investigations Office Ames Research Center 240-8 Moffett Field, CA 94035 (415) 965-6368
Gough, L. P., and Severson, R. C.	--	Geologic	Southern	Establishing principles for predicting element concentrations in plants in the Capps Coal Field	Branch of Regional Geochemistry Box 25045, MS 925 Denver Federal Center Denver, CO 80225 (303) 234-5242
Gough, L. P.,	--	Geologic	Statewide	Geochemical census of Alaska	Branch of Regional Geochemistry Denver Federal Center, Box 25046 Lakewood, CO 80225 (303) 234-5242
Grantz, Arthur	May, S. D. Dinter, D. A.	Geologic	Offshore	Resource appraisal and study of geologic framework, Beaufort-Chukchi Seas	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 2695
Grantz, Arthur	Silberman, M. L. Wolfe, J. A.	Geologic	Southern	Stratigraphic and structural studies of the Nelchina area	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 2695
Hamilton, T. D.	Obi, Curtis	Geologic	Northern	Studies of surficial geology, Brooks Range	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 2156
Herman, K. A.	(See Carlson, P. R.)				
Hinkley, Todd	--	Geologic	Southern	Study of dusts in annual glacier strata	Branch of Regional Geochemistry Denver Federal Center, Box 25046 Lakewood, CO 80225 (303) 234-5628
Hoare, J. M.	Decker, J. E. (State of AK)	Geologic	Southwestern	Geologic mapping of Taylor Mountains quadrangle	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4133
Hoffman, J. G.	Sutley, S. J. Day, G. W.	Geologic	Statewide	Geochemical work in support of AMRAP and RARE II studies	Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-3552

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Holden, K. D.	(See Hoose, P. J.)				
Hoose, P. J.	--	Conservation	Offshore	Mapping shallow geologic features, northern Aleutian Shelf	800 A Street Anchorage, AK 99501 (907) 271-4361
Hoose, P. J., and Holden, K. D.	--	Conservation	Offshore	Identification of geologic hazards, lower Cook Inlet, Shelikof Strait	800 A Street Anchorage, AK 99501 (907) 271-4361
Hopkins, D. M.	Hartz, R. W. Pounders, Sandra Smith, P. A.	Geologic	Northern	Geochronologic studies of offshore sediments, Beaufort Sea coast and shelf area	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4107
Hudson, Travis	--	Geologic	Statewide	Investigations of tin, tungsten, and molybdenum deposits	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Jones, D. L.	Silberling, N. J. Hillhouse, J. H. Coney, P. (Univ. of AZ)	Geologic	Statewide	Compilation of tectonostratigraphic map of Alaska	Branch of Paleontology and Stratigraphy 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 323-8111 x 2269
Kachadoorian, Reuben	--	Geologic	Northern	Engineering geology studies in NPRA	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4129
Kharaka, Y. K.	--	Water Resources	Northern	Geochemical studies of oilfield waters, NPRA	345 Middlefield Road, MS 27 Menlo Park, CA 94025 (415) 323-8111 x 2144
King, H. D.	Tripp, R. B.	Geologic	West-central	Geochemical mapping, Solomon and Bendeleben quadrangles (AMRAP)	Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6186
King, H. D.	Woemper, Mark Duttweiler, Karen	Geologic	Southern	Geochemical mapping, Healy quadrangle (AMRAP)	Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6186
Krumhardt, A. P.	Hopkins, G. C. Wilcox, D. E.	Water Resources	East-central	Geohydrologic studies, Fairbanks North Star Borough	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 x 214

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work–Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Krumhardt, A. P.	Kernodle, D. R.	Water Resources	Southern	Hydrologic conditions in Peters Creek, Beluga, and Healy coal areas	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 x 214
Lachenbruch, A. H.	--	Geologic	Statewide	Heat-flow studies	Branch of Tectonophysics 345 Middlefield Road, MS 18 Menlo Park, CA 94025 (415) 323-8111 x 2272
Lahr, J. C.	Page, R. A. Stephens, C. D. Rogers, J. A. Criley, E. E.	Geologic	Southern	Studies of current tectonic processes generating earthquakes in Alaska to evaluate hazards	Branch of Ground Motion and Faulting 345 Middlefield Road, MS 77 Menlo Park, CA 94025 (415) 323-8111 x 2510
Lahr, J. C.	Stephens, C. D. Fogleman, K. A. Rogers, J. A. Tam, Roy Cancilla, R. S.	Geologic	Southern	Studies of current tectonic processes generating earthquakes in Alaska to evaluate hazards	Branch of Ground Motion and Faulting 345 Middlefield Road, MS 77 Menlo Park, CA 94025 (415) 323-8111 x 2510
Lamke, R. D.	--	Water Resources	Statewide	Collection of surface-water data	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Lamke, R. D.	--	Water Resources	Statewide	Maintaining ground-water station network	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Lanphere, M. A.	(See Eberlein, G. D.)				
Lantz, R. J., and Carter, R. D.	--	ONPRA	Northern	Exploration, development, and operation of gas fields near Barrow	District Bldg., Suite 110 1109 NE 45th Street Seattle, WA 98105 (206) 442-1995
Larson, J. A.	(See Turner, R. F.)				
Larson, J. A.	Fortier, J. D. Sloan, E. G. Turner, R. F. Olson, D. W.	Conservation	Northern, West-central, Southern, Southwestern	Conodont biostratigraphy and thermal maturity of rocks	800 A Street Anchorage, AK 99501 (907) 271-4361
Lauer, D. T.	Miller, J. M (Univ. of AK) (co-Chief) Fleming, M. D. Martin, Gayle; George, T. H., and Dean, K. G. (Univ. of AK)	EROS Field Office	East-central	Effect of timing of data collection on vegetation classification techniques	EROS Data Center Sioux Falls, SD 57198 (605) 594-6111

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work–Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Le Compte, J. R.	--	Geologic	Statewide	Analysis of Landsat imagery (AMRAP)	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2025
Linden, David	(See Rohde, W. G.)				
Loney, R. A.	Himmelberg, G. R. (Univ. of MO)	Geologic	Southeastern	Investigations of copper- and nickel-bearing rocks	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4146
Madison, R. J.	--	Water Resources	Statewide	Basic-data collection, quality of water	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Magoon, L. B.	Claypool, G. E.	Geologic	Southern	Assessment of oil resources, Cook Inlet-Shelikof Strait	Branch of Oil and Gas Resources 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 856-7028
Marlow, M. S.	Cooper, A. K. Kingston, M. J. Jones, D. M.	Geologic	Offshore	Evaluation of resource potential and studies of tectonic framework, Bering Sea region	Branch of Pacific-Arctic Geology 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 856-7092
McCoy, G. A.	--	Water Resources	Northern	Nutrient limitation in two Arctic lakes	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
McDougall, K. A.	--	Geologic	Northern	Chronostratigraphic studies	Branch of Paleontology and Stratigraphy 345 Middlefield Road, MS 95 Menlo Park, CA 94025 (415) 323-8111 x 2805
McLaurin, J. D.	Fordham, R. E.	National Mapping	Northern, West-central, Southern	Production of maps (13 projects)	Rocky Mountain Mapping Center Building 25, Box 25046 Denver Federal Center Lakewood, CO 80225 (303) 234-2351
Meier, M. F.	Post, A. S. Hodge, S. M. Rasmussen, L. A. Taylor, P. L. Sikonia, W. A., Krimmel, R. M. Brown, C. S. Juni-Fountain, A. G.	Water Resources	Statewide	Studies of snow accumulation, melt and runoff on glaciers, water flow through and under glaciers, glacier surges and stability of calving glaciers	Office of the Regional Hydrologist 1201 Pacific Avenue, Suite 850 Tacoma, WA 98402 (206) 593-6502

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Miller, T. P.	Grauch, R. I.	Geologic	Statewide	Reconnaissance study of uraniferous plutonic rocks	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4547
Molenaar, C. M.	Huffman, A. C. Bartsch-Winkler, Susan	Geologic	Northern	Stratigraphic, petrographic and paleontologic studies of Cretaceous rocks, North Slope	Branch of Oil and Gas Resources Box 25046, MS 940 Denver Federal Center Lakewood, CO 80225 (303) 234-4642
Mortensen, C. E.	Iwatsubo, E. Y. Jones, A. C. Myren, G. D. Murray, T. L.	Geologic	Southern	Monitoring crustal deformation associated with strain accumulation prior to earthquakes	Branch of Tectonophysics 345 Middlefield Road, MS 77 Menlo Park, CA 94025 (415) 323-8111 x 2583
Mull, G. C.	--	Geologic	Northern	Resource appraisal, Killik River and Chandler Lake quadrangles	Branch of Alaskan Geology 218 E Street Anchorage, AK 99501 (907) 271-4144
Nelson, G. L.	--	Water Resources	Southern	Water-resources investigations, Kenai Peninsula Borough	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Nelson, G. L.	--	Water Resources	Southern	Hydrologic studies in coal fields, western shore of Cook Inlet	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Nelson, R. E.	--	Geologic	Northern	Study of pollen, insects and plant macrofossils in the National Petroleum Reserve in Alaska	Quaternary Research Center University of Washington Seattle, WA 98195 (206) 543-4571
Nelson, S. W.	Dumoulin, Julie Winkler, G. R. Case, J. E. Silberman, M. L. Hessin, T. D. Miller-Hoare, Martha Mull, G. C.; Hoekzema, R. B., Kurtak, J., and Sasser, W. (Bureau of Mines)	Geologic	Southern	Mineral-resource appraisal of Chugach (RARE II) area	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work–Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Nokleberg, W. J.	Zehner, R. E. Miyaoka, R. M. Lange, I. M. Aleinikoff, J. N. Albert, N. R. D. Nelson, W. H. Tripp, R. B. Curtin, G. C. Yeend, W. E. Jones, D. L. Silberling, N. J. Richter, D. H.	Geologic	Southern	Mineral-resource appraisal, Mount Hayes quadrangle	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4139
O'Leary, R. M.	Risoli, D. A. Gruzensky, A. L. Galland, D. A. Hurrell, J. T.	Geologic	Statewide	Spectrographic and chemical analyses in support of AMRAP	Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6151
Olson, D. W.	--	Conservation	Southern	Studies of diatomites and ash, Kenai Peninsula	800 A Street Anchorage, AK 99501 (907) 271-4361
Osbakken, W. E.	--	Geologic	Southeastern	Operation of Sitka Observatory	Branch of Electromagnetism and Geomagnetism Sitka Observatory, Box 158 Sitka, AK 99835 (907) 747-3332
Page, R. A.	Pelton, J. R.	Geologic	Southern	Earthquake source properties in the Yaktaga seismic gap	Branch of Ground Motion and Faulting 345 Middlefield Road, MS 77 Menlo Park, CA 94025 (415) 323-8111 x 2881
Patrick, L. D.	--	Water Resources	Statewide	Collection of data on water use	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Patton, W. W., Jr.	Moll, E. J.	Geologic	West-central	Investigations of geology and resources, Norton Sound - Yukon region	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4105
Petering, G. W.	(See Smith, T. N.)				
Petering, G. W., and Smith, T. N.	Magoon, L. B. Egbert, R. M.	Conservation	Southwestern	Investigation of geology adjacent to OCS sale areas	800 A Street Anchorage, AK 99501 (907) 271-4361

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work–Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Plafker, George	Bruns, T. R. Winkler, G. R. Atwood, T. J.	Geologic	Offshore	Evaluation of tectonic framework, petroleum potential and geo-hazards, eastern Gulf of Alaska OCS	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4103
Plafker, George	Hudson, Travis Hunt, S. J. Dixon, K. L.	Geologic	Statewide	Evaluation of earthquake hazards; studies of tectonic processes	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4103
Reed, B. L.	--	Geologic	Statewide	Investigations of tin occurrences	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Reimnitz, Erk	(See Barnes, P. W.)				
Riehle, J. R.	Smith, R. L.	Geologic	Statewide	Reconnaissance study of geothermal resources, mapping, and petrologic studies of young volcanic rocks	Branch of Alaskan Geology 800 A Street Anchorage, AK 99501 (907) 271-4571
Roberts, A. A.	Cunningham, K. I.	Geologic	Northern	Study of microseepage of helium from petroleum reservoirs, northern Alaska	Branch of Oil and Gas Resources Box 25045, MS 940 Denver Federal Center Lakewood, CO 80225 (303) 234-3803
Rohde, W. G., and Linden, David	Krebs, P. V. (BLM)	EROS Field Office	Southern	Verification of vegetation classification accuracy	218 E Street Anchorage, AK 99501 (907) 271-4065
Savage, J. C.	Prescott, W. H. King, N. E. Lisowski, Michael Hamilton, G. D. Wendt, K. J. Stiffler, C. A.	Geologic	Southern	Measurement of crustal strain, Yakataga area	Branch of Tectonophysics 345 Middlefield Road, MS 77 Menlo Park, CA 94025 (415) 323-8111 x 2633
Schmoker, J. W.	--	Geologic	Northern	Borehole gravity studies in NPRA	Branch of Oil and Gas Resources Box 25046, MS 964 Denver Federal Center Lakewood, CO 80225 (303) 234-5601

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Schmoll, H. R., and Yehle, L. A.	Chleborad, A. F. Gardner, C. A. Pasch, A. D. Powers, P. S. Smith, F. S. Odum, J. K.	Geologic	Southern	Engineering geology in coal lands, Cook Inlet basin	Branch of Engineering Geology Box 25046, MS 903 Denver Federal Center Lakewood, CO 80225 (303) 234-3290, -2999, -3721
Scholl, D. W., and Vallier, T. L.	Stevenson, A. J.	Geologic	Offshore	Assessment of geologic hazards and resources of the Aleutian Ridge and Shelf	Branch of Pacific-Arctic Geology 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 856-7089 (Scholl) -7048 (Vallier)
Seitz, Harold	--	Water Resources	Southeastern	Studies of hydrologic conditions, Keta River	Juneau Subdistrict Office P.O. Box 1508 Juneau, AK 99802 (907) 586-7216
Severson, R. C.	(See Gough, L. P.)				
Silberman, M. L.	Gray, L. B. Conner, C. L. Pickthorn, W. J. Berg, H. C. Grantz, Arthur Nelson, S. W. Csejtey, B. Jr. Winkler, G. R. Patton, W. W. Grybeck, D. G. Chapman, R. M. (Brookins, D. G., U. of NM) (Mitchell, P. A., EXXON)	Geologic	Statewide	Geochemical and geochronological studies of igneous rocks and ore deposits	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4134
Sloan, C. E.	--	Water Resources	Northern	Collection of hydrologic information, NPRA.	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Sloan, C. E.	Childers, J. M.	Water Resources	Statewide	Hydrologic studies in support of the Alaska natural gas pipeline	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Smith, J. G.	--	Geologic	Southeastern	Application of potassium-argon dating techniques	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2484

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work–Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Smith, T. N.	(See Petering, G. W.)				
Smith, T. N., and Petering, G. W.	Lyle, W. M. (State of AK) Bolm, J. G.	Conservation	Southwestern	Investigation of geology adjacent to OCS sale areas	800 A Street Anchorage, AK 99501 (907) 271-4361
Steffy, David	(See Comer, C. D)				
Still P. J.	--	Water Resources	Statewide	Data reduction, Yukon subregion	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Still, P. J.	Lamke, R. D. Madison, R. J. Brunett, J. O.	Water Resources	Statewide	Collection of stream-sediment data	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 (907) 271-4138
Stricker, G. D.	Roehler, H. W.	Geologic	Statewide	Evaluation of coal resources and assessment of Btu values and other coal characteristics	Branch of Coal Resources Denver Federal Center, Box 25046 Lakewood, CO 80225 (303) 234-3588
Thrasher, G. P.	(See Turner, B. W.)				
Thrasher, G. P., and Craig, J. D.	--	Conservation	Offshore	Mapping shallow geologic features, Beaufort Shelf	800 A Street Anchorage, AK 99501 (907) 271-4361
Thrasher, G. P., and Turner, B. W.	--	Conservation	Offshore	Mapping shallow geologic features, Kodiak Shelf	800 A Street Anchorage, AK 99501 (907) 271-4361
Till, A. B.	King, H. D.	Geologic	West-central	Mineral resource appraisal, Solomon and Bendeleben quadrangle	Branch of Alaskan Geology 218 E Street Anchorage, AK 99501 (907) 271-4355
Till, A. B.	Riehle, J. R. Yount, M. E.	Geologic	Southern	Volcanic hazards studies, Cook Inlet	Branch of Alaskan Geology 218 E Street Anchorage, AK 99501 (907) 271-4355
Townshend, J. B.	Papp, J. E. Sauter, E. A. Nelson, M. N. Rudge, K. A.	Geologic	East-central (location of observatory)	Operation of College Observatory to produce geomagnetic and seismic data for national and international use	Branch of Electromagnetism and Geomagnetism College Observatory Yukon Drive on West Ridge Fairbanks, AK 99701 (907) 479-6146

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Tripp, R. B.	Hampton, J. O. Huston, D. L.	Geologic	Southern	Geochemical sampling and analysis in support of AMRAP, Mount Hayes quadrangle	Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303)234-5536
Tripp, R. B.	Wong, H. W. Spiesman, D. L.	Geologic	East-central	Use of geochemistry in support of AMRAP, Circle quadrangle	Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-5536
Turner, B. W.	(See Comer, C. D.)				
Turner, B. W.	(See Thrasher, G. P.)				
Turner, B. W., and Thrasher, G. P.	--	Conservation	Offshore	Mapping shallow geologic features, eastern Gulf of Alaska	800 A Street Anchorage, AK 99501 (907) 271-4361
Turner, R. F.	Cuffy, R. J. (Penn. St. Univ.) Thrasher, G. P. Turner, B. W. Ariey, Catherine Larson, J. A. Olson, D. W.	Conservation	Southern	Taxonomy and ecology of fossil and modern Bryozoa, Gulf of Alaska	800 A Street Anchorage, AK 99501 (907) 271-4361
Turner, R. F., and Larson, J. A.	Olson, D. W. Flett, T. O.	Conservation	Southern	Biostratigraphy and paleoenvironment studies, Gulf of Alaska	800 A Street Anchorage, AK 99501 (907) 271-4361
Vacant	--	Water Resources	Southern	Studies of lake formation at Knik Glacier	733 W. 4th Avenue, Suite 400 Anchorage, AK 99501 Fairbanks, AK 99701 (907) 271-4138
Vallier, T. L.	(See Scholl, D. W.)				
von Heune, R. E.	Fisher, M. A. Cochrane, G. R.	Geologic	Offshore	Studies of geologic framework and resource assessment, western Gulf of Alaska	Branch of Pacific-Arctic Geology 345 Middlefield Road, MS 99 Menlo Park, CA 94025 (415) 856-7105
Wahrhaftig, Clyde	--	Geologic	Southern	Evaluation of coal in central Alaska Range	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2664

Table 3.--Listing of project chiefs, associated personnel, and brief description of project work--Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Weber, F. R.	Foster, H. L. Hamilton, T. D.	Geologic	East-central	Studies of glacial history, Yukon-Tanana Upland	Branch of Alaskan Geology Box 80568 Fairbanks, AK 99708 (907) 479-7245
White, E. R.	Coonrad, W. L. Salem, B. B.	Geologic	Statewide	Design and implementation of bibliographic computer data base for materials available from Tech. Data and for earth science literature on Alaska	Technical Data Unit Alaskan Geology Branch 345 Middlefield Road, MS 48 Menlo Park, CA 94025 (415) 323-8111 x 2342 or 2684
White, E. R.	Okamura, Ann Tailleur, M. E.	Geologic	Statewide	Information, procurement, and publication services	Technical Data Unit Alaskan Geology Branch 345 Middlefield Road, MS 48 Menlo Park, CA 94025 (415) 323-8111 x 2342 or 2684
Wilcox, D. E.	--	Water Resources	Southern	Study of trace metals in surface water, Healy and Lignite Creek basins	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 x 214
Williams, J. R.	(See Winkler, G. R.)				
Williams, J. R.	Connor, C. L. (Univ. of MT)	Geologic	Southern	Mapping surficial deposits of southwestern Copper River basin	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4130
Williams, J. R.	Kachadoorian, Reuben Ferrians, O. J., Jr. Sloan, C. E.	Geologic	Statewide (corridor)	Provides advice to agencies responsible for plan and design review	Branch of Alaskan Geology 345 Middlefield Road, MS 90-B (415) 323-8111 x 4130
Wilson, F. H.	Shew, Nora	Geologic	Statewide	Geochronological and petrologic studies	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Winkler, G. R.	--	Geologic	Southern	Mineral-resource assessment, Anchorage quadrangle	Branch of Alaskan Geology 1209 Orca Street Anchorage, Alaska 99501 (907) 271-4150
Winkler, G. R.	Case, J. E. Grantz, Arthur Johnson, K. M. Le Compte, J. R. Miller, R. J. Silberman, M. L. Williams, J. R.	Geologic	Southern	Mineral-resource assessment, Valdez quadrangle	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150

Table 3.–Listing of project chiefs, associated personnel, and brief description of project work–Continued

Project Chief	Associated Personnel	Organizational Designation	Region of Operation	Type of Work	Mailing Address and Telephone Number
Winkler, G. R., and Williams, J. R.	Johnson, K. M. Connor, C. L. (Univ. of MT)	Geologic	Southern	Mapping of surficial deposits, Valdez quadrangle	Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150 (Winkler) Branch of Alaskan Geology 345 Middlefield Road, MS 90-B Menlo Park, CA 94025 (415) 323-8111 x 4130 (Williams)
Witmer, R. J.	--	ONPRA	Northern	Maintaining file of paleontologic data, NPRA	ONPRA Casa Mills 200 Middlefield Road, MS 87 Menlo Park, CA 94025 (415) 323-8111 x 2138
Wood, S. H.	--	Geologic	Southern	Tectonic tilt measurements in southern Alaska	Branch of Earthquake Tectonics and Risk Boise State University Boise, ID 83702 (208) 385-1631
Yeend, W. E.	Yuan, Georgia (National Res.	Geologic	Statewide	Investigations of placers	Branch of Alaskan Geology 345 Middlefield Road, MS 17 Menlo Park, CA 94025 (415) 323-8111 x 2541
Yehle, L. A.	(See Schmoll, H. R.)				

Many of the Survey's programs and projects in Alaska are planned with and funded by other Federal, State, and local agencies. The Survey enters into these formal cooperative agreements to improve information-gathering abilities and when such cooperation is advantageous to the agencies and to the public. In many situations, the cost of the project is shared equally by the Survey and the cooperator. These cooperative programs are reviewed annually to assure that they continue to be responsive to current needs of the agencies and the public. The table below lists FY 1981 cooperators in Alaska.

Table 4.--Cooperating Agencies

[Federal cooperators within the same division as the project are not listed.]

Federal	State	Local	Project Title	Project Chief	Organizational Designation
Dept. of Agriculture, Forest Service; U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL)	Depts. of Natural Resources (ADNR); Fish and Game; Transportation; Environmental Conservation Alaska Power Authority	Municipality of Anchorage; Kenai Peninsula Borough; Fairbanks North Star Borough	Collection of Basic Records Program (surface water, ground water, water quality)	Division personnel	Water Resources
Bureau of Land Management (BLM); National Aeronautics and Space Administration (NASA);	University of Colorado, Institute of Arctic and Alpine Research		Vegetation Mapping of Northern Alaska	Gaydos, L. J.	National Mapping
Dept. of Agriculture, Soil Conservation Service; Bureau of Land Management (BLM)	Univ. of Alaska		Operation of IDIMS in Vegetation Classification	Carneggie, D. M.	EROS Field Office
Army, Chief of Engineers; Dept. of Interior			Alaska Natural Gas Transportation System	Williams, J. R.	Geologic
National Oceanic and Atmospheric Administration (NOAA); CRREL			Alaska Seismic Studies	Lahr, J. C.	Geologic
NOAA			National Petroleum Reserve in Alaska Paleontologic Data	Witmer, R. J.	ONPRA
National Park Service			Classification of Vegetation and Sheep/Goat Habitat in Part of the Wrangell-St. Elias National Monument	Fleming, M. D., Wright, G. R.	EROS Field Office
Dept. of the Interior			Hydrologic Conditions along the Proposed Route of the Alaska Natural Gas Pipeline	Sloan, C. E.	Water Resources

Table 4.–Cooperating Agencies–Continued
[Federal cooperators within the same division as the project are not listed.]

Federal	State	Local	Project Title	Project Chief	Organizational Designation
Dept. of State			Geologic Framework and Resource Assessment of the Aleutian-Bering Sea Region	Marlow, M. S.	ONPRA
Dept. of Agriculture, Forest Svc.			Vegetation Classification using Landsat Data for Renewable Resource Evaluation Research for Alaska	Fleming, M. D.	EROS Field Office
Environmental Protection Agency (EPA)			Hydrologic Studies Related to Coal Mining	Krumhardt, A. P.	Water Resources
EPA			Hydrology of the Capps Creek Coal Area	Nelson, G. L.	Water Resources
EPA			Nutrient Limitation in Two Arctic Lakes near Umiat	McCoy, G. A.	Water Resources
NOAA, National Oceanic Survey			Alaskan Bathymetric and Topographic Maps	McLaurin, J. D.	National Mapping
NOAA			National Petroleum Reserve in Alaska Data Open File	Carter, R. D.	ONPRA
Office of National Petroleum Reserve in Alaska (ONPRA)			Geochemistry of Oilfield Waters, National Petroleum Reserve in Alaska	Kharaka, Y. K.	Water Resources
ONPRA; Conservation Division			Brooks Range Devonian Clastic Rocks	Brosgé, W. P.	Geologic
ONPRA			Borehole Gravity Studies in the National Petroleum Reserve in Alaska	Schmoker, J. W.	Geologic
CRREL, AK District			Sediment Transport in the Tanana River in the Vicinity of Fairbanks, Alaska	Burrows, R. L.	Water Resources
Bureau of Mines			Chugach National Forest (RARE II)	Nelson, S. W.	Geologic
	ADNR, Div. of Geological and Geophysical Surveys (DGGS)		Lower Cook Inlet-Shelikof Strait Field Program, 1980	Smith, T. N., Petering, G. W.	Conservation
	DGGS	Kenai Peninsula Borough; Municipality of Anchorage	Ground-water Stations in Alaska	Lamke, R. D.	Water Resources
	Univ. of Alaska, Geophysical Inst.		Effect of Date and Phenology on Classification of Alaska Vegetation Using Landsat Data	Lauer, D. T.	EROS Field Office

Table 4.--Cooperating Agencies--Continued
[Federal cooperators within the same division as the project are not listed.]

Federal	State	Local	Project Title	Project Chief	Organizational Designation
	ADNR, Div. of Forest, Land, and Water Management		Alaska Water-Use Data Program	Patrick, L. D.	Water Resources
	DGGS		Earthquake Hazards Mapping, Anchorage-Susitna Lowlands	Ferriana, O. J., Jr.	Geologic
	DGGS		Integration of Data, Lower Cook Inlet	Bolm, J. G., Lyle, W. M.	Conservation
	DGGS		Alaska Mineral Resource Appraisal (AMRAP)	Miller, T. P.	Geologic
	DGGS		Knik Glacier Studies	Vacant	Water Resources
	Pennsylvania State Univ.		Taxonomy, Ecology, and Bathymetric Distribution of Fossil and Recent Bryozoa, Kodiak Shelf, Gulf of Alaska	Turner, R. F.	Conservation
		Kenai Peninsula Borough	Water Resources Investigation of the Kenai Borough	Nelson, G. L.	Water Resources
		Municipality of Anchorage	Geohydrology of the Anchorage area	Cowing, D. J.	Water Resources