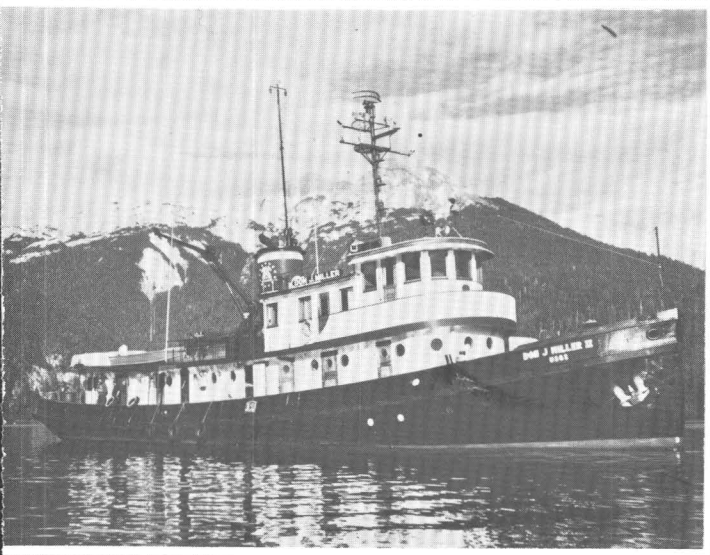
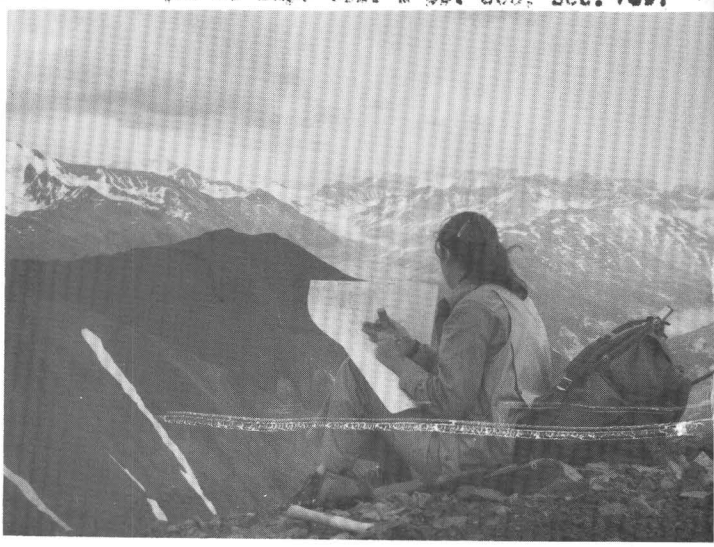
THE U. S. GEOLOGICAL SURVEY IN ALASKA





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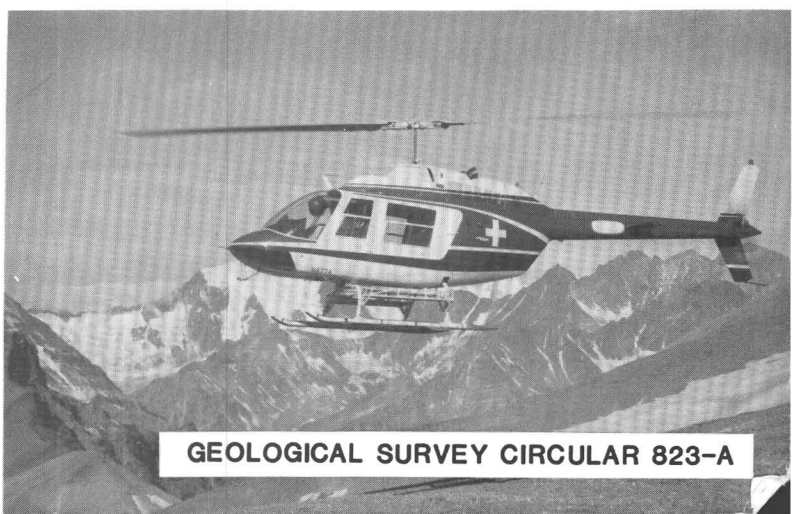

GEOLOGICAL SURVEY CIRCULAR 823-A

Cover photographs, clockwise from the top:

Geologists on Augustine Island, an active volcano
(Photo by Hans-Ulrich Schmincke, Bochum, W. Germany)
Geologic mapping in central Alaska
Helicopter being used in Survey activities
Instruments at Sitka Observatory
The Survey's vessel used in coastal work in Alaska

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

1980 PROGRAMS

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GEOLOGICAL SURVEY CIRCULAR 823-A

1980

UNITED STATES DEPARTMENT OF THE INTERIOR
CECIL D. ANDRUS, *Secretary*

GEOLOGICAL SURVEY
H. WILLIAM MENARD, *Director*

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and Public Inquiries Office, 508 Second Avenue, Anchorage, AK 99501

FOREWORD

During the past decade, preservation of our natural environment and realization that our mineral and energy resource supplies are becoming increasingly short have become major national concerns that deeply affect our domestic and foreign well being. The impact of these concerns and the Nation's reaction to them is surfacing in world events and, in economic terms, in the Nation's negative balance of payments and the problems of inflation.

Alaska's little explored potential for energy and mineral resources and the effort to preserve the essentially untouched natural environment of most of Alaska have been thrust into the limelight by these conflicting and rapidly emerging issues.

In the decade ahead, information concerning Alaskan resources will be a vital base from which to make intelligent national resource decisions. In view of this, the Geological Survey is in the process of expanding and consolidating its activities in Alaska.

Notable program changes in 1980 are as follows:

Establishment of a USGS/EROS Field Office in Anchorage. This facility will provide Landsat/Remote-Sensing digital analysis images, training, and technical assistance for users. In addition, files of other satellite and aerial photographs will be maintained.

Establishment of an Alaskan Headquarters for the National Mapping Division; increased funding for topographic mapping; and the establishment of a National Cartographic Information Center in Alaska.

A new program for research in Arctic Hydrology.

Establishment of a regional headquarters in Alaska for the Conservation Division and increased funding for an expanded program of Outer Continental Shelf and onshore oil and gas lease activities.

Relocation of the headquarters of the Geologic Division's Branch of Alaskan Geology from Menlo Park, California, to Anchorage, Alaska.

Five additional oil and gas exploration wells were started in the National Petroleum Reserve in northwestern Alaska. When these wells are completed in late 1980, a total of 24 wells will have been drilled in the current exploration program which was begun by the Navy in 1975 and transferred to the Department of the Interior in 1977.

H. W. MENARD
Director, U.S. Geological Survey

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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**

INTRODUCTION

Alaska is at once the largest, the least populated, the least explored, and the least developed of the Nation's states. The land area of Alaska contains 375 million acres, 16 percent of the onshore land of the Nation. More than half of the United States' 600 million acres of Outer Continental Shelf lies off Alaska's coast. Alaska's resources of all kinds, which are largely undeveloped and only partly assessed, present an opportunity to demonstrate how the needs of development and conservation can be met for the benefit of America's citizens.

The U.S. Department of the Interior's Geological Survey, established in 1879, is the Nation's principal fact-finding agency concerned with physical resources -- the configuration and character of the land surface, the composition and structure of the underlying rocks, and the quality, volume, and distribution of water and minerals. The Survey is an impartial research agency that gathers, interprets, and distributes data to advance scientific knowledge of the Earth and so that managerial decisions related to natural resources can be based on objective information.

The Geological Survey's first leaders were men of many accomplishments -- scientists, authors, and administrators. Men like Clarence King and John Powell established the Survey's tradition of scholarship and integrity, which continues to this day. The Survey began its work in Alaska in 1889 with the exploration and survey of the Alaska-Canada border. The 90 years that followed have seen the Survey's involvement in the State grow. In the last decade Survey personnel in Alaska have been active in basic earth science research and in projects associated with the construction of the trans-Alaska oil pipeline, exploration for oil, gas and coal as well as other energy and mineral resources, and studies of earthquake hazards. In addition, the Survey makes maps of the State and collects many types of hydrologic data.

This Circular describes the 1980 programs and projects of the Survey in Alaska. A brief description of the Alaskan operations of each major division of the Survey is followed by project descriptions arranged by geographic regions in which the work takes place. A directory table at the back of this booklet lists all project chiefs in alphabetical order and presents other summary information as well.

A companion Circular, 823-B, consists of articles describing significant accomplishments of the Survey's topical and field investigations in Alaska during 1979.

ORGANIZATION OF THE GEOLOGICAL SURVEY

The mission of the Geological Survey is to identify the Nation's land, water, mineral and energy resources; to classify its federally owned mineral lands and water-power sites; to resolve the exploration and development of Federal and Indian lands; and to appraise the petroleum potential of the National Petroleum Reserve in Alaska. The operational work of the Survey is accomplished by four divisions and two offices (fig. 1). The function and purpose of each of these are described briefly below.

Within the Director's Office, the OFFICE OF NATIONAL PETROLEUM RESERVE IN ALASKA (ONPRA) has been established to evaluate the resources of the 37,000-square-mile National Petroleum Reserve in Alaska (NPRA) located in northwestern Alaska.

The OFFICE OF LAND INFORMATION AND ANALYSIS (LIA), also part of the Director's Office, has organized to develop multidisciplinary land-resources programs of the Survey.

The NATIONAL MAPPING DIVISION is charged with the execution of surveys and the preparation of maps, charts, and bulletins pertaining to the delineation of the physical features of land areas in the United States, its outlying areas, and Antarctica.

The GEOLOGIC DIVISION studies include geologic and geophysical mapping to establish the composition and structure of rocks beneath the surface of the land and the outer continental shelves; research into geologic principles and processes to provide guidance for significant geologic interpretations, including specialized research in geochemistry, geophysics, and paleontology; development of new exploration techniques; and collation and synthesis of geologic knowledge of mineral and mineral fuels resources.

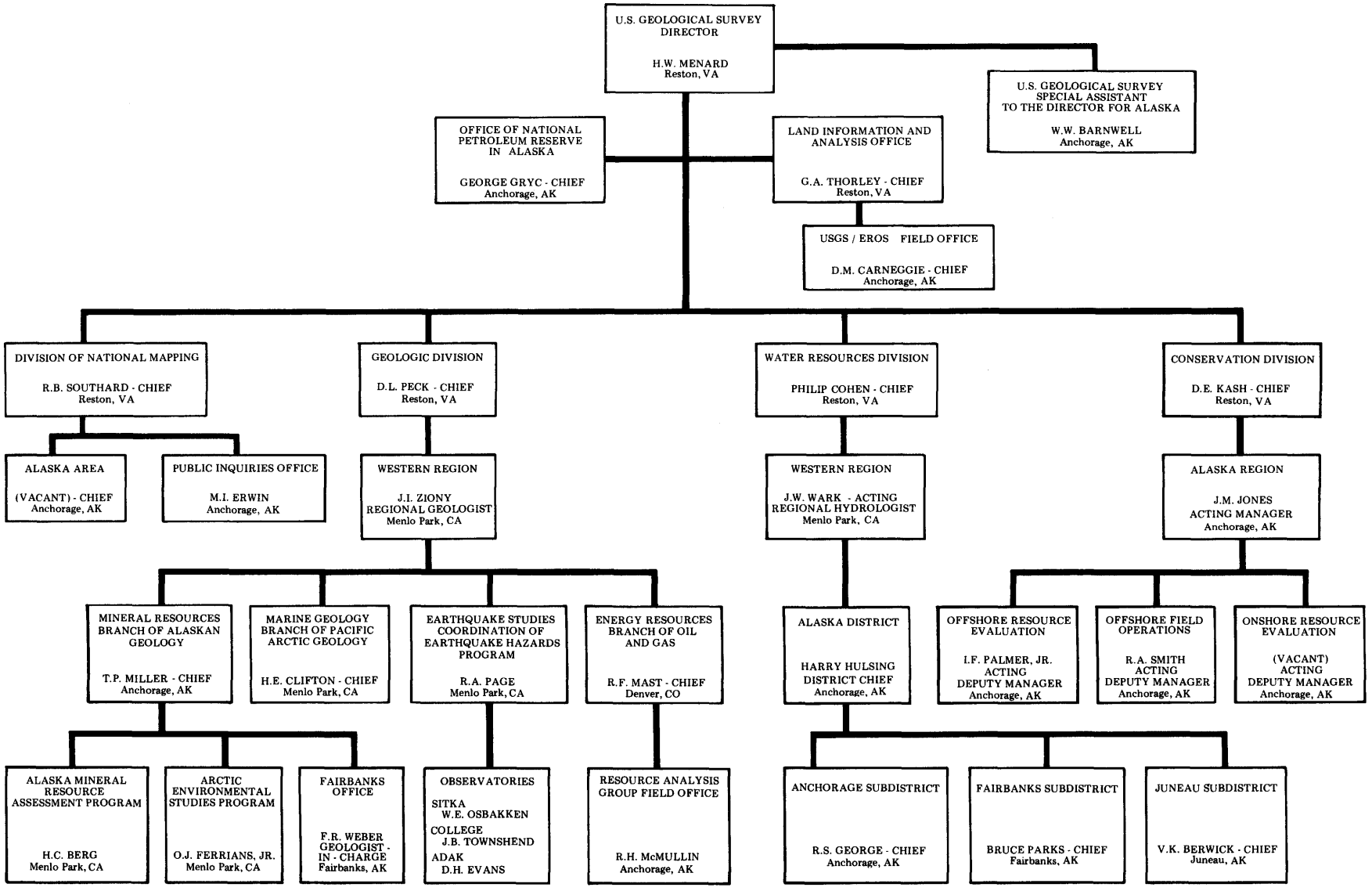


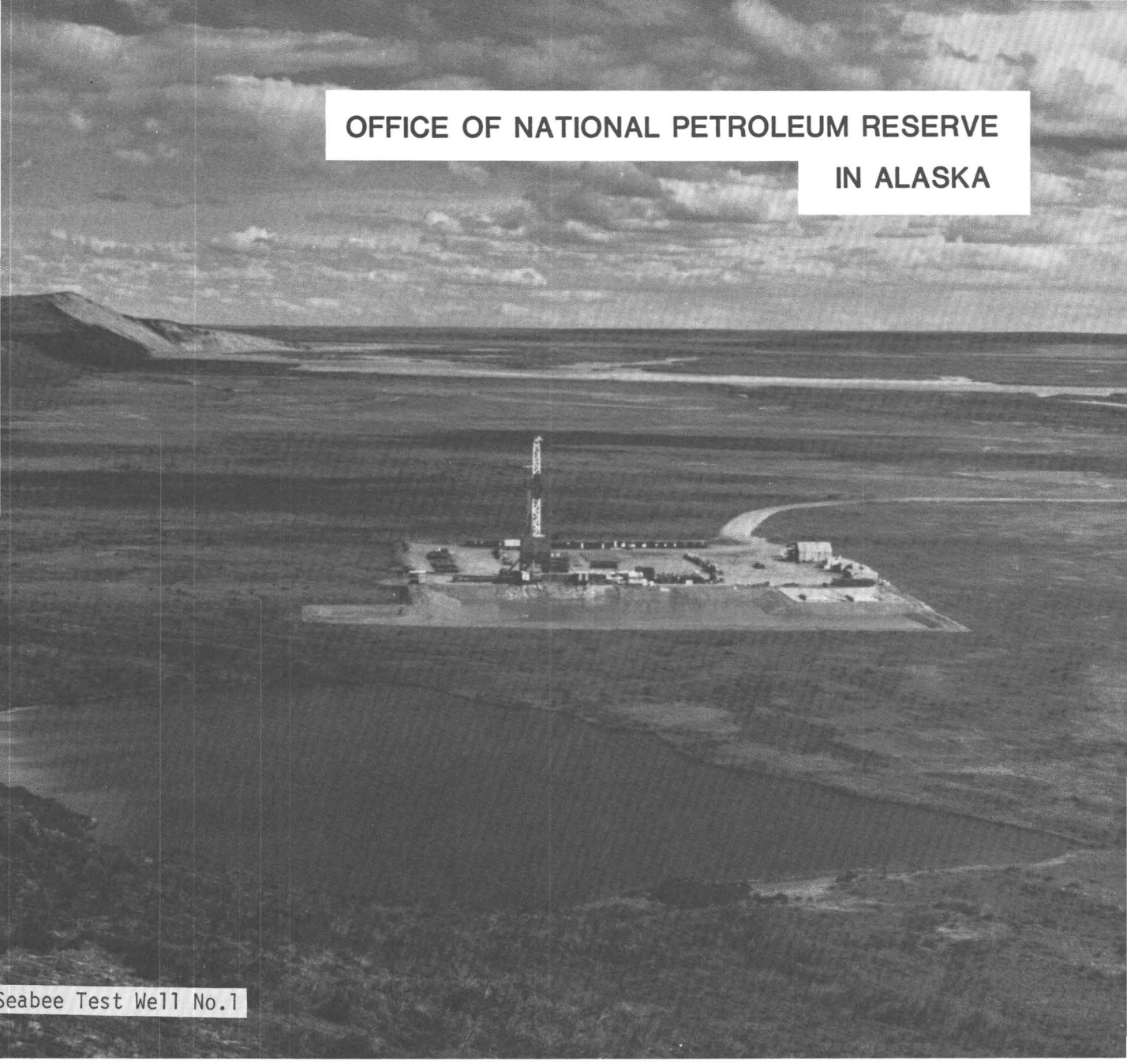
Figure 1.-- Organization of the U. S. Geological Survey as it pertains to Alaska.

The WATER RESOURCES DIVISION investigates the occurrence, quantity, quality, distribution, and movement of surface and underground water that comprises the Nation's water resources.

The CONSERVATION DIVISION examines and classifies Federal lands in the United States as to their mineral character, water-power and water-storage values, supervises technical operations under oil and gas and other mineral leases on Federal, outer continental shelf, Indian and Naval petroleum reserve lands, and maintains accounts of related production and royalty accruals.

Leadership of the Geological Survey is provided by the Director, whose office is located in the National Center, Reston, Virginia. He is represented in Alaska by a Special Assistant for Alaska, who is responsible for coordination of Survey activities in Alaska. The Assistant's office is in Anchorage.

OFFICE OF NATIONAL PETROLEUM RESERVE IN ALASKA



Seabee Test Well No.1

For further information, contact the offices listed below.

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George Gryc, Chief; or

Max Brewer, Chief, Operation Office

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OFFICE OF THE NATIONAL PETROLEUM RESERVE IN ALASKA

On April 5, 1976, as part of the Naval Petroleum Reserves Production Act (Public Law 94-258), the Naval Petroleum Reserve No. 4 was redesignated as the National Petroleum Reserve in Alaska (NPRA), and jurisdiction was transferred from the Secretary of the Navy to the Secretary of the Interior. The Secretary of the Interior assigned the responsibility for the surface management of the 23.68 – million-acre Reserve, approximately the size of the State of Indiana (fig. 2), to the Bureau of Land Management, the responsibility for the on-going exploration program to the U.S. Geological Survey.

The Geological Survey, through the Office of National Petroleum Reserve in Alaska (ONPRA), assumed management of the exploration program on June 1, 1977, the effective date for transfer of jurisdiction as stipulated in the Act. Husky Oil NPR Operations, Inc., continued as the prime contractor for all phases of the Geological Survey's exploration program, as mandated under the terms of the Act which called for the continuation of all previously existing Navy contracts.

At the time of the transfer, the Survey assumed responsibility for the following specific tasks:

(1) Explore the Reserve and evaluate the petroleum potential of the area by means of geological and geophysical investigations and by drilling. The evaluation of the petroleum potential is intended to assist the Congress in determining the best use of the land within the Reserve.

(2) Continue to develop and produce natural gas from the South Barrow Gas Field, or other fields as necessary, to supply gas at reasonable and equitable rates to the Native village of Barrow and other communities and governmental installations located near or at Point Barrow.

(3) Continue environmental rehabilitation in areas of the Reserve disturbed by previous exploration and governmental construction activities.

The first complete year of Survey activities in the NPRA was Fiscal Year (FY) 1978. The exploration program for FY 1979 included completing two test wells begun in FY 1978, Inigok and South Meade. In addition, five exploratory wells were spudded during FY 1979. Two of these, Seabee and Lisburne, are deep wells (more than 14,000 feet). The remaining three were drilled to medium depths (3,000 to 14,000 feet) and completed before the end of the fiscal year: Peard, East Simpson No. 1, and J. W. Dalton. At the close of FY 1979, drilling was continuing at the following deep test wells: Tunalik (FY 1978), Lisburne, and Seabee.

The exploration program for FY 1980 includes continuing work on four deep test wells. Ikpikpuk Test Well No. 1 (FY 1978) was reentered in late December 1979, and the total depth of 15,481 feet was reached on February 13, 1980. In early January 1980, Tunalik Test Well No. 1, also part of the FY 1978 program, was plugged and abandoned at a total depth of 20,335 feet, making it the deepest well ever drilled in Alaska. As of February 1, 1980, Seabee Test Well No. 1 was at 13,179 feet, and Lisburne Test Well No. 1 was at 12,092 feet. The anticipated completion date for both wells is April 1980.

Another deep well, Awuna Test Well No. 1, will be spudded during the winter of FY 1980. With an anticipated depth of about 15,000 feet, it is planned as a two-season well and will not be completed until the late winter of FY 1981. It is located in the Northern Foothills Province and is approximately 152 miles south-southwest of Barrow.

Plans for the FY 1980 program also include three new medium-depth wells on the coastal plain. One of these, Walakpa Test Well No. 1, had been drilled to its total depth of 3,666 feet by February 1, and a gas zone at 2,071 feet was being tested. A second well, East Simpson No. 2, was at 2,410 feet on February 1. The other medium-depth test well, West Dease, is planned for spudding later in the winter.

By the end of the 1980 program year, 22 exploration wells will have been completed under the present program and one well will be in progress on the NPRA. More specific information on the exploratory wells may be found in table 1a.

Seismic data are being obtained as another important part of the petroleum exploration within the NPRA. In FY 1980, 977 line miles of seismic and related geophysical information will be acquired.

The Geological Survey also is responsible for the operation of the South Barrow Gas Field as part of the Congressional mandate to the Secretary of the Interior under Public Law 94-258. Natural gas requirements for the Community of Barrow have increased with improved and larger housing and with the addition of many new public facilities. To comply with the mandate, South Barrow Wells 14, 17, and 19 were completed as producible gas wells in FY 1979. Additionally, an all-season gravel road was completed to the pressure reducing station in the South Barrow Field.

Additional drilling is planned for FY 1980 to accommodate the increased rate of consumption and to more fully develop the eastern portion of the South Barrow Field. South Barrow Wells 15, 18, and 20 will be drilled to depths of approximately 2,400 feet (table 1b). These new gas wells in a separate reservoir will reduce the rate of demand on the rapidly declining reserves in the original field, and slowing the rate of the

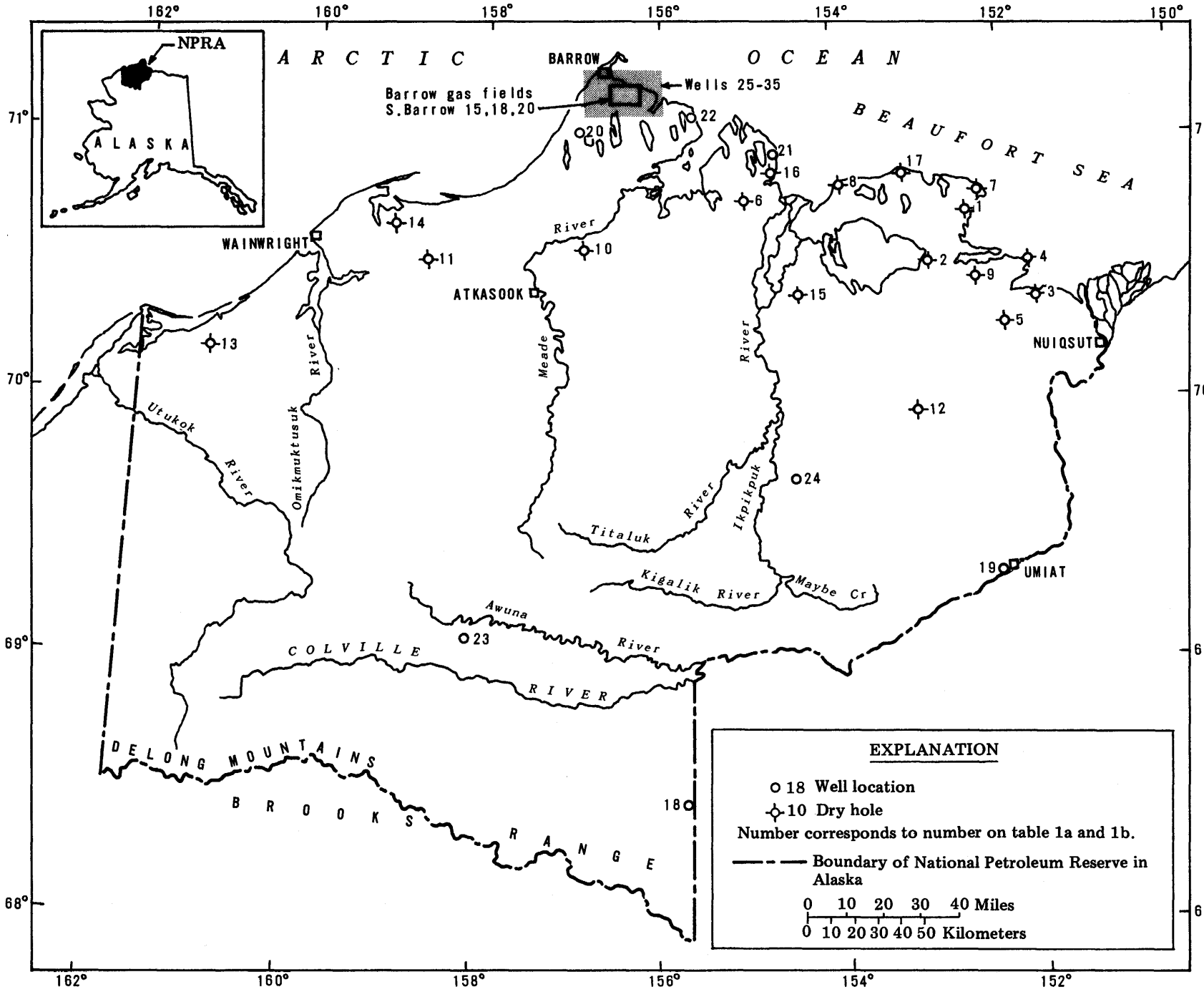

Figure 2. -- Exploration wells on National Petroleum Reserve in Alaska.

Table 1a. -- Exploration wells drilled by the Navy from 1975 through 1977 and wells drilled or planned during the USGS program from FY 1978 through FY 1979. Status of wells in progress is shown as of February 1, 1980.

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	10,644 ft	Granite basement	Dry; plugged and abandoned
3	So. Harrison Bay No. 1	50 mi SE of Barrow	11/21/76	2/8/77	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	3/18/77	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	4/27/77	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	4/30/77	8,805 ft	Argillite basement (Devonian or older)	Gas shows; plugged and abandoned
7	W. T. Foran No. 1	23 mi ESE of Lonely	3/7/77	4/24/77	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 (Devonian or older)	Poor oil and gas shows; plugged and abandoned
10	So. Meade Test Well No. 1	45 mi S of Barrow	2/7/78 (12/4/78) reentered	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	2/12/78	5/29/78	12,588 ft	Lisburne Group (Mississippian)	Poor gas shows; 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)	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	Poor-fair gas show; plugged and abandoned
14	Peard Test Well No. 1	25 mi NE of Wainwright	1/27/79	4/13/79	10,225 ft	Argillite basement (Devonian or older)	Trace of oil and gas shows; plugged and abandoned

Table 1a. -- 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	11/28/78	Drilling	16,000 ft (projected)	Argillite basement (projected)	Drilling at 15,271 ft on 2/1/80, no significant shows
16	East Simpson Test Well No. 1	33 mi W of Lonely	2/19/79	4/10/79	7,739 ft	Argillite basement	Poor oil show; plugged and abandoned
17	J. W. Dalton Test Well No. 1	3 mi E of Lonely	5/7/79	8/1/79	9,367 ft	Argillite basement	Residual heavy oil show; plugged and abandoned
18	Lisburne Test Well No. 1	110 mi SW of Umiat	6/11/79	Drilling	15,000 ft (projected)	Lisburne-Endicott Group (projected)	Drilling at 12,092 ft on 2/1/80; no zones of interest
19	Seabee Test Well No. 1	1 mi NW of Umiat	7/1/79	Drilling	15,000 ft (projected)	Basal Cretaceous (projected)	Drilling at 13,179 ft on, 2/1/80; minor oil and gas show
20	Walakpa Test Well No. 1	14 mi S of Barrow	12/25/79	Testing	3,666 ft	Argillite basement	Testing gas zone on 2/1/80
21	East Simpson Test Well No. 2	35 mi W of Lonely	1/29/80	Drilling	7,600 ft (projected)	Argillite basement (projected)	Drilling at 2,410 ft on 2/1/80; no zones of interest
22	West Dease Test Well No. 1	28 mi ESE of Barrow			4,000 ft (projected)	Argillite basement (projected	Preparing location 2/1/80
23	Awuna Test Well No. 1	152 mi SSW of Barrow			15,000 ft (projected)	Fortress Mountain Formation, Cretaceous (projected)	Preparing location 2/1/80
24	Koluktak Test Well No. 1	118 mi SSE of Barrow FY 81			4,500 ft	Torok Formation, (projected) (projected)	Preparing location 2/1/80 Cretaceous

Table 1b. -- Barrow gas wells recently drilled by the Navy and the Geological Survey. (See fig. 2.)

Map Number	Name	Location	Date Spudded	Date Completed	Total Depth	Deepest Horizon Attained	Remarks
25	So. Barrow No. 11	Sec. 14, T22N, R18W	2/10/74	3/6/74	2,350 ft	Argillite basement (Devonian or older)	Completed as gas producer
26	So. Barrow No. 12	Sec. 23, T22N, R17W	3/10/74	5/4/74	2,285 ft	Argillite basement (Devonian or older)	Suspended as marginal gas well
27	Iko Bay*	Sec. 16, T21N, R16W	2/1/75	3/8/75	2,731 ft	Argillite basement (Devonian or older)	Marginal gas well
28	So. Barrow No. 13	Sec. 14, T22N, R18W	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	Sec. 25, T22N, R17W	1/28/77	3/1/77	2,257 ft	Sag River Sand (Triassic)	Suspended; completed as gas well on 3/2/79
30	So. Barrow No. 16	Sec. 1, T22N, R18W	1/28/78	2/17/78	2,400 ft	Argillite basement (Devonian or older)	Dry; plugged and abandoned
31	So. Barrow No. 17	Sec. 30, T22N, R16W	3/2/78	4/13/78	2,382 ft	Argillite basement (Devonian or older)	Suspended; edge well; completed as marginal gas well on 3/25/79
32	So. Barrow No. 19	Sec. 23, T22N, R17W	4/18/78	5/17/78	2,300 ft	Argillite basement (Devonian or older)	Suspended; completed as gas well on 2/16/79
33	So. Barrow No. 15	Sec. 23, T22N, R17W	Planned 7/15/80		2,400 ft (projected)	Argillite basement (Devonian or older)	
34	So. Barrow No. 18	Sec. 24, T22N, R17W	Planned 8/29/80		2,400 ft (projected)	Argillite basement (Devonian or older)	
35	So. Barrow No. 20	Sec. 26, T22N, R17W	Planned 10/13/80		2,400 ft (projected)	Argillite basement (Devonian or older)	

*Iko Bay well was drilled approximately 20 miles southeast of Barrow to locate a new gas field to supplement the gas supply for Barrow.

drop in pressure. Drilling is scheduled to begin in July 1980 and will require approximately 30 to 45 days at each site to complete the wells for production.

A new pressure reducing station, all-season access roads between the southern and eastern portions of the field and to all the new wellsites, and gathering pipelines will be constructed in FY 1980. The access roads will provide for maintenance capabilities on a year-round basis without extensive damage to the tundra from vehicles traveling to the wells. It is anticipated that approximately 1.1 billion cubic feet of natural gas will be produced and used locally during FY 1980.

Conducting a major exploration program without disrupting the tundra environment or impacting the wildlife of Alaska's North Slope presents a major challenge to the Survey. Sound environmental protection procedures have evolved from the cumulative experiences gained during the 1944-53 exploration program, from industry's experience in the Prudhoe Bay area, and from the Canadian exploration program. Much of the knowledge, however, is the result of research and recent operational experiences within the NPRA. Since 1944, Survey personnel have been involved in geological and geophysical exploration activities on the NPRA. Many of these same individuals provide expertise for today's exploration program.

Two early major developments impacted the Reserve: (1) the Department of the Navy's Oil Exploration from 1944 to 1953, and (2) the construction of the Distant Early Warning Line (DEWLine) of radar stations begun in 1953 by the U.S. Air Force. During the earlier programs, the pioneering efforts emphasized being able to operate in a new environment and getting the job done. Environmental protection was not a major concern of the American public or the operators, and evidence of some of this lack of concern is still present today -- bulldozed trails, some of which are now canals, mar the landscape; eroded banks and tundra denote the old areas of operation; and widespread litter, particularly old fuel drums, remains around former exploration sites and trails. The program for the cleanup of this old litter will be continued on the NPRA during FY 1980. This will include the burial of junk and debris of the Grandstand and Gubic well sites. While both are outside of the NPRA, the litter resulted from the 1944-53 exploration program and hence will be cleaned up.

After the discovery of the Prudhoe Bay oil field in 1968 and with the advent of more rigorous environmental stipulations, additional knowledge of sound Arctic engineering and environmental practices was acquired through research, construction, and development and, more importantly, was adopted as a mode of operation. These past experiences have led to the development of improved procedures and new techniques; therefore, the current ONPRA exploration program is proceeding with a minimal amount of environmental disruption.

Advances in construction and engineering techniques continue today. During the current program, Hi-Density Styrofoam insulation has been used to reduce the amount of borrow material used in the drilling pads and airstrips at four deep wells designed for year-around operations: Tunalik, Inigok, Lisburne, and Seabee. Using a one-inch layer of insulation, generally with the same insulating properties as provided by approximately one foot of gravel, the typical 5- to 6-foot-thick all-season pads are reduced to a thickness of 2 to 3 feet. Personnel from the U.S. Army's Cold Regions Research and Engineering Laboratory (CRREL) monitor the thermal characteristics of the permafrost at these installations. Thermocouples, installed during the construction phase, are read periodically, and the data obtained are used for design improvements at other installations.

The lack of adequate construction material (sand/gravel) in most areas of the NPRA fostered another design concept, the thin pad. This concept, limited to winter operations, utilizes only the material excavated during the construction of the reserve (mud) pit for the drilling pad. The design was used successfully, both from an environmental and an engineering standpoint, at the South Meade wellsite in FY 1978 and at the Peard and East Simpson wellsites in FY 1979. All five new exploration wellsites for the FY 1980 program will be drilled during the winter months; therefore, the thin-pad concept will be used. Borrow sites, and their attendant ice access roads, will not be required at any of the FY 1980 exploratory sites. As a result, possible disturbances to the tundra from the opening of borrow sites and the hauling of the material will be eliminated. Overall, reduced construction requirements result in fewer acres of tundra that may need rehabilitation.

It has been observed that these thin drilling pads generally are high enough above the adjacent tundra that wind will keep the pad surface relatively free of snow. A drilling pad constructed in this manner tends to settle during the thaw season until pad relief is insignificant when compared to the surrounding tundra. It also will provide suitable seed bed material for the grass seed spread over the disturbed areas during the rehabilitation program. The low profile of the thin pad brings the seed bed closer to the water table and thus accelerates the revegetation process.

As one of the last generally de facto wilderness areas in the United States, the North Slope of Alaska, including the NPRA, is home or nesting area to a variety of wildlife species, including caribou, moose, grizzly bear, gray wolf, wolverine, polar bear (along the coast), geese, ducks, shorebirds, falcons, hawks, eagles and owls. Most of the mammals are year-around residents of the Reserve, but the majority of the birds are present during only part of the year. Large numbers of waterfowl, shorebirds, and songbirds move into the area each spring to breed and raise

South Meade Test Well No. 1, a medium-depth well drilled only during the winter months, was completed in FY 1979. The ice road shown above leads to the wellsite from the ice airstrip, borrow sites, and water source lakes used in support of the South Meade operation. It is typical of the ice roads regularly constructed at NPRA exploration wellsites in winter. Such roads have proven to be an effective way to protect the tundra and vegetation where heavy traffic must utilize a given route over a sustained period of time. A small amount of sand occasionally falls from the trucks hauling borrow material and can be seen partially covering the ice road in this picture. The worker in the foreground is sampling the thickness of the ice road to determine its characteristics under a regime of heavy truck and equipment traffic.

young during the brief Arctic summer. Only a few birds, including the raven, snowy owl, gyrfalcon, and ptarmigan, can successfully survive as year-round residents.

Several species of fish inhabit the larger, deeper Arctic lakes and streams, and some of these, particularly some of the salmonids (whitefish and grayling) are important to the Native people who fish these lakes and streams. A variety of marine mammals including whales, walrus, seals, and polar bear are important subsistence resources to the residents of the coastal villages. In many areas of the NPRA, subsistence hunters relied heavily on caribou up until the time that the harvest was severely limited by the State.

Caribou are a major concern to all involved in the NPRA exploration program. These animals provide an important protein source for Native inhabitants. They are highly valued as a wildlife resource among conservationists and game managers alike. For these reasons, great care is taken throughout the year to avoid disturbing the caribou. Additional precautions are necessary during the time of the year when the pregnant females are calving, particularly in areas where calving is concentrated during May and early June. Any well being drilled in these areas, including the Utukok Uplands Special Area, must either be completed in a single winter drilling season before the caribou return in May, or must be suspended until the calving is complete in mid-June. Thus, the Awuna Test Well will be suspended in May 1980 and reentered after freeze up in the fall.

The Arctic peregrine falcon is presently the only terrestrial animal in the NPRA listed as an endangered species by the U.S. Department of the Interior. The bluffs along the Colville River and some of its tributaries provide prime nesting sites for this bird, although the number of pairs successfully nesting there at present is only about one-third of the number that nested in this area during the 1950's. The decline of the Arctic peregrine is not the result of any human factor operating in Alaska. Peregrine population decreases have occurred primarily because of contamination of this predator's food chain with DDE, a breakdown product of the insecticide DDT. Contamination from DDT has occurred along the peregrine's migration route and in its wintering habitat in the contiguous 48 states, Mexico, and Central and South America. Generally, when an organism is physiologically stressed by one environmental factor, it has decreased resistance to other environmental factors, even those factors that might normally be of little significance. Thus, while aircraft noise and human activity associated with the exploration program would not normally be expected to affect peregrines nesting in northern Alaska, possible effects on the already stressed birds are uncertain. For this reason, when exploration activities are underway in areas within 15 miles of known peregrine nesting sites, Geological Survey environmental specialists and representatives of the U.S. Fish and Wildlife Service assess the exploration program activities to insure that they will not adversely affect the falcons. During the construction of the Seabee wellsite, for example, the Geological Survey, through its operator Husky Oil NPR Operations, Inc., requested that the Federal Aviation Administration change the aircraft approach patterns at the nearby Umiat airstrip. This change was facilitated to eliminate any possible disturbance to nesting birds and will remain in effect for aircraft using the Umiat airstrip even after the exploration program has been terminated.

Questions and problems relating to these and other wildlife species are a continuing concern to personnel associated with the NPRA exploration. Within the limits of the Congressional mandate for exploration of the Reserve, all possible steps are taken to assure that neither the wildlife nor their habitat will be altered, even temporarily, in any significant way.

Final reports concerning the exploration are made available through the Environmental Data and Information Service, National Oceanic and Atmospheric Administration, Boulder, Colorado, 80303; (303) 499-1000 ext. 6338. Core chips and ditch cuttings may be provided by the Department of the Natural Resources, Alaska Division of Oil and Gas Conservation, 3001 Porcupine Drive, Anchorage, Alaska 99501.

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, Inc. The geological investigations, primarily by the Geological Survey's Geologic Division, are described in this circular as part of each operating division's program in the State.

For additional information about the ONPRA activities, contact:

George Gryc, Chief, or
Max Brewer, Chief, Operation Office,
Office of National Petroleum Reserve in Alaska
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Anchorage, Alaska 99503
Tel. (907) 276-7422

PROJECTS OF THE OFFICE OF NATIONAL PETROLEUM RESERVE IN ALASKA

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 wells in the National Petroleum Reserve in Alaska (NPRA) and to make available to the public microscope slides of fossils (by loan agreement) and reports on paleontology based on test well samples.

Status: Anderson, Warren, and Associates Micropaleontology Consultants of San Diego, California, subcontractor for Husky Oil NPR Operations, drilling contractor for the Office of National Petroleum Reserve in Alaska (ONPRA), has processed sediments from the NPRA test wells and analyzed the microfossil assemblages, including both palynomorphs and foraminifers, in terms of biostratigraphy and paleoecology. Microfossil reports and distribution charts are being made available through the National Oceanic and Atmospheric Administration (NOAA). Information regarding loans of microscope slides of fossils can be obtained at the ONPRA office in Menlo Park. Microfossil data are presently being encoded in computers at Petroleum Information Corporation to facilitate manipulation of this voluminous data bank. Computer files of species diversity plots of the various microfossil groups, as well as formation and paleontological stage/zonule tops, are now being printed for most of the NPRA test wells. Numerous megafossils recovered from test well cores have been sent to the Survey's Paleontology and Stratigraphy Branch for examination, and this information is currently being incorporated into the total paleontological framework.

The project location is shown in figure 2.

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

Chief: John K. Kienzle

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 the National Petroleum Reserve in Alaska.

Status: Through Husky Oil NPR Operations, Inc., the contractor to the Office of National Petroleum Reserve in Alaska (ONPRA), and Geophysical Service, Inc. (GSI), a subcontractor to Husky Oil, approximately 1,000 miles of CDP seismic and gravity data will be acquired in NPRA in 1980. The seismic data will be collected by two GSI dynamite crews operating in the southern part of NPRA. The gravity and seismic data will be processed by GSI and interpreted by Tetra Tech, a subcontractor to Husky Oil, and by ONPRA. With the completion of the 1980 fieldwork, approximately 12,500 miles of CDP seismic and gravity data will have been collected in NPRA since 1972.

The project location is shown in figure 2.

Project Title: Archeological Studies of the National Petroleum Reserve in Alaska

Chief: Max Brewer

Objectives: To inventory cultural resources of the National Petroleum Reserve in Alaska; inspection, evaluation and clearance of all sites proposed for drilling, roads, airfields, and construction material.

Status: Detailed cultural and archeological resource surveys are conducted at all sites where construction, drilling, or seismic activities are planned on the National Petroleum Reserve in Alaska. These surveys are carried out to assure that oil and gas exploration activities do not adversely affect the cultural or archeological resources of the reserve. Management cooperate to inspect, evaluate and clear all sites of proposed airfields, access roads, drilling pads, construction material and water source sites, haul roads and trails, and seismic survey lines.

The project location is throughout NPRA where any oil and gas exploration related activities are proposed.

In addition, the Office of National Petroleum Reserve in Alaska funds a project described in the Geologic Division's section. The project is titled "Engineering Geologic Studies in the National Petroleum Reserve in Alaska", under the leadership of Reuben Kachadoorian. As part of this project work, several design options were considered for airfields, roads, and drilling pads including (1) gravel over sand, with sufficient thickness of gravel to contain seasonal thaw penetration, (2) gravel over insulation on sand, (3) landing mat with insulation, and (4) landing mat without insulation. Test sections were constructed and tested. Using seasonal thaw indexes and subsurface temperature data, maximum thaw penetration depths were calculated. The design selected for Inigok and Tunalik wells was gravel over insulation with sufficient thickness of insulation to prevent summer thaw of subgrade and minimum thickness of gravel to prevent crushing of insulation under heavy wheel loads. This project is also monitoring ground temperatures at Inigok, Tunalik, Ivotuk/Lisburne, Seabee, and Awuna to record performance of the airfield and drilling site during design life and after abandonment of the site.

The project location is shown in figure 2 as numbers 12, 13, 18, 19, and 23 (Awuna).

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

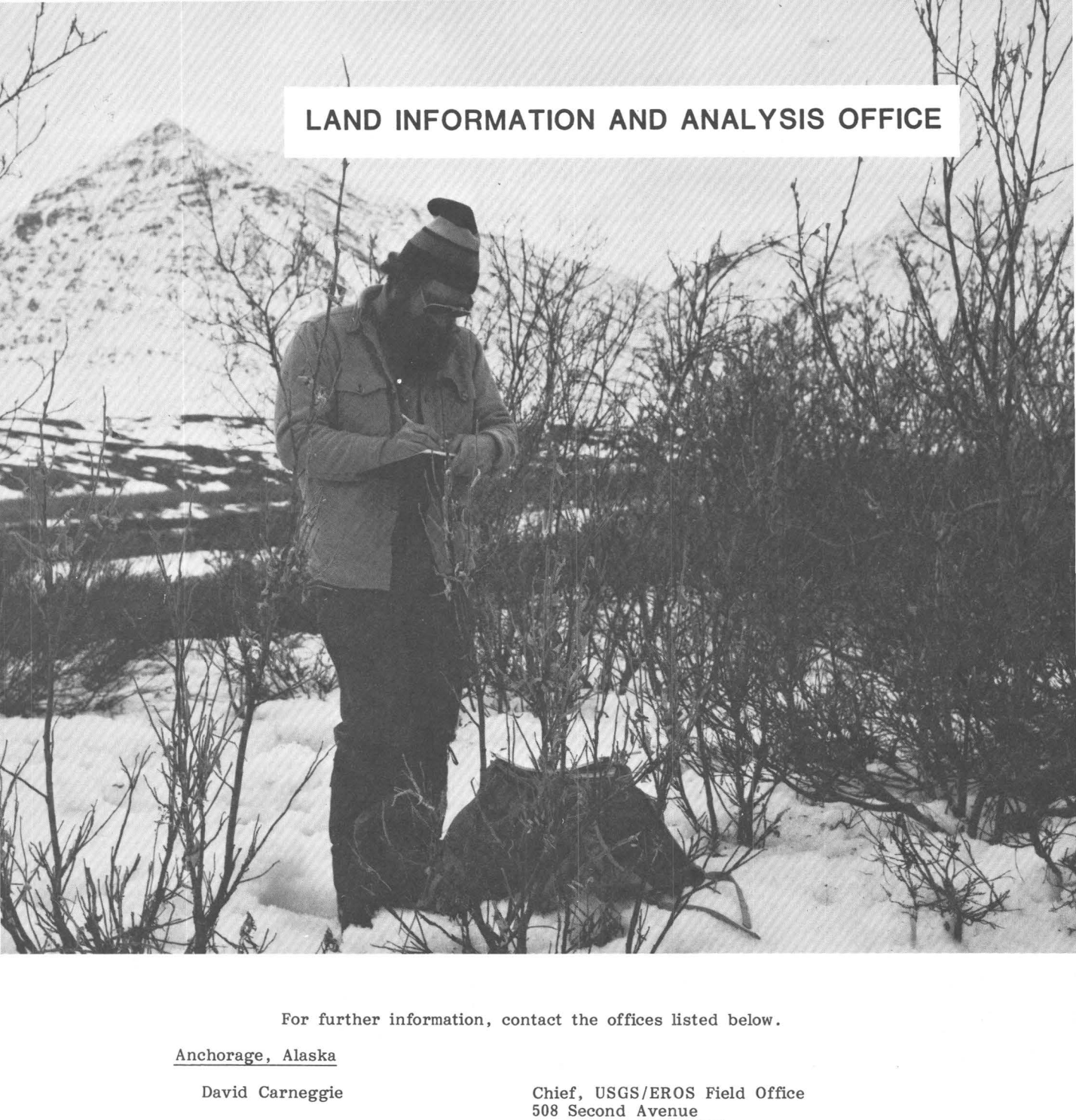
Chief: Robert D. Carter

Objectives: To acquire, inventory, organize, reproduce, store, and make available to the public through the National Oceanic and Atmospheric Administration (NOAA) (Boulder, Colorado) all geologic 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 and basic geophysical data generated in NPRA (NPR-4) by the U.S. Navy prior to June 1, 1977, have been released through NOAA. Well logs and histories from six wells drilled during 1977 and 1978 are also available from NOAA, along with an interpretive summary seismic report which integrates 1977 data with the prior seismic information. NOAA is presently processing for release data from five wells drilled in 1978 and 1979; a summary geologic report for FY 1978; seismic, magnetic, and gamma-ray data gathered in 1977 and 1978; and a Barrow area "package" which includes descriptions of the gas productive areas there, an energy study, and a high-resolution seismic stratigraphic study.

The project location is shown in figure 2.

LAND INFORMATION AND ANALYSIS OFFICE



For further information, contact the offices listed below.

Anchorage, Alaska

David Carneggie

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LAND INFORMATION AND ANALYSIS OFFICE

The Land Information and Analysis (LIA) Office manages interdisciplinary land-resources and environmental impact programs of the Survey. The programs are directly concerned with the technologies and methodologies of collecting, describing, communicating, and applying earth-sciences information to resources management. The principal program elements of the LIA Office include the Earth Resources Observation System (EROS), Earth Sciences Applications, Resource and Land Investigations, and Environmental Impact Analysis.

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 photography and other remotely sensed data acquired by aircraft and spacecraft, particularly the Landsat satellite. The EROS Data Center in Sioux Falls, South Dakota 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 programs. Inquiries on specific problems or other matters, 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 Alaska to improve the availability of technical assistance to Alaskan users. This facility is located at the Geophysical Institute, University of Alaska, Fairbanks 99702. Interpretation equipment, including a color additive viewer and minicomputer enhancer, is available. In addition, files are maintained of selected Landsat images, 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. Congressional approvals obtained in late FY 1979 have enabled the Data Center to purchase digital analysis equipment to be installed in the new Field Office. The primary objectives of the Field Office are to provide training on manual and automated analysis of remotely sensed data (both aircraft and spacecraft data) for resource inventory and to make the analysis equipment available to resource managers from government agencies in Alaska.

The USGS/EROS Field Office, Anchorage, will be staffed by approximately five full-time scientists. Personnel will be located in Anchorage beginning in March 1980. The interactive digital image analysis system will be used to train resource managers to digitally display, enhance, classify, and manipulate Landsat data. It will also be available to qualified government personnel who wish to use the system in conducting resource inventories in Alaska. Equipment for manual analysis of remote sensing data such as stereoscopes and light tables also will be available. The Field Office will conduct training courses (yet to be announced) on the uses of remote sensing techniques. The Field Office will be linked closely to the EROS Data Center and will utilize personnel, analysis techniques, and software from the Center when needed. The Field Office will work closely with the National Cartographic and Information Center and the University of Alaska 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 508 Second Avenue in Anchorage. For more information contact the Field Office Chief, David M. Carneggie.

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.

ENVIRONMENTAL IMPACT ANALYSIS PROGRAM

The Environmental Impact Analysis (EIA) 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.

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 supervisory 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 EIA Program integrates Geological Survey EIS activities by providing the following: (1) Direction, coordination, and expertise in the preparation of environmental impact statements for which the Survey has lead or joint-lead responsibility; (2) scientific and technical support in the preparation of impact statements for which the Survey has contributing responsibility; (3) oilspill risk analysis; (4) manuals, guidelines, and training courses on the preparation and review of impact statements; and (5) environmental research.

In 1978, the Geological Survey was assigned lead responsibility by the Department of the Interior for an analysis of environmental impacts of potential petroleum development in the National Petroleum Reserve in Alaska as mandated by Section 105(b) of Public Law 94-258, the Naval Petroleum Reserves Production Act. The analysis has been accomplished by an EIA Program task force under the leadership of William J. Schneider. The physical, biological, and cultural impacts of potential petroleum development, including possible impacts on Native subsistence activities, have been evaluated. Publication of the comprehensive report and of a companion report on economic and policy analysis is expected by mid 1980.

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 EIA Program. "An oilspill risk analysis for the Kodiak Island (Proposed Sale 46) Outer Continental Shelf lease area", by William B. Samuels, Kenneth J. Lanfear, and Anastase Nakassis, USGS Open-File Report 80-175, was completed in January 1980. An analysis for Cook Inlet (Proposed Sale 60) is scheduled for release in July 1980, and an analysis of Norton Basin (Proposed Sale 57) is scheduled to begin in September 1980.

PROJECTS OF THE LAND INFORMATION AND ANALYSIS OFFICE

STATEWIDE

Project Title: Outer Continental Shelf (OCS) Oil and Gas Information Program (Resource and Land Investigations Program)

Chief: David A. Nystrom

Objectives: To make available to affected States and, upon request, to the executive of any local government: (1) a summary report of information designed to assist them in planning for the nearshore and onshore impacts of potential OCS oil and gas development and production; and (2) an index which lists all relevant lease sale information. These documents are to be made available on a regular basis and updated as significant changes in the information occur. The program was mandated by 30 CFR 252 and by the OCS Lands Act Amendments of 1978.

Status: The Alaska Index was developed and distributed to State and local officials. The Alaska Index lists all relevant plans, programs, reports, and documents used by the Federal government in the decision-making process for leasing, exploration, development, and production of the Outer Continental Shelf.

Work has begun on the Gulf of Alaska Summary Report which will include: (1) geologic and geophysical data and updated oil and gas resource and reserve estimates; (2) projections of the magnitude and timing of development; (3) methods of transportation to be employed; and (4) the general location and nature of near-shore and onshore facilities.

Project Title: Hazards Warning, Preparedness, and Technical Assistance (Earth Science Applications Program)

Objectives: To develop a system for communicating information on geologic and related hazards to State and local jurisdictions and to Federal agencies with facilities or programs that may be affected by the hazards.

Status: A meeting with appropriate State and Federal representatives and the Governor's designee for Alaska was held in 1978, and mutually agreeable communications procedures for hazards information have been developed.

On May 10, 1978, Federal, State, and local officials were notified of the potential hazard from a landslide on Pillar Mountain at Kodiak. The Survey continues to serve on a Geotechnical Advisory Committee established by the City of Kodiak to oversee and evaluate the results of continuing data collection and mitigation planning for this potential hazard.

On June 1, 1979, Federal, State, and local officials were notified of the possibility of a large earthquake in the area of Cape Yakataga in southern Alaska. This area has been identified as a "seismic gap", where an earthquake could occur at any time and is likely in the next 2 to 4 decades. The Survey intensified its studies and monitoring in this area in 1979 in an effort to develop a better understanding of the potential for large earthquakes and to observe the processes leading up to them. (See Geologic Division activities, southern region.)

Project Title: Wrangell-St. Elias National Monument Analysis Project

Chief: David M. Carneggie

Objectives: Demonstrate the use of various remote sensing techniques and data types for providing baseline resource data pertinent to the major planning and management issues of the Monument. 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. Specific tasks include mapping vegetation cover and environmental hazards using high altitude color-infrared photographs and Landsat color composite imagery.

Status: Small-scale color-infrared photographs and Landsat color composite of the Chitina Valley have been purchased. A vegetation classification scheme is being prepared and preliminary interpretation is in process. The 1980 summer field season will provide the opportunity to collect ground data related to vegetation type and environmental hazards, and complete the cover mapping.

The project location is shown in figure 3.

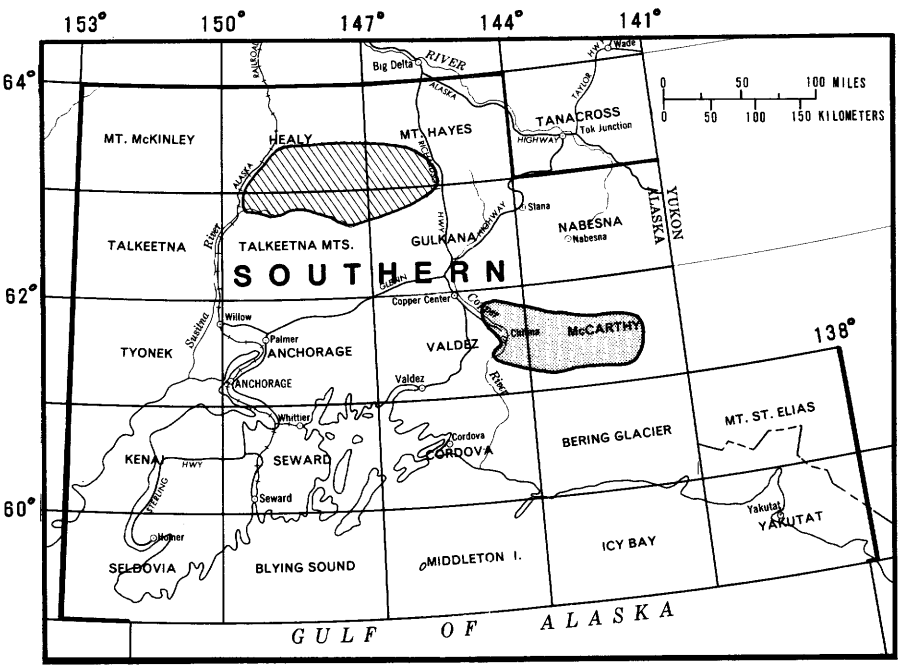
Project Title: Denali Resource Map Assessment Project

Chief: Wayne G. Rohde (EROS) and Paula Krebs (BLM)

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 NASA Application Systems Verification Test in the upper watershed 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 comprise Landsat data are reclassified to the class corresponding to the majority of picture elements in a given area.

Status: BLM and EROS Data Center personnel cooperated to (a) select ground sampling units for each land cover class, (b) acquire and interpret aerial photographs of each sample unit, and (c) collect ground data about vegetation within a portion of each sample unit. The aerial photographs were acquired and the field survey was conducted in late summer 1979. The results are compiled to determine the classification accuracy of the cover maps. Preliminary results show that this accuracy is improved when smoothing is applied after the classification process. Moreover, the classification improved as the minimum map unit size over which smoothing was applied was increased.

The project location is shown in figure 3.

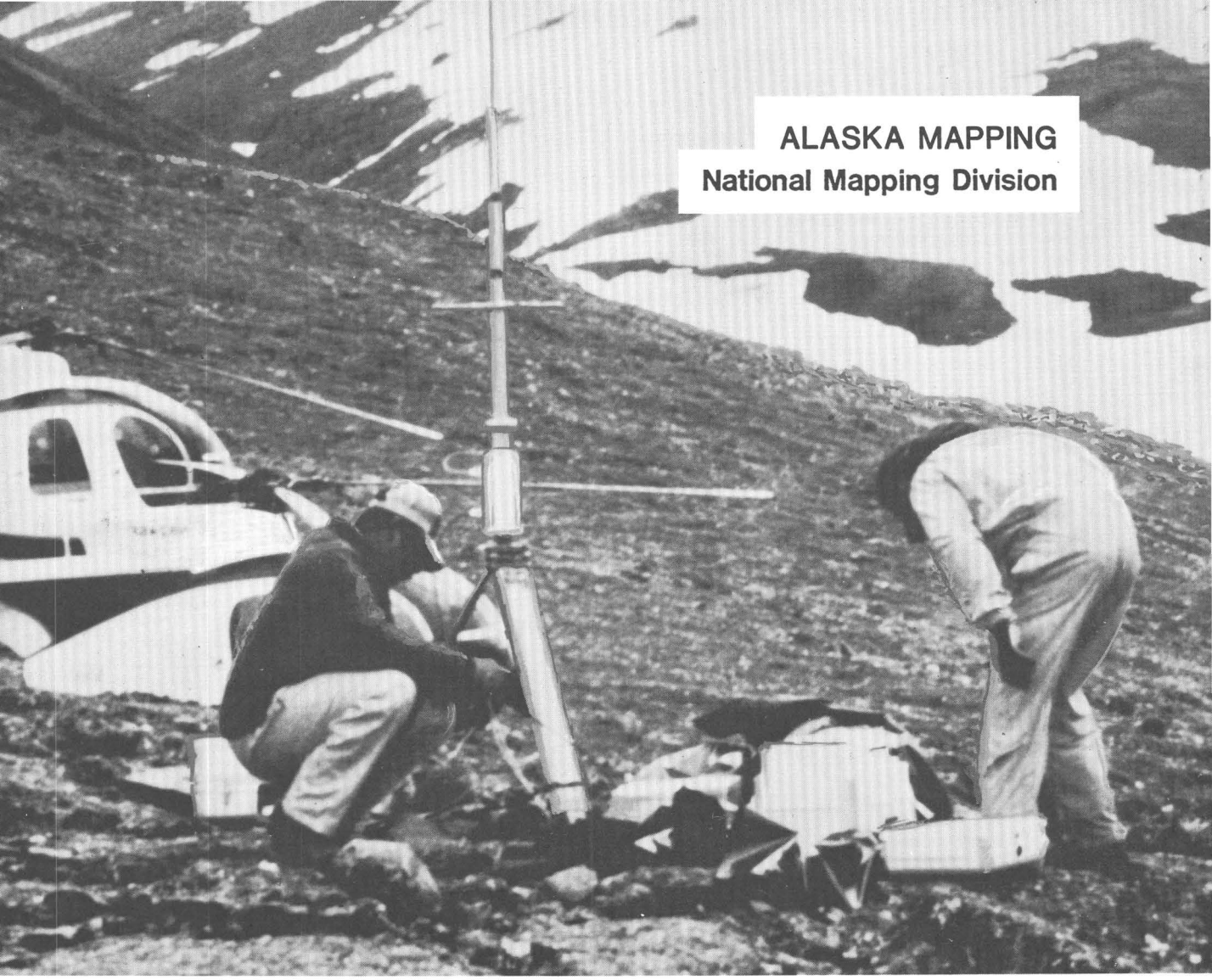


EXPLANATION

Wrangell-St. Elias National Monument Analysis Project

Denali Resource Map Assessment Project

Figure 3. -- Land Information and Analysis Office activities in Alaska.



ALASKA MAPPING
National Mapping Division

For further information, contact the offices listed below.

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Tel. (703) 860-6231

ALASKA MAPPING

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

Tha Alaskan mapping program operations are primarily the responsibility of the Chief, Rocky Mountain Mapping Center, in Denver, Colorado. The resident cartographer in Alaska is the National Mapping Division's representative. His office is located in Anchorage. This office gathers and maintains files on cartographic material used in mapping. In addition to its assigned responsibilities, this office provides assistance to the public in obtaining National Cartographic Information Center (NCIC) cartographic materials, EROS (satellite) photographic products, geodetic control, and base-map material.

Published topographic mapping at a scale of 1:63,360 (1 inch = 1 mile) is available for about 84 percent of Alaska. An additional 11 percent of the State is in various stages of production at either 1:63,360 scale or 1:50,000 scale (metric).

The Division also has a program for providing 1:25,000-scale (metric) maps for developing areas of Alaska. Maps of the Anchorage area should be published in FY 1980. Other areas for which maps are being prepared include Valdez, Seward, Cordova, Whittier, and in a newly authorized project the Kenai Peninsula.

The Division also prepares indexes by State showing the topographic maps that have been published. The Alaska index is available free from the Survey's Public Inquiries Office, 108 Skyline Building, 508 Second Avenue, in Anchorage. 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 resident cartographer's office.

The National Mapping Division will continue the support of the public lands surveys of the Bureau of Land Management (BLM) in Alaska, through horizontal geodetic control operations and the preparation of orthophoto products. The Division also continues its supportive role in the State-Federal interagency program to obtain uniform high-altitude aerial photography coverage for the entire State.

Listed below are current projects of the National Mapping Division. All project locations are shown on figure 4.

PROJECTS OF THE NATIONAL MAPPING DIVISION

NORTHERN REGION

Project Title: Vegetation Mapping of Northern Alaska Using Landsat Digital Data

Chief: Leonard J. Gaydos

Objectives: To produce maps of vegetation in northern Alaska using Landsat multispectral scanner digital data after defining a classification system appropriate to the region and attainable with Landsat data.

Status: The mapping phase of the project for the National Petroleum Reserve in Alaska (NPRA) is complete. Fieldwork was carried out during the summers of 1977 and 1978 primarily by L. A. Morrissey and R. A. Ennis. A color-coded vegetation map produced from a mosaic of ten Landsat scenes is being produced under the direction of J. R. Wray in Reston. It will be published in 1980 along with a paper explaining the methodology used in the project. Publication of color-coded vegetation maps for eight 1° x 3° quadrangles (Barrow, Wainwright, Meade River, Teshekpuk, Harrison Bay, Utukok River, Lookout Ridge, and Ikpikpuk River) is planned. Assistance is expected from the Bureau of Land Management and NASA Ames in assessing classification performance.

In 1980 work is beginning on extending the vegetation classification to the coastal area east of NPRA to the Canadian border, including Prudhoe Bay and the northern part of the Haul Road. Interpretation assistance will be provided by the University of Colorado, Institute of Arctic and Alpine Research, and the Army's Cold Regions Research and Engineering Laboratory.

Project Title: National Petroleum Reserve in Alaska

Chief: John D. McLaurin

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

Status: The project consists of 82 quadrangles being mapped at 1:50,000 scale with metric contours. At the beginning of FY 1980, advance manuscript copy was available for about 90 percent of the project. Compilation will continue in FY 1980.

Project Title: Coal Resource Area

Chief: John D. McLaurin

Objectives: To provide new 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 is expected to be accomplished in FY 1980 with compilation to follow.

Project Title: Eastern Brooks Range

Chief: John D. McLaurin

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

Status: About 30 percent of the remaining 33 quadrangles are expected to be compiled in FY 1980.

WEST-CENTRAL REGION

Project Title: Hughes-Shungnak

Chief: John D. McLaurin

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

Status: The project consists of 55 quadrangles which will be mapped at 1:50,000 scale with metric contours. Field mapping control has been completed. Work is not scheduled on this project in FY 1980 because of higher priorities in other areas of Alaska.

EAST-CENTRAL REGION

Project Title: Yukon Flats BLM Control

Chief: Robert C. Foley

Objectives: The project is a repay project for the Bureau of Land Management (BLM). The BLM State Office in Alaska has requested the USGS to establish horizontal control on requested points to support their boundary surveys of the Yukon Flats National Monument.

Status: The USGS plans to establish the requested control on the Yukon Flats project to the degree permitted by funding and time frame. The USGS proposes to utilize doppler satellite methods on this project.

Project Title: Yukon Charley BLM Control

Chief: Robert C. Foley

Objectives: The project is a repay project for BLM. The BLM State Office in Alaska has requested the USGS to establish horizontal control on requested points to support their boundary surveys of the Yukon Charley National Monument.

Status: The USGS plans to establish the requested control on the Yukon Charley Project this season. The USGS proposes to establish these requested points by doppler satellite methods.

SOUTHERN REGION

Project Title: Talkeetna Mountains BLM Control

Chief: Robert C. Foley

Objectives: To establish horizontal control on points requested by BLM to facilitate their boundary surveys of State withdrawal lands. Surveys will be accomplished by doppler satellite and standard electronic traverse methods.

Status: Fieldwork and final computations are to be completed in FY 1980.

Project Title: Willow South

Chief: John D. McLaurin

Objectives: To provide modern 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. The schedule calls for aerotriangulation in FY 1980 and map compilation in FY 1981.

Project Title: Anchorage

Chief: John D. McLaurin

Objectives: To provide modern large-scale topographic maps of the greater Anchorage area.

Status: The project consists of 31 quadrangles of 1:25,000-scale maps with metric contours. Sixteen are standard line maps and 15 are orthophotomaps. All will be published in FY 1980.

Project Title: Valdez

Chief: John D. McLaurin

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

Status: The project consists of five 1:25,000-scale maps with metric contours. The schedule calls for these maps to be compiled during FY 1980.

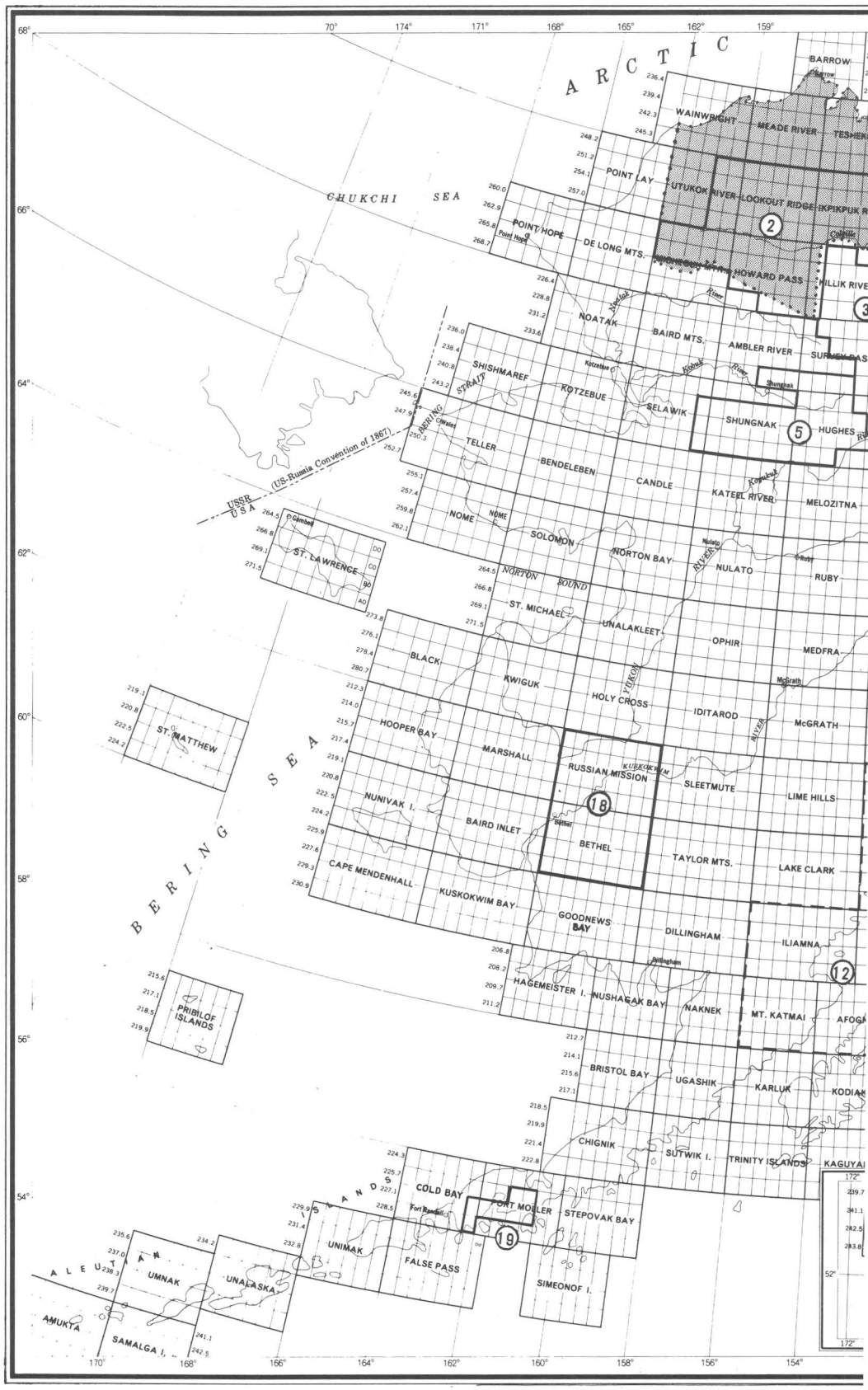
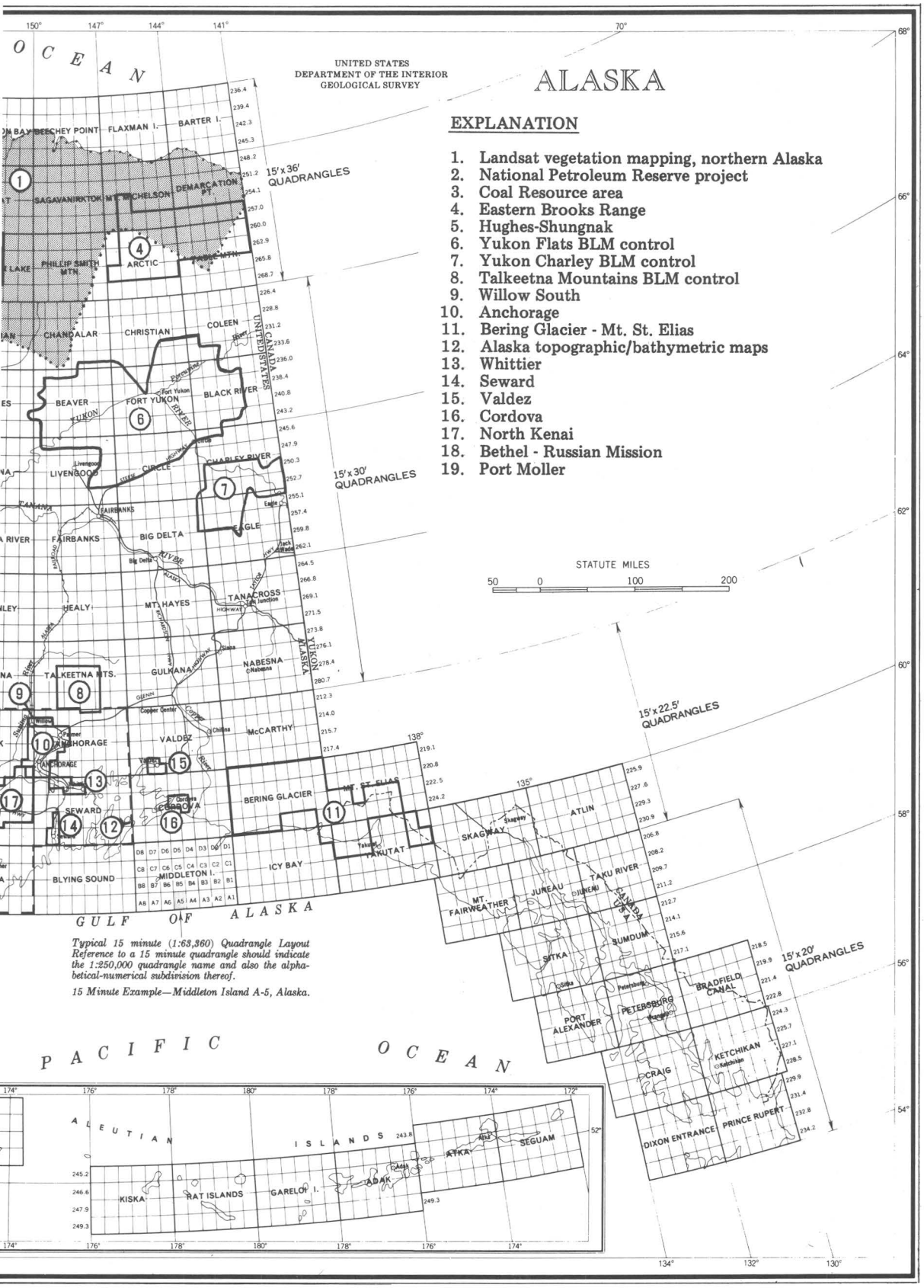


Figure 4. -- National Mapping Divi



Typical 15 minute (1:63,360) Quadrangle Layout Reference to a 15 minute quadrangle should indicate the 1:250,000 quadrangle name and also the alphabetical-numerical subdivision thereof.

15 Minute Example—Middleton Island A-5, Alaska.

ctivities in Alaska for 1980.

Project Title: Cordova

Chief: John D. McLaurin

Objectives: To provide modern 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.

Project Title: North Kenai

Chief: Frank E. White

Objectives: To provide modern large-scale maps for this project area, which covers the towns of Kenai and Soldotna, as well as the large industrial complex north of Kenai. The east half of the project and area along Sterling Highway is in the National Moose Range and covers recreational areas.

Status: During 1980, the USGS proposes to establish the necessary horizontal and vertical photocontrol for compilation of 1:25,000-scale metric maps in project area.

SOUTHWESTERN REGION

Project Title: Bethel - Russian Mission

Chief: John D. McLaurin

Objectives: To prepare two new 1:250,000-scale maps to replace the old reconnaissance maps that presently cover this area.

Status: These two maps are in the final cartographic phases prior to publication.

Project Title: Bering Glacier - Mount St. Elias Area

Chief: John D. McLaurin

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

Status: This project consists of 50 quadrangles at 1:63,360 scale. Five maps have been compiled and advance manuscript copy for them is available. Compilation of the remaining quadrangles is expected to begin in FY 1980.

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 quadrangle maps which will be prepared under the Geological Survey/National Oceanographic Survey (NOS) joint topographic/bathymetric mapping agreement. NOS plans to provide the bathymetry during FY 1981 and the survey plans to add this bathymetry to the topographic maps during FY 1982.

Project Title: Whittier

Chief: John D. McLaurin

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

Status: The project consists of seven 1:25,000-scale quadrangles with metric contours. The schedule calls for these maps to be compiled during FY 1980.

Project Title: Seward

Chief: John D. McLaurin

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

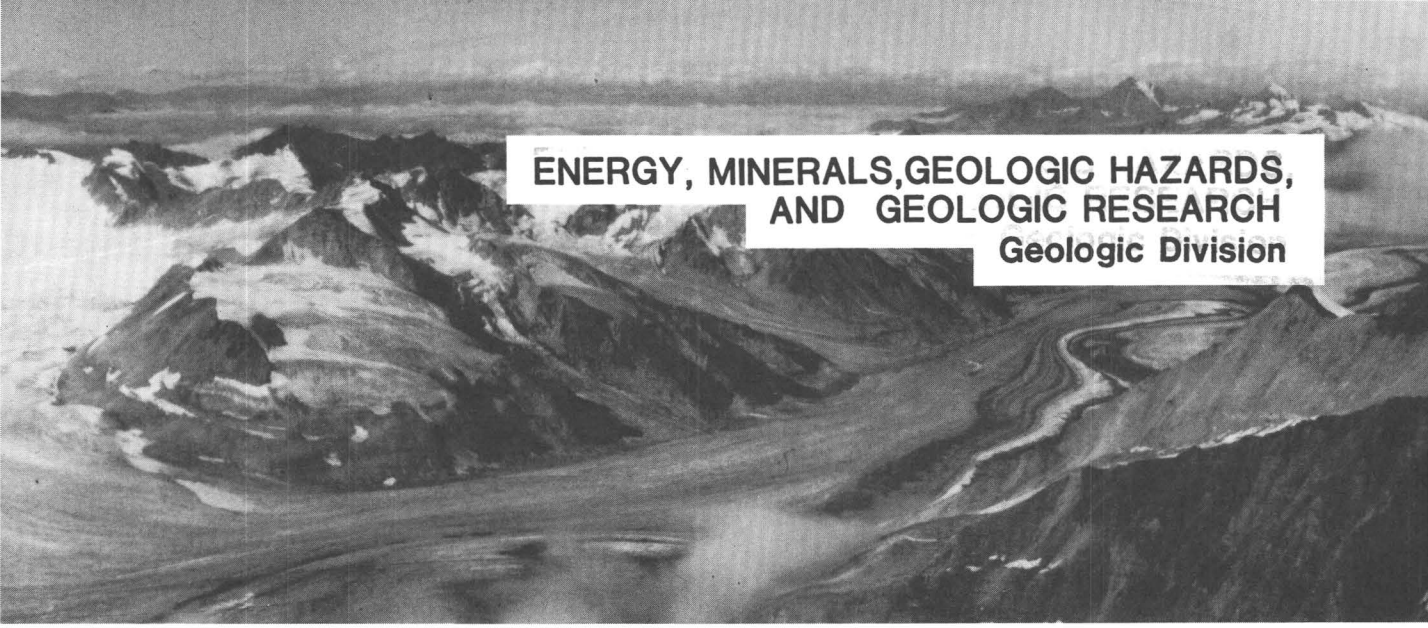
Status: The project consists of six 1:25,000-scale quadrangles with metric contours. The schedule calls for these maps to be compiled during FY 1980.

Project Title: Port Moller

Chief: John D. McLaurin

Objectives: To prepare eight new 1:63,360-scale maps of the Port Moller area.

Status: Advance copy of the compilation manuscripts is available for the eight quadrangles.



ENERGY, MINERALS, GEOLOGIC HAZARDS, AND GEOLOGIC RESEARCH

Geologic Division

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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, California; the Branches of Regional Geophysics, Electromagnetism and Geomagnetism, Exploration Research, Isotope Geology, and Engineering Geology at the Central Region Headquarters in Denver, Colorado; 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, California. 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 5 through 13 show the locations of current division activities. Projects for other divisions are presented under similar geographic headings for easy cross-referencing or gaining an overview of all Survey activities in a region.

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
* Geologic research in support of the 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 Henry C. Berg, 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 quadrangles, 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 5 shows the current status of AMRAP studies. Mapping and geochemical fieldwork is scheduled for five quadrangles in 1980. Fieldwork is completed and geochemical and other laboratory studies are underway or final reports are in preparation for seven quadrangles. Project work in fifteen 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 investigate 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.

At present there are six active projects within the North Slope Petroleum Program: a reservoir study of the Lisburne Group; a study of the structural style of the eastern Brooks Range foothills; 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 reservoir study of the Fortress Mountain Formation and a study of potential hydrocarbon, uranium and thorium resources of the Arctic National Wildlife Range. 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 1979 included: (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 evalua-

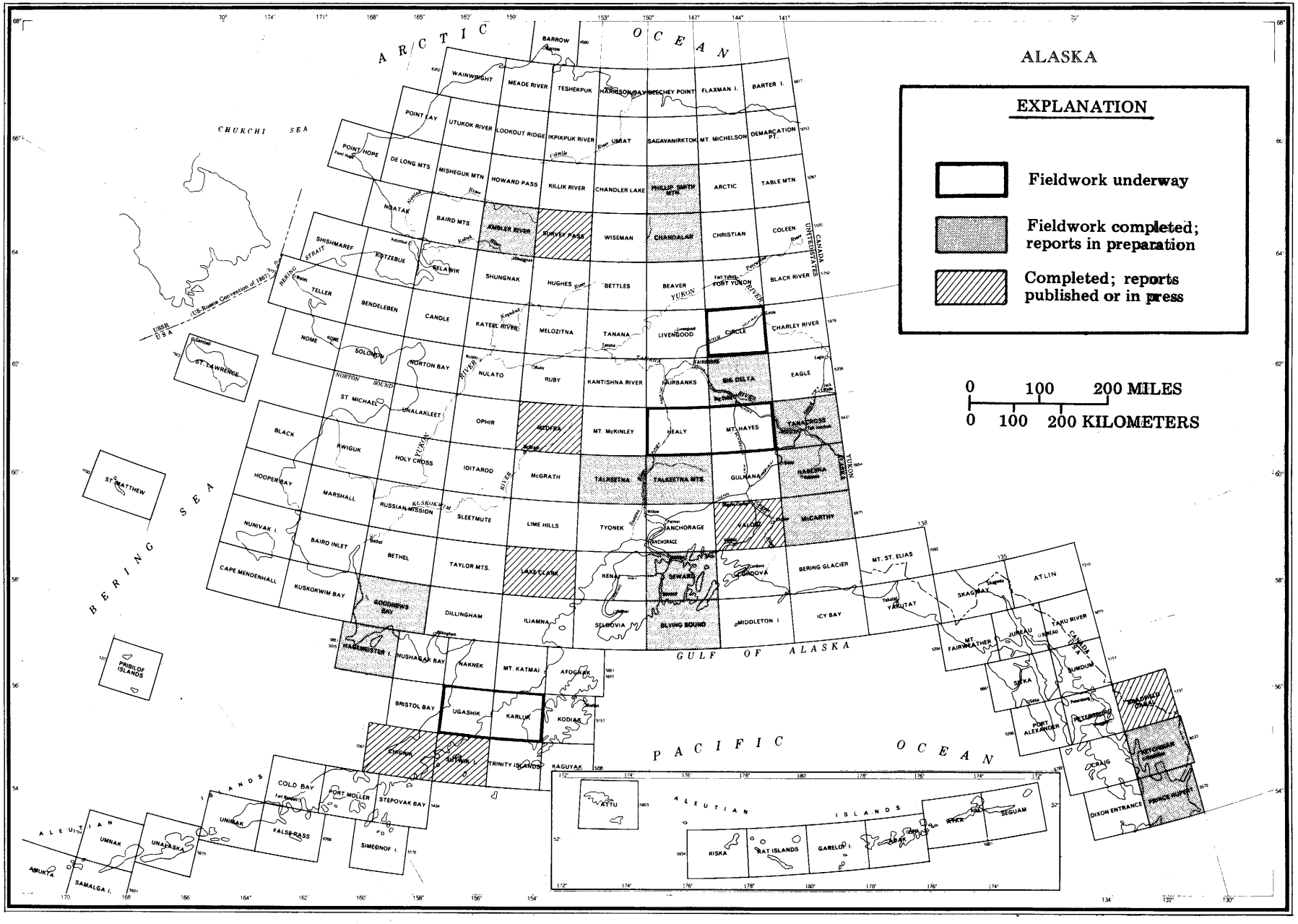


Figure 5. -- Status of Level III Alaska Mineral Resource Assessment Program (AMRAP), January 1, 1980.

tions 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 provide a comprehensive understanding of the oil and gas resource potential of an area and the geologic hazards related to 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, 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 (1) improve our ability either 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 areal 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. Serverity of the hazard was amply illustrated by the great Alaskan 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. Based on 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 Page.

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

Upper Cook Inlet and Susitna Lowland area, Alaska.--Project chief is Randall G. Updike of the State of Alaska, Department of Natural Resources, Division of Geological and Geophysical Surveys. The study is designed to establish local engineering expertise regarding earthquake hazards and to initiate studies which will reduce these hazards. These objectives are being met by three studies: (a) development of an engineering sub-surface soils data retrieval system, to be available in 1981; (b) post-1964 strain history of major Anchorage landslides, nearing completion; and (c) examination of liquefaction potential of the Bootlegger Cove Clay, a report on which is in preparation.

Strong ground motion in two seismic gaps: Shumagin Islands, Alaska, and northern Lesser Antilles, Carribean Sea.--This project will start in FY 1980 under Klaus H. Jacobs of the Lamont-Doherty Geological Observatory at Columbia University. Strong motion recorders and accelerometers will be incorporated in an instrument network to refine data collection in the seismic gaps.

Earthquake Prediction Studies

Vertical deformation studies in the Shumagin Islands and Yakataga region.--Project chiefs are Roger Bilham and John Beavon of the Lamont-Doherty Geological Observatory at Columbia University. Vertical deformation is being measured in the hope of observing preseismic deformation. Mean sea-level recorders are being operated in the Shumagin Islands, and the area near Yakataga has been instrumented with strainmeters and geodetic level lines. In addition, an attempt is being made to date young marine terraces near Yakataga as indicators of prehistoric earthquake episodes.

A field study of earthquake prediction methods in the centeral Aleutian Islands.--Project chiefs are Carl Kisslinger and S. Billington of the Cooperative Institute for Research in Environmental Sciences at the University of Colorado in Boulder. A network of seismographs and tiltmeters is operated on and near Adak Island to gather data for studying the gross geologic processes that generate earthquakes along the Aleutian Island chain and to search for earthquake and crustal deformation phenomena that are precursors of large earthquakes.

PROJECTS OF THE GEOLOGIC DIVISION

STATEWIDE

Project Title: Alaska Geothermal Project

Chief: Thomas P. Miller

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 6.

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 6.

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: This 8-year program has resulted in detailed strip mapping and reconnaissance studies of virtually all known or suspected active faults that are exposed on land in Alaska and evaluation of marine terrace sequences in the Gulf of Alaska region. Studies of the offset history of the Chatham Strait fault and recent elevation changes along shorelines in southeastern Alaska will be continued in 1980. In addition, a detailed survey of marine terraces in the Yakataga area will be completed.

The location of project emphasis is shown in figure 6.

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. 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. Knowledge of the role of igneous and metamorphic processes in genesis of ore deposits is vital. Spatial association alone suggests an important causative relation that should be evaluated.

Status: Owing to budgetary and staffing limitations, most topical studies carried out under this project are in recess, including that of the Willow Creek mining district. Geochronology of igneous rocks in the Medfra AMRAP and Ophir quadrangles is nearing completion. K-Ar geochronology of Precambrian metamorphic rocks in the Mount McKinley, Medfra, Ruby and Kantishna quad-

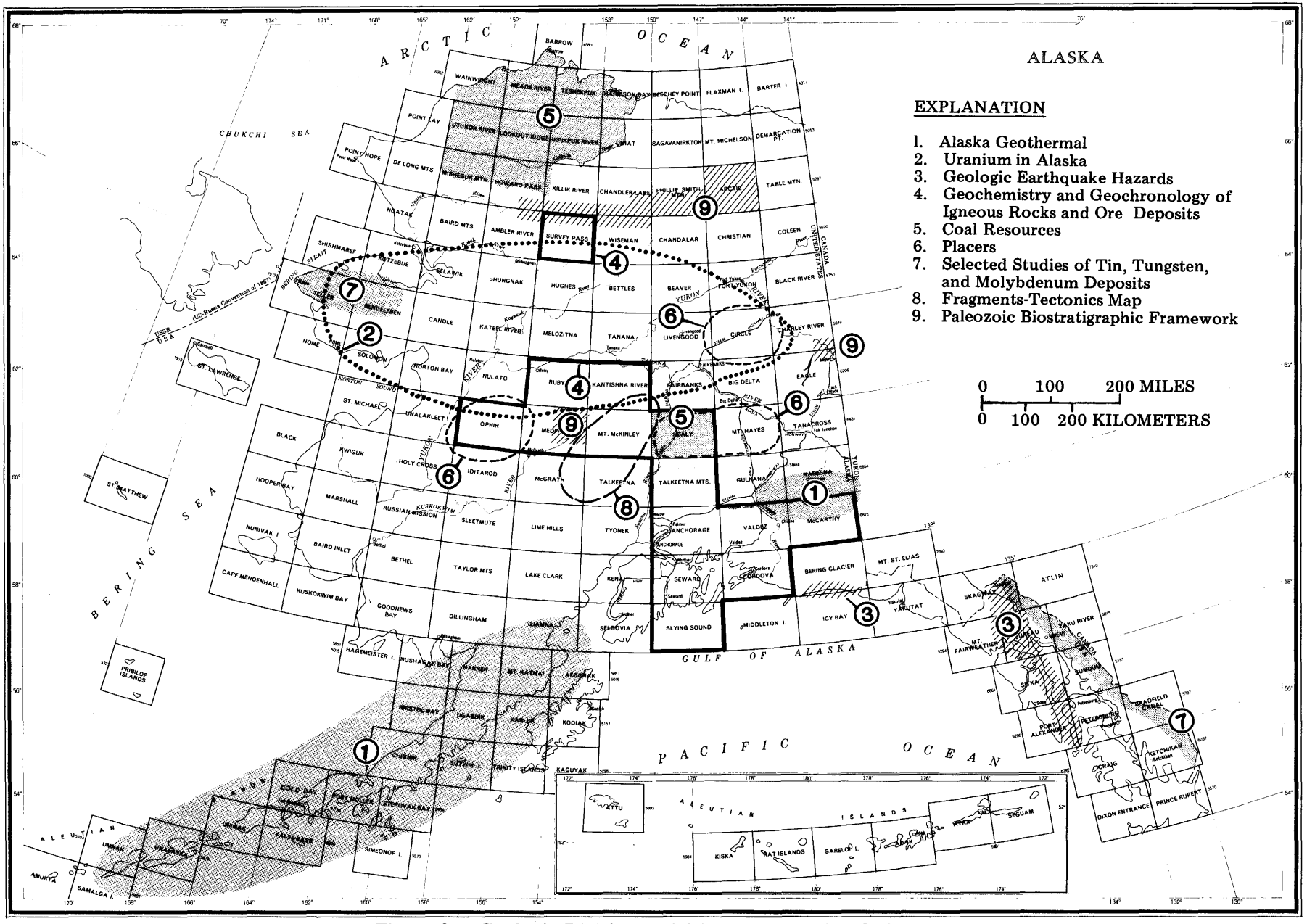


Figure 6. -- Geologic Division activities statewide in Alaska.

rangles is underway; preliminary results from both studies are reported in Circular 804-B. Rb-Sr dating of metaplutonic and metavolcanic rocks from the Survey Pass (AMRAP) quadrangle is nearly complete; several short papers and abstracts have been published or are in press. Collaborative work with the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys is proceeding. K-Ar dating of extentionally related volcanic and hypabyssal plutons in the upper Cook Inlet region is about one-half completed, and the results are being used to develop a regional tectonic model. Fieldwork on this study is completed; additional dating and geochemical studies of the rocks are in process. In 1979, fieldwork and sampling of mineralized areas in the Chugach National Forest RARE II lands and Valdez quadrangle, as well as preliminary K-Ar ages and stable isotope results, have led to development of a modified, accretion-related igneous-metamorphic model for the Prince William Sound lode gold deposits. The model was presented in abstract at the Cordilleran Section meeting of the Geological Society of America (GSA) in March 1980. K-Ar ages of metamorphism and stable isotope results from the Nikolai Greenstone in the McCarthy quadrangle have led to development of a metamorphic-segregation, accretion-related model for the vein copper deposits hosted by this unit. This study is continuing and holds promise for explaining the origin of the Kennecott massive sulfide lodes as well. Preliminary results of this study were reported at the March GSA meeting.

In 1980 the project will be concentrated on studying the genesis and controls of lode gold mineralization of the regions's RARE II lands.

The project location is shown in figure 6.

Project Title: Placers of Alaska

Chief: Warren E. Yeend

Objectives: To investigate mineral and metal resources in placer deposits in selected parts of Alaska with emphasis on the origin and potential resources of the deposits. Products envisioned include: (1) Maps showing locations of placer deposits, principal mineral commodities, and expected concentrations and volumes of potentially recoverable minerals; and (2) a short text accompanying each map describing: history of mining, total production, geology and origin of the placer deposit, and resource potential.

Status: The project was begun late in FY 1979. The investigations consisted of 13 days of fieldwork and approximately the same number spent in preparatory work. Most of the field time was spent investigating the Slate Creek placers in the Mount Hayes quadrangle. At each locality a rough sketch map was made showing the general geology and particularly the type of deposit hosting the gold. Photographs were taken of the mining operations and geology. Pan samples were taken, and the concentrate was kept. Counts were made of cobble- and boulder-size clasts at each locality. Information about the deposit contributed by the operators was duly noted. In addition, the immediate source for the gold was determined where possible.

Several days were spent mapping, measuring, describing, and sampling the gold-bearing Tertiary conglomerate west of the Slate Creek mining area; plant fossils in the gold-bearing rocks were collected for dating at two localities.

Areas east of the Richardson Highway were visited. There is currently no mining activity in the area, but it has been mined previously. West of the Richardson Highway on the south side of the Alaska Range the following localities were visited, mapped, and sampled: north and west forks of Rainy Creek, Ann Creek, Specimen Creek, Eureka Creek, and Broxson Gulch.

In FY 1980 placer examination will continue in the Mount Hayes quadrangle and commence in the Healy, Circle, and Ophir quadrangles. Emphasis is placed on studying current AMRAP areas.

The project location is shown in figure 6.

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: During FY 79 coal beds were measured in the Broad Pass and Nenana Coal Fields (Healy, 1:250,000 quadrangle, AMRAP) for resource assessment, and samples were collected for coal quality studies. Depositional environment and coal bed distribution studies were completed for the western part of NPRA.

The project location is shown in figure 6.

Project Title: Selected Studies of Tin, Tungsten, and Molybdenum Deposits in Alaska

Chief: Travis Hudson

Objectives: To investigate the origin of intrusive rocks associated with tin, tungsten, and molybde-

num deposits in Alaska. Petrology, geochemistry, and geochronology are integrated with regional geology in order better to understand the genesis of the deposits.

Status: Reports on the Oonatut Granite Complex and associated tin mineralization (Seward Peninsula) and on the intrusive rocks associated with the Quartz Hill molybdenum deposit (Ketchikan quadrangle) have been published. Laboratory studies of intrusive rocks associated with molybdenum deposits in the Ketchikan quadrangle and with tin deposits of Seward Peninsula are continuing.

The project location is shown in figure 6.

Project Title: Alaskan 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 post-date the accretionary history. (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 1980 for release as an open-file report or Miscellaneous Field Studies map. Field studies in the central Alaska Range and in McKinley National Park will continue in FY 80 in order to establish distribution and relations of important terranes. Compilation of regional structural features will commence in FY 80. Analysis of paleomagnetic data in hand will be completed, and field studies will start on Lower Cenozoic volcanic rocks of the central Alaska Range.

The project location is shown in figure 6.

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 (Ford Lake Shale and Calico Bluff Formation) of east-central Alaska.

Status: This project was initiated this fiscal year. Fieldwork has been completed for parts (1) and (3), and is continuing for part (2). For the Medfra quadrangle, descriptions of new stratigraphic units and preliminary biostratigraphic determinations are underway. A manuscript establishing new formations will be finished this year. For the Brooks Range study area, biostratigraphic and sedimentologic results have been summarized in a series of short papers and a regional map to be completed this fiscal year. For east-central Alaska, a paper describing biostratigraphy and paleontology is being written this fiscal year and is planned for completion in FY 1982.

The project location is shown in figure 6.

The locations of the projects described below are not shown on maps because of their extensive areal coverage. 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 whenever the need arises. Most data are so organized 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; by early 1980, records should be complete as of December 31, 1979.

Project Title: Alaskan Gravity Surveys

Chief: David F. Barnes

Objectives: To provide gravity data which can contribute to Alaskan mineral assessments, geologic mapping and earthquake studies. One 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: The original project goal was the preparation of a 1:2,500,000-scale simple Bouguer anomaly map of Alaska which 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 which are used in the interpretation of more detailed surveys. Most

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. Development of computer techniques to handle such data has consumed much of the past year's effort. 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 million tons of barite.

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 following 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; (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, and Circle quadrangles are being analyzed. These quadrangle studies (all to be published in FY 1980) 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: All analytical work for the Bradfield Canal, Medfra, and Valdez quadrangles has been completed. Analytical work for the Circle, Mount Hayes, and Ugashik-Karluk quadrangles has been partly completed. (See quadrangle projects.)

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

Status: A preliminary basement map of Alaska has been completed, and a map with an explanatory text is being processed for publication.

Project Title: Ecology and Zoogeography of Arctic Calcareous Fossils

Chief: Kristin A. McDougall

Objectives: To gain knowledge of the distributional patterns of the organisms that occur in the sediments, as well as insight into the factors that influence these patterns, to elucidate the history of Neogene and Quaternary deposition in cold water regions. The principal objective of this project is to establish a Holocene data base using foraminifers, ostracods, and mollusks to which the older sediments can be compared. Such a base of knowledge about the distribution and limiting environmental parameters of calcareous assemblages would provide the ability to interpret Quaternary transgressive-regressive cycles with great precision. The findings from this project will have immediate impact to ongoing programs concerning onshore and offshore Neogene and Quaternary sediments of Alaska.

Status: Current efforts are the accumulation and processing of samples and the identification of faunas from nearly all of the Alaskan main-land coast.

Project Title: Geology and Geochemistry of Tin

Chief: Bruce L. Reed

Objectives: 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; to maintain and continuously refine quantitive appraisal of domestic and foreign tin resources; to evaluate and assist ongoing projects in appraising the resource potential of tin occurrences in Alaska as they are discovered; 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; to consult with and offer assistance to industry and government personnel interested in tin.

Status: Work is continuing on all objectives. In 1979 recently discovered Canadian tin deposits were visited, and potentially tin-bearing granites in central Alaska were examined. Fieldwork investigating tin in the Circle quadrangle has been proposed for 1980. Geological Survey Open-File Report 79-576-L describes tin occurrences in the United States.

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 75 percent complete, and laboratory and work compilation 60 percent complete. Plans for 1980 field season include 2 weeks in Tintina Valley and 2 weeks studying uranium occurrences on Kuiu, Kupreanof, Zarembo, and Admiralty Islands.

Project Title: Geothermal Studies

Chief: Arthur H. Lachenbruch

Objectives: (1) To obtain as many heat-flow data as possible from holes drilled statewide for other purposes; and (2) to drill 10 to 15 holes in basement rocks near existing roads in the area bounded by Fairbanks, Anchorage, and the Yukon border (if funds become available).

Status: Preliminary heat-flow data have been determined for about 30 sites statewide. Most of the information will require substantial corrections for the effects of topography, structure, and climatic history. Some determinations are affected by vertical water movement either in the formations penetrated or in the hole.

NORTHERN REGION

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

Chief: Reuben Kachadoorian

Objectives: To make engineering geologic investigations to provide geotechnical analyses needed for petroleum exploration of the National Petroleum Reserve in Alaska. Investigations include, but are not limited to, (1) determining sources of construction materials, and (2) evaluating site locations of such facilities as airstrips, roads, drill sites, and construction camps. Project personnel consult with those of the Office of National Petroleum Reserve in Alaska on (1) engineering geology and permafrost-related engineering problems, and (2) 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 7.

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 20,000 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. Vertebrate remains have been submitted to the Branch of Paleontology and Stratigraphy for study, but examination is not yet complete. Pollen analysis and study of the fossil insects are presently underway.

The pollen analysis indicates that the basal sediments in the 20-meter-high exposure near the base camp were deposited during a time of harsher climate than that of the present, possibly during a time of glaciation in the Brooks Range to the south.

It is hoped that the project will be completed, and final reports prepared, by the end of FY 1981.

The project location is shown in figure 7.

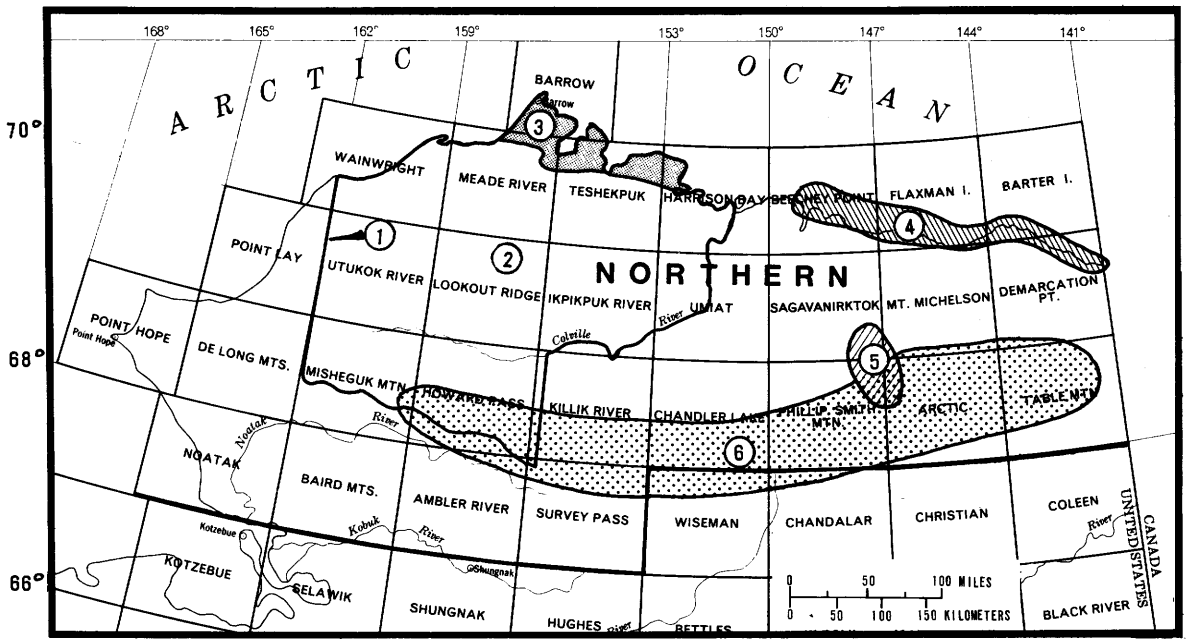
Project Title: Helium Detection, National Petroleum Reserve in Alaska (NPRA) (North Slope Petroleum Program)

Chief: Alan A. Roberts

Objectives: To determine if microseepage of helium from petroleum reservoirs will result in anamalously 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.

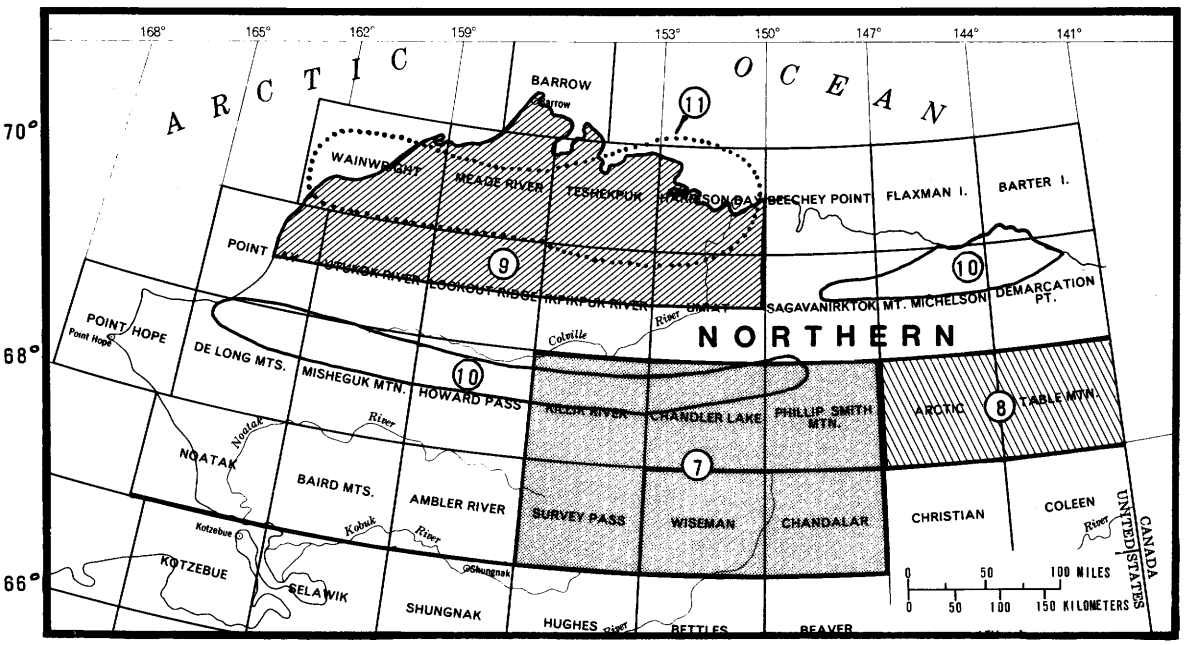
Status: Three helium surveys involving about 1,500 samples have been run. Anomalously high helium concentrations were observed to be associated with the South and East Barrow gas fields. No such pattern was observed in a survey around the J. W. Dalton test site near Camp Lonely prior to the drilling of the dry hole there. A pattern of high helium samples was observed on the Simpson Peninsula, outlining a possible petroleum prospect. Further surveys will be run on other potential prospect areas in the National Petroleum Reserve.

The project location is shown in figure 7.



EXPLANATION

1. National Petroleum Reserve boundary
2. Quaternary Environments of NPRA
3. Helium Detection, NPRA
4. Northern Alaska Cenozoic
5. Geological-Geophysical Profile Across Brooks Range Front
6. Brooks Range Devonian Clastic Rocks



EXPLANATION

7. Surficial Geology of Central Brooks Range
8. Southeast Brooks Range Geology
9. Western Arctic Coastal Plain Quaternary
10. North Slope Cretaceous Studies
11. Reservoir Study of Lisburne Group

Figure 7. -- Geologic Division activities in northern Alaska.

Project Title: Northern Alaska Cenozoic

Chief: David M. Hopkins

Objectives: 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.

On the basis of this information and data gained from coastal geologic studies, to determine history of sea level, lateral migration of shoreline, and other paleogeographic parameters for the Beaufort lease area during the past 120,000 years.

From this, to develop a model to explain and predict the distribution of shallow and deep permafrost on the Beaufort Sea shelf.

Status: The final phase of offshore drilling has been completed, and Survey Open-File Report 79-1303, containing stratigraphic logs of the 1979 boreholes, has been released. Analytical work on core samples is now under way. A final report on the lithology and paleontology of the 1976 and 1977 boreholes is in progress. Coastal geologic mapping from the Canning River to Demarcation Point is planned for the summer of 1980. This work will provide supporting data for offshore investigations.

The location of the project is shown in figure 7.

Project Title: Geologic-geophysical Profile Across the Brooks Range Front, Northeastern Alaska (North Slope Petroleum Program)

Chief: Kenneth J. Bird

Objectives: To determine the structural style of the Brooks Range front and its relation to the petroleum potential of this general area by studying a strip about 10 miles wide by 40 miles long extending from the Shaviovik anticline in the foothills to Wahoo Lake in the range. This area is uniquely suited to a study of this type because of the variety of geologic and geophysical data available and the presence of the Kemik gas field. The data consist of surface geologic maps, four wells, several seismic lines, gravity and magnetic measurements, and rock samples.

Status: Information on gravity, magnetics, rock densities, and magnetic susceptibilities have been summarized in the Survey's Open-File Report 79-1504. In preparation is a report summarizing the stratigraphy, paleontology, and geochemical data. Synthetic seismograms are being used to match stratigraphy with seismic data. An update of the surface geology by means of aerial photographs is in progress.

The project location is shown in figure 7.

Project Title: Brooks Range Devonian Clastic Rocks

Chief: William P. Brosgé

Objectives: To determine the depositional environment of the Upper Devonian sandstone and conglomerate that extends throughout the eastern and central Brooks Range, as well as the probable location of the source of these sediments, and the directions in which the sediments were transported, and the present location and trend of the various facies. To relate the present azimuths of directional features in the exposed rocks to those in the less disturbed subsurface rocks on the North Slope by comparison of paleomagnetic orientations in outcrops and well cores.

Status: The project is about two-thirds completed. In 1978 and 1979 the Upper Devonian 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 thoughout this interval. In addition, about 500 cores were collected from the outcrop for paleomagnetic study. This regional study has demonstrated that the three fluvial members of the Kanayut and the basal marine member are persistent for great distances from east to west, and that the directions in which currents flowed and sediments became finer are consistently to the southwest and west. In 1979 the Kanayut was mapped and examined in more detail in a typical area in the central Brooks Range to determine if there are local variations in the regional pattern of sedimentation. In order to compare the shape of the Devonian river system inferred from study of the Kanayut sediments with the Devonian topography that may be inferred from other geologic data, a paleogeologic map will be prepared to show the structural grain of northern Alaska at about the time the Kanayut was deposited.

Pole positions have been determined for about half of the cores in the paleomagnetic study. These indicate that the observed magnetic orientation was re-set in the Cretaceous. Thermal demagnetization is now planned in order to determine the Devonian pole positions for these cores.

A geologic map of the members of the Kanayut in part of the central Brooks Range has been placed on open file; a map of a larger area and a report on the sedimentology and stratigraphy of the Kanayut are being prepared for publication.

The project location is shown in figure 7.

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 hazards. A general stratigraphic framework, based on measured sections, radiocarbon dates, soil analyses, and geomorphic age criteria, is also being developed for the region. This framework will tie together glacial and nonglacial deposits of the northern and southern Brooks Range, and will provide a basic structure to which other Quaternary events in northern and central Alaska can be related.

Status: Surficial geologic maps have been published for the following quadrangles: Philip Smith Mountains (MF-878-A), Chandalar (MF-879-A), Chandler Lake (MF-1121), and Wiseman (MF-1122).

A map of the Killik River quadrangle currently is being prepared for publication. Field mapping of the Survey Pass quadrangle is about 75 percent complete, and work in this area will be finished in the summer of 1980.

The location of the project is shown in figure 7.

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.

Status: The project is about 50 percent completed. Fieldwork in the Arctic quadrangle was finished in 1979, and a geologic map of the quadrangle is being prepared for publication. No fieldwork is planned for 1980.

The project location is shown in figure 7.

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. Results will be published in the form of maps and reports, with project completion scheduled for 1982.

Project locations is shown in figure 7.

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: Two seasons of fieldwork and associated surface and subsurface studies since 1977 have been concentrated on the Nanushuk Group in the National Petroleum Reserve in Alaska (NPRA) area. This work has resulted in the publication of Circular 794 in 1979, and a second circular is in preparation. Subsurface studies on this phase of the project will continue as new data are acquired from the ongoing NPRA drilling program.

In 1980, field studies will start on different aspects of the project objectives. One part of the project will be a study of the Fortress Mountain Formation and lower part of the Torok Formation in the foothills of the Brooks Range. This part will be supported by the Office of National Petroleum Reserve in Alaska and should aid in assessing the potential of these rocks as a drilling objective in NPRA. A second part will be a study of the Cretaceous and lower Tertiary strata in the Arctic National Wildlife Range to aid in the assessment of the petroleum potential of that area. In addition, studies of the uranium and thorium potential of selected areas will be made.

The project location is shown in figure 7.

Project Title: Reservoir Study of the Lisburne Group (North Slope Petroleum Program)

Chief: Kenneth J. Bird

Objectives: To map reservoir trends by determining the relation of reservoir characteristics to lithofacies and then to construct a series of lithofacies maps. Analysis of the Lisburne Group well logs and selective study of well samples and thin sections are designed to determine reservoir characteristics and mappable lithofacies.

Status: A comprehensive report on the petroleum potential of the Lisburne Group in the eastern Arctic Slope has been published in the American

Association of Petroleum Geologists Bulletin (September 1977). The present focus of the study is in the National Petroleum Reserve in Alaska (NPRA). Here, new well penetrations of the Lisburne provide the information necessary to extend our knowledge of the petroleum potential of this unit.

The project location is shown in figure 7.

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 will be provided by Geochem Research, Inc., Houston, Texas, and Global Geochemistry, Canoga Park, California. To date, more than 20,000 analyses have been completed. Petroleum Information, Denver, is building and maintaining the data file of these analyses and implementing graphical displays. Several preliminary reports are in various stages of publication.

The boundary of the project's study area is shown in figure 7.

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: Approximately 8,000 kilometers of low altitude (90 meters) total field aeromagnetic profiles was flown in July 1979 in northern Alaska. Profiling was done at 1.5-kilometer spacing. Five major areas of high amplitude anomalies suggesting shallow concentrations of magnetic material were isolated. Four of these anomalous areas overlie areas of commercial oil or gas production or documented microseepage. Another region of high amplitude anomalies may define a prospective site on National Petroleum Reserve in Alaska. Sampling and preliminary analyses of available core data suggests that rocks within anomalous areas have a relatively large remanent magnetism. Additional surveys will be flown in 1980. Results will be published in the form of reports and maps.

The general area of the project work is shown in figure 7.

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.

WEST-CENTRAL REGION

Project Title: Geophysical Exploration for Uranium in Frontier Areas, Alaska

Chief: John W. Cady

Objectives: To develop geophysical techniques for uranium exploration in frontier areas, emphasizing regional geophysical studies to determine the setting of known occurrences and to extrapolate knowledge of uranium potential into lesser known areas (northern Washington and Yukon-Tanana, Brooks Range, and Seward Peninsula, Alaska). To use more detailed geophysical techniques where needed to decipher the geology of potential uranium disticts within these regions (Ekiek Creek pluton and surrounding Selawik lowlands).

Status: The emphasis to date has been on the high-grade metamorphic terrane of northern Washington and southern British Columbia, but in 1980 the emphasis will shift to the interpretation of geophysical data over the Ekiek Creek pluton, west-central Alaska, and the adjacent Selawik lowlands. Interpretation of aeromagnetic and gravity data for the Circle quadrangle should help to determine the subsurface configuration of plutonic rocks, some of which have a known uranium potential. Steven Hackett of the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, is cooperating informally on this project.

The project location is shown in figure 8.

Project Title: Shungnak-Hughes Project

Chief: William W. Patton, Jr.

Objectives: To carry out petrologic-geochemical studies and geologic mapping of the igneous and metamorphic terranes of the Nulato, Unalakleet, and Norton Bay quadrangles. Earlier investigations in these quadrangles were focused primarily upon the sedimentary rocks and their petroleum potential. The present investigations are intended to complete the geologic maps and resource appraisal by concentrating efforts on the crystalline rocks.

Status: Fieldwork was completed in the Kaiyuh Mountains of the Nulato quadrangle during 1979, and compilation of a final geologic map is underway. In 1980, fieldwork will start in the volcanic-plutonic terranes of the central and eastern parts of the Unalakleet quadrangle.

The project location is shown in figure 8.

Project Title: Northern Alaska Geophysics

Chief: John W. Cady

Objectives: To interpret aeromagnetic and gravity data in the Circle quadrangle and provide consultation pertinent to the aeromagnetic interpretation of the Medfra quadrangle, both in support of the AMRAP program. To make a regional (1:1,000,000 scale) synthesis of aeromagnetic and gravity data in the Seward Peninsula, Brooks Range, and Yukon-Tanana upland, beginning with the Philip Smith Mountains, Chandalar, Wiseman, Survey Pass, and Ambler River quadrangles. The purpose of the regional syntheses is to help decipher the tectonic history of northern Alaska and to aid in regional extrapolation of the results of AMRAP mineral resource investigations.

Status: Aeromagnetic interpretation maps have been published for Chandalar and Philip Smith Mountains quadrangles. That for Survey Pass quadrangle is in preparation. A preliminary aeromagnetic and Landsat interpretation of Circle quadrangle was made prior to geological and geophysical fieldwork there in 1979, and further interpretation will continue during 1980. The regional synthesis of geophysical data in northern Alaska is proposed to begin in FY 1981. The project has the informal cooperation of Steven Hackett of the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys.

The project quadrangles are shown in figure 8.

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), Digital and Analog Proton Magnetometer (F). The observatory also makes absolute and scale value observations that serve as base-line 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 8.

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 within 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, 1977, and 1978. A strip map of the surficial deposits along the proposed route of the Alcan (Alaska Highway) gas pipeline from Fairbanks to the Canadian border was published in 1978, and a map of the surficial deposits of the project area is in preparation.

The project location is shown in figure 8.

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 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.

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 have been made available for these quadrangles. Reconnaissance geologic mapping of the Circle quadrangle, the last unmapped quadrangle in the study area, is about 40 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. Reconnaissance geochemical sampling is about 50 percent complete, and planned fieldwork for geophysical interpretation is 90 percent complete. Few fossils are found in the metamorphic rocks; it is therefore difficult to date events and determine the geologic history. Several types of radiometric dating (potassium-argon, lead-uranium, and possibly fission track) are being applied as personnel and funds are available.

The project quadrangles are shown in figure 5.

Project Title: AMRAP Geochemistry, Circle Quadrangle

Chief: William D. Crim

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 mineral resource assessments for specific areas in Alaska.

Status: More than half the reconnaissance geochemical sampling was completed in the Circle quadrangle during the 1979 field season. The remainder of the sampling program, as well as detailed geochemical studies of mineralized areas, will be completed during the 1980 field season.

The quadrangle location is shown in figure 5.

Project Title: Petrographic Studies--Yukon-Tanana Upland

Chief: Cynthia Dusel-Bacon

Objectives: To obtain information about origin, age, and tectonic setting of the crystalline rocks of the Yukon-Tanana Upland through petrographic, petrologic, and geochronologic studies of suitable metamorphic bodies. Mineral paragenesis, textural features, field relations, chemistry, and isotopic data will be used to formulate conclusions about the age and nature of the protoliths of the metamorphic rocks studied. A large (approximately 700 square kilometers) body of augen gneiss and an aluminum silicate-bearing gneiss dome are currently being studied.

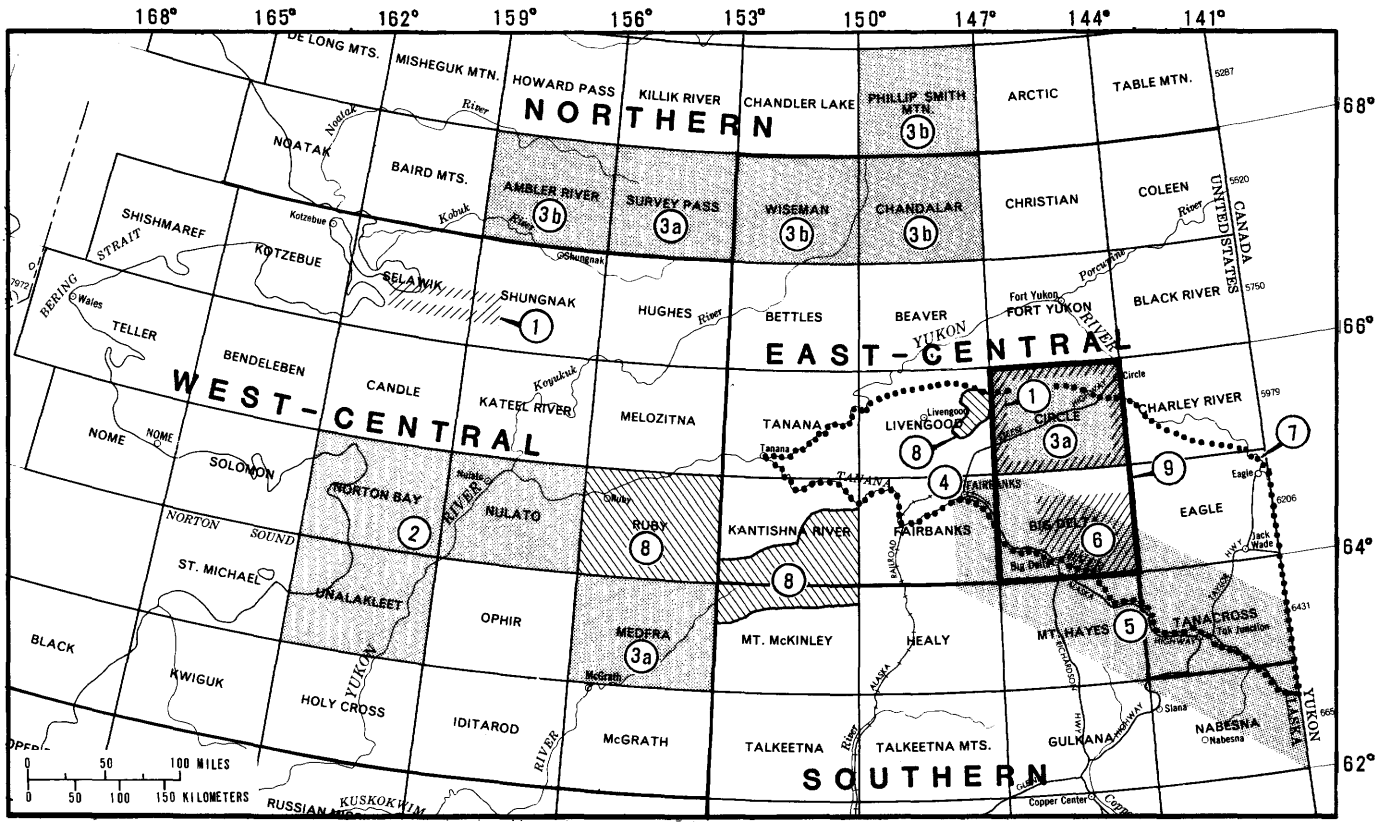
Status: Preliminary reconnaissance mapping on which these studies are based has already been completed under AMRAP. Critical field relations were examined and key samples collected for radiometric dating and geochemical analysis during 5 days of helicopter-supported fieldwork in June 1979. The results of both the augen gneiss and gneiss dome study will be reported as soon as the data become available.

The project location is shown in figure 8.

Project Title: Glacial Geology of the Yukon-Tanana Upland

Chief: Florence R. Weber

Objectives: To locate and describe the glacial advances in the Yukon-Tanana Upland, to describe associated features such as lakes and terraces, and to obtain dates of events, if possible, to describe the Quaternary history of the area. The goal is to correlate the glacial history of the upland to that of other parts of Alaska. Additionally, an attempt will be made to relate glacial events to archeological sites and to determine the relation of glaciation to gold placer deposits or other mineralization.



EXPLANATION

1. Geophysical Exploration for Uranium in Frontier Areas
2. Petrologic-Geochemical Studies and Geochemical Mapping in the Nulato, Unalakleet, and Norton Bay Quadrangles (Shungnak- Hughes Project)
3. Northern Alaska Geophysics
   a. Quadrangle Studies in Support of AMRAP
   b. Quadrangles for Proposed Synthesis
4. College Observatory
5. Tanana Valley Transportation-Development Corridor
6. Petrographic Studies - Yukon-Tanana Upland
7. Glacial Geology of Yukon-Tanana Upland
8. Arctic Mineral Resources, Kantishna River - Ruby Quadrangles
9. Geochronological and Petrologic Studies in Central Alaska (Also in Southwestern Alaska)

Figure 8. -- Geologic Division activities in west-central and east-central Alaska.

Status: This was a new project in 1979 and approximately 20 percent of the total planned work has been accomplished so far.

A preliminary photogeologic study was made of approximately 6,000 square kilometers of the most mountainous parts of the Yukon-Tanana Upland in the western part of the Eagle quadrangle and the adjoining parts of the Big Delta and Circle quadrangles to identify the glacial deposits. Nine days were spent in the field with a helicopter in September 1979 to obtain a general overview of the glacial features in a representative valley in each of the mountainous areas. A comparison of physical characteristics was made with the Donnelly and Delta moraines on the north side of the Alaska Range. At least three major glacial advances and one minor, late advance were identified. Each major advance is a complex of three or four substages. Two large areas in the Eagle quadrangle were recognized as ephemeral Pleistocene lake basins.

The project location is shown in figure 8.

Project Title: Arctic Mineral Resources (Kantishna River - Ruby Quadrangles)

Chief: Robert M. Chapman

Objectives: To map, describe, and interpret the bedrock units, surficial deposits, and structural features within a large part of the Ruby province in central Alaska and to make regional correlations and tectonic interpretations in order to provide an adequate geologic base for mineral-resource and land-use evaluations of this region. The current immediate objectives are: completion of geologic maps of the Ruby, Kantishna River, and northern part of Mount McKinley quadrangles; determination of ages for several rock units from which paleontologic and radiometric samples were collected in 1979; and confirmation of suggested correlations between several similar rock units that are discontinuously exposed in this region.

Status: Reconnaissance geologic mapping of bedrock and surficial deposits in the eastern half of the Kantishna River and northern part of the Mount McKinley quadrangles was completed in 1979. Also, most of the igneous rock bodies in the Kantishna River and southeastern part of the Ruby quadrangles were examined and sampled for radiometric dating and petrologic studies, and stratigraphic and paleontologic studies were made of selected areas and rock units in the Mount McKinley, Kantishna River, and Livengood quadrangles. The discovery in 1979 of Ordovician graptolites in the Lake Minchumina area provided new age information, and additional age data, critical to regional correlations, are expected from a number of samples of radiolarian cherts and igneous rocks. Compilation of geologic maps of Ruby, Kantishna River, and Mount McKinley quadrangles is in progress. Results of geologic studies prior to 1979 have been presented in open-file geologic maps of the Tanana and the western half of Kantishna River quadrangles, and in several short papers on the Ruby, Kantishna River, and Medfra quadrangles published in U.S. Geological Survey Circulars 733, 751-B, 772-B, 804-B. This project has been coordinated with similar work in the adjacent Livengood, Beaver, Bettles, Melozitna, Medfra, and Nulato quadrangles, and with a brief reconnaissance in the Ophir quadrangle.

The project location is shown in figure 8.

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

Chief: Frederic H. Wilson

Objectives: (1) To make topical chronologic and petrologic/geologic studies including dating of alteration mineral assemblages associated with copper porphyry-type mineralization. (2) To assist other ongoing projects by potassium-argon dating throughout central and western Alaska as needed. (3) To maintain a computer-based compilation of radiometric dates for Alaska and periodically publish the compilation in map and other forms.

Status: The project is beginning in FY 1980. However, a radiometric age map of southeastern Alaska was released as Open-File Report 79-594. The radiometric age map of south-central Alaska is in final draft stage. Preparation of the southwestern Alaska age map is underway, as is work on Miscellaneous Field Studies Map MF-1053-M, a report on Chignik and Sutwik Island quadrangles.

The project location is shown in figure 8. See also figure 11.

SOUTHERN REGION

Project Title: Chugach National Forest (RARE II)

Chief: Steven W. Nelson

Objectives: To complete multidisciplinary mineral appraisal of land in the Chugach National Forest that has been allocated for further planning under RARE II. 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: In FY 1980, the first full year for this project, an interdisciplinary team will begin field and laboratory studies leading to a resource assessment of 2.8 million acres of the Chugach

National Forest RARE II area. U.S. Forest Service guidelines call for a 1983 deadline for these studies, which will be undertaken jointly by the U.S. Geological Survey and U.S. Bureau of Mines.

Accomplishments from the 1979 season:

(1) An aeromagnetic survey of the study area by LKB Resources, Huntingdon Valley, Pennsylvania, was completed. (2) Field and petrologic studies by Travis Hudson and J. G. Arth have shown that the belt of Lower Jurassic plutonic rocks on Kodiak and Afognak Islands is predominantly quartz diorite and tonalite with little or no variation toward granodiorite; potassium feldspar is a very minor constituent of these rocks. This style of petrologic variation was also found to characterize a belt of plutonic rocks in the northern Chugach Mountains, but it is distinctly different from that identified in all other plutonic belts of southern Alaska. (3) Geochemical sampling in Prince William Sound by the U.S. Bureau of Mines was started. (4) Isotopic studies of the quartz veins in the Hope-Sunrise district by M. L. Silberman have determined that the metamorphic dehydration model for ore fluid generation is no longer valid. Oxygen isotope values for the quartz veins have the same values as meteoric water in the local area.

The project location is shown in figure 9.

Project Title: Lower Turnagain Arm and Upper Knik Arm; Alaska Coastal Environments

Chief: Susan Bartsch-Winkler

Objectives: To determine the factors which control sediment transport and deposition in the coastal region near Anchorage. The initial, now completed, phase of the project took place in upper Turnagain Arm. The study emphasis will now shift to the Fire Island area of upper Cook Inlet, where studies of the mineralogy and source of sediments will take place. In upper Knik Arm, a reconnaissance textural, compositional, and facies study will be undertaken.

Status: Studies of upper Turnagain Arm are complete. The second phase of the project, the studies of sediments surrounding Fire Island and in upper Knik Arm, will commence in 1980.

The project location is shown in figure 9.

Project Title: Framework and Petroleum Geology of Cook Inlet-Shelikof Strait Basin

Chief: Leslie B. Magoon

Objectives: To assess the oil resources of the Cook Inlet-Shelikof Strait basin by studying concurrently the geologic framework and petroleum geology. The principal parts of this study include: (1) preparation of a geologic map which displays those elements that relate to oil and gas activity; (2) preparation of a structural and stratigraphic framework that ties subsurface to surface geology; (3) oil and gas source rock evaluation; and (4) examination of the composition and diagenesis of possible reservoir sandstones.

Status: Fieldwork in the Kamishak Hills-Cape Douglas area is complete, and reports are being written. R. M. Egbert has completed the petrographic work on the sandstones from the Tuxedni Bay area and is writing up the results. The lower Cook Inlet COST No. 1 well data are being interpreted and incorporated into a report on the framework geology that is to be published as a USGS circular. Stratigraphic sections measured adjacent to the Shelikof Strait area on the Alaska Peninsula are being interpreted as analytical and petrographical data are acquired. Further work in other parts of the basin is to be completed over the next few years.

The project location is shown in figure 9.

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.

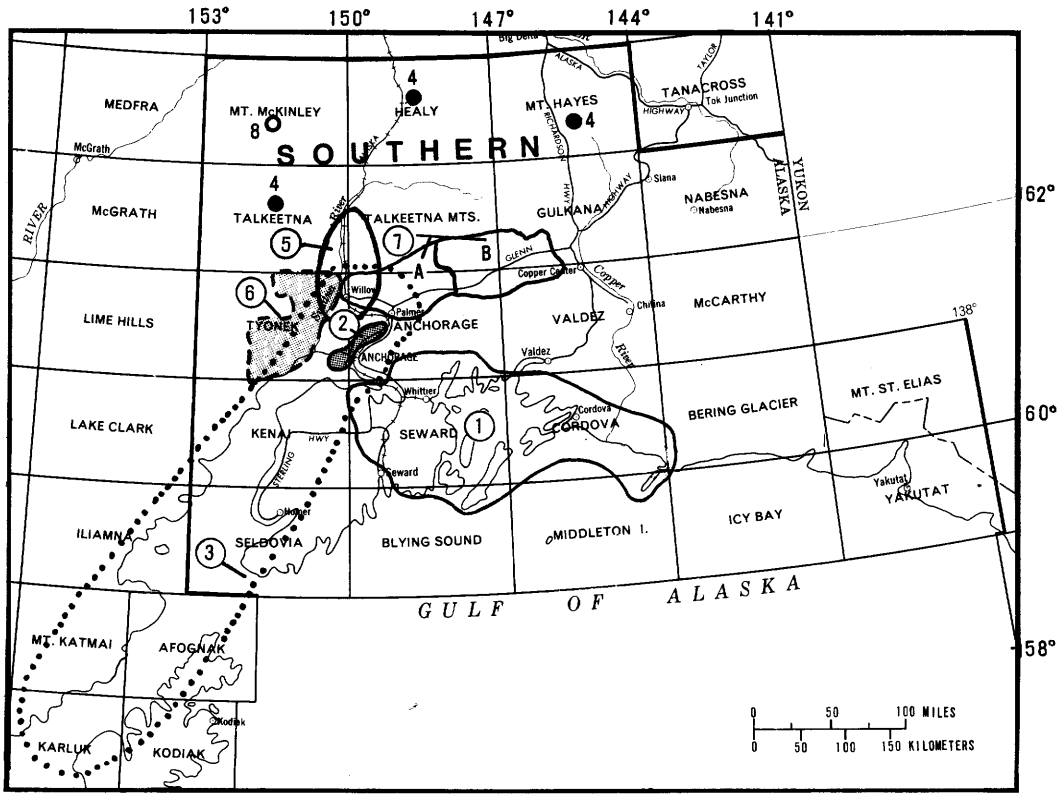
Status: The project is inactive in FY 1980. Three reports are nearing completion. The topics are as follows: Geology of the coal deposits in the Nenana coal field, the illustrations for which have been released as Open-File Report 73-355; a late Cenozoic orogeny in the Alaska Range and the history of 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 badland erosion was described in a paper presented in June 1979 at the Pacific-Northwest Experiment Station of the U.S. Forest Service in Corvallis, Oregon.

The project location is shown in figure 9.

Project Title: Earthquake Hazards Mapping, Anchorage-Susitna Lowlands

Chief: Oscar J. Ferrians, Jr.

Objectives: To complete earthquake hazards mapping in the region, with emphasis on assessing the response of surficial materials to earthquakes. The Anchorage-Susitna Lowlands region, which is within an extremely active seismic zone,



EXPLANATION

1. Chugach National Forest (RARE II)
2. Alaska Coastal Environments, Turnagain and Knik Arms
3. Framework and Petroleum Geology, Cook Inlet and Shelikof Strait
4. Alaska Range Coal Resources
5. Earthquake Hazards Mapping
6. Regional Engineering Geology of Cook Inlet Coal Lands
7. Nelchina Area Stratigraphic Studies
   a. Stratigraphic and Tectonic
   b. Detailed Mapping and Stratigraphic
8. Geochemical Composition, Sources and Transport of Atmospheric Dusts

Figure 9. -- Geologic Division activities in southern Alaska.

undoubtedly will experience the greatest development and population growth of any region in Alaska. It occupies a strategic location for land and air transportation and includes the largest city in Alaska (Anchorage), as well as the proposed site for the new State capital near Willow. 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 earthquake hazards indentification and evaluation.

Status: A demonstration area has been selected for this investigation and for mapping at a scale of 1:100,000. This area includes all of the Anchorage A-8, B-8, and C-8, Tyonek A-1, B-1, and C-1 quadrangles, and a narrow strip along the southern border of the Anchorage D-8 and Tyonek D-1 quadrangles. This will be a 3-year study and will include: surficial and bedrock geologic mapping, engineering geologic mapping and assessment, Bootlegger Cove Clay study, active faults study, slope mapping, seismic study, ground response study, engineering soils study (liquefaction and sensitive clays), collection and syntheses of subsurface soils data, and earthquake hazards mapping.

The project location is shown in figure 9.

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 65 miles west of Anchorage, where strip mining of coal is 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 test hole drilled to a depth of 120 meters in the proposed Capps coal field area.

The project location is shown in figure 9.

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 9.

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 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: Sampling in Alaska was completed in 1977, but analytical data for the State are still incomplete. Some Alaskan data have been reported in two preliminary publications, Open-File Report 78-701 and in the volume of abstracts for the 1978 national 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, Buffalo, are collaborating with sampling. Analytical cooperation is being provided by Virginia Polytechnic Institute and other branches of the Survey.

The project location is shown in figure 9.

Project Title: Healy Quadrangle (AMRAP)

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: In a reconnaissance fashion, the geology of approximately the southern one-third of the quadrangle has been mapped. Summer plans for 1980 call for the continuation of geologic mapping and investigations, as well as for geochemical sampling, in the eastern half of the quadrangle. Additional fieldwork is planned for the summer of 1981.

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: Project fieldwork will commence during the summer of 1980.

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 thorough mineral-resource assessment of the Mount Hayes quadrangle. Fieldwork will include: (1) geologic mapping at scales of 1:250,000 to 1:1,200; (2) detailed studies and sampling of mineralized areas; (4) isotopic studies of bedrock and mineralized rocks; (5) interpretation of aeromagnetic surveys; (6) mapping and sampling of placer deposits; and (7) surficial geology studies.

Status: Two 30-day field seasons are planned for the summers of 1980 and 1981 with a team of 7 to 12 people. Fieldwork will concentrate on the northern part of the quadrangle. A team of 7 to 17 people completed studies of the southern part of the quadrangle in 1979. Fieldwork in 1980 will include: (1) geologic mapping in the northern part of the quadrangle at a scale of 1:63,360; (2) detailed mapping and sampling of bedrock mineral deposits; (3) study and mapping of surficial deposits; (4) geochemical sampling of stream sediments; (5) mapping and sampling of placer deposits; and (6) sampling of bedrock for isotopic studies.

The quadrangle location is shown in figure 5.

Project Title: AMRAP Geochemistry, Mount Hayes Quadrangle

Chief: Gary C. Curtin

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: Reconnaissance geochemical sampling was 80 percent completed during the 1979 field season. The remainder of the reconnaissance geochemistry and other geochemical studies will be completed during the 1980 season.

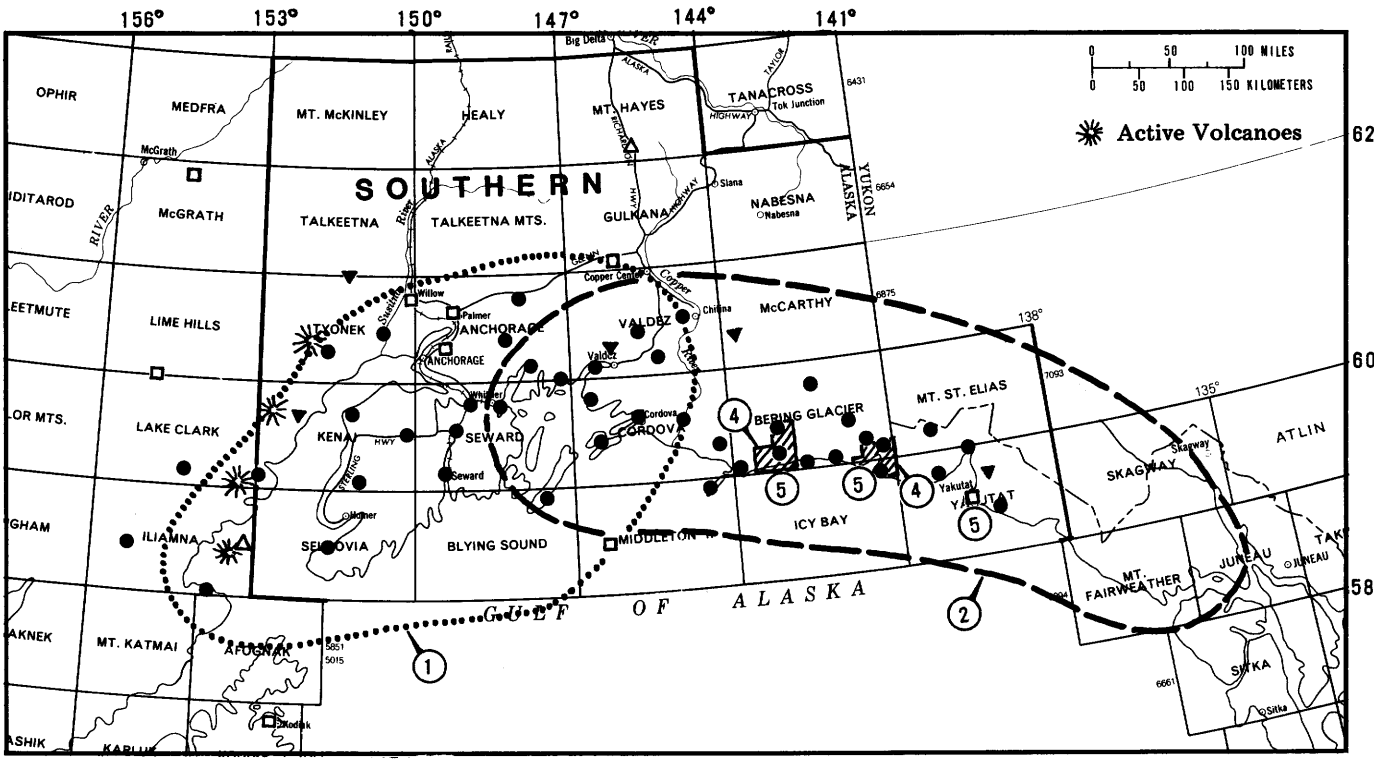
The quadrangle location is shown in figure 5.

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: The Alaska seismic studies project, which began in 1971, currently operates seismic equipment at 25 sites covering the region from



EXPLANATION

1. Alaska Seismic Studies
2. Eastern Gulf of Alaska Seismic Studies
3. Network of Sensitive Seismographs
   - ● USGS Vertical Component
   - ▼ USGS 3 Component
   - □ NOAA
   - △ University of Alaska
4. Tilt Operations
5. Crustal Strain Study

Figure 10. -- Geologic Division earthquake studies in southern Alaska.

Cook Inlet to Prince William Sound. Open-file reports summarizing the data collected are prepared with quarterly listings of earthquake parameters and epicenter maps.

The seismic instrument locations are shown in figure 10.

Project Title: Eastern Gulf of Alaska Seismic Studies

Chief: John C. Lahr

Objectives: To evaluate the hazards associated with earthquake activity in the eastern Gulf of Alaska and adjacent onshore areas that could pose a threat to the safety of petroleum exploration and development.

Status: A network of 25 short-period telemetered seismic stations is now operating between Prince William Sound and Yakutat Bay. Three additional stations will be installed this year to extend the network into the region between Juneau and Yakutat. Strong motion instruments are operated at 17 sites between Cook Inlet and Yakutat. Special emphasis is being placed on data collected from the region between Icy Bay and Kayak Island. This area has been identified as a likely site for large earthquakes within the next few decades. Quarterly and annual reports are published by the National Oceanic and Atmospheric Administration as "Alaskan OCS Principal Investigators' Reports."

The project location and network are shown in figure 10.

Project Title: Tilt Operations in the Yakataga Seismic Gap

Chief: Carl E. Mortensen

Objectives: To monitor crustal deformation associated with strain accumulation prior to earth-

quakes in the Yakataga seismic gap.

Status: Two tiltmeters were installed at Cape Yakataga and Yakutat in March 1977. In August 1979 redundant instruments were added at Cape Yakataga and Yakutat and a new site was established at Icy Bay. Data from these instruments are telemetered through the GOES satellite system to Menlo Park, California, for analysis. On-site recorders provide a telemetry backup.

The project area is shown in figure 10.

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: The Cape Yakataga geodetic network was first surveyed by the Geological Survey in 1979 and will be resurveyed in 1980. Funding permitting, the Icy Cape network will be surveyed for the first time in 1980. In addition, the Shumagin Islands network will be surveyed.

The project location is shown in figure 10.

SOUTHWESTERN REGION

Project Title: Tikchik Lakes-Taylor Mountain Quadrangle Area, Southwest Alaska

Chief: Joseph M. Hoare

Objectives: The long-term objective is to complete the geologic mapping (recessed in 1971) of the Taylor Mountains quadrangle. The short-term objective is to determine the age and structure of rocks accessible by boat or foot along the shores of the Tikchik Lakes.

Status: Prior to the recent investigation, Permian fossils had been found at 10 localities in the Paleozoic rocks in the Tikchik Lakes area and the structure of the rocks suggested that all the Paleozoic rocks were Permian. However, radiolarians in chert collected along the shores of two lakes show that many of the rocks are of early Paleozoic age. A paper describing the results of this study is being prepared. The results of a paleomagnetic study made on Permian volcanic rocks are described in a preliminary paper now in press; a paper describing the paleomagnetic study in greater detail is being prepared. The work so far has been restricted to the southern Tikchik Lakes. Further work will extend the investigation northward.

At least 40 to 60 days of helicopter-assisted fieldwork will be needed to study the mountains between the lakes and to map the eastern part of the quadrangle.

The project location is shown in figure 11.

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

Chief: Robert L. Detterman

Objectives: To provide a rapid evaluation of the mineral and energy resources of the quadrangles based on reconnaissance geologic, geochemical, geophysical, and telegeologic mapping. These include geologic mapping at 1:63,360 and 1:250,000 scale; stream-sediment and pan-concentrate sampling of streams; age determination of mineralized and altered areas by potassium-argon methods; a regional aeromagnetic study; and a geothermal investigation of the volcanic centers.

Status: Geologic mapping was started on a limited scale in 1979; about 30 percent of the area has been covered. Geochemical sampling of the streams and bedrock is about 50 percent complete. Fieldwork in 1979 was primarily confined to the Ugashik quadrangle. Aeromagnetic data will be obtained in 1980.

The project quadrangles are shown in figure 11.

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

Status: Forty percent of the reconnaissance geochemical sampling was completed during the 1979 field season. This sampling program is expected to conclude with the 1980 field activities.

The project quadrangles are shown in figure 11.

SOUTHEASTERN REGION

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

Chief: Henry C. Berg

Objectives: To furnish timely, objective information on southeastern Alaska's regional mineral

endowment, and to provide reliable geological estimates of its undiscovered mineral resources. In FY 1980, the project will begin a multidisciplinary mineral resource assessment of the southeastern panhandle that will integrate geology, geotectonics (stratotectonics), geophysics, geochemistry, and economic geology. The assessment, which will feature 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, 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. However, during the last fiscal year several investigations under the AMRAP program were used as background studies for this project. These investigations included: (1) Starting compilation of 1:1,000,000-scale maps of the study area portraying mineral deposits (with tables) and aeromagnetic contours; (2) publishing a tectonostratigraphic terrane map (Open-File Report 78-1085); (3) publishing preliminary reports (Alaska Geological Society abstract and USGS Circular 804-B article) describing distribution of selected types of mineral deposits in the tectonostratigraphic terranes of the study area; and (4) beginning mapping and sampling of selected types of mineral deposits and their tectonostratigraphic settings.

In addition, the following findings of economic interest 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 Late Triassic metallogenic province in the study area containing volcanogenic massive zinc, lead, silver (and copper) sulfide, as well as 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 12.

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 Range plutonic and metamorphic complex, and to assist in solving other geochronology problems through consultation and dating of minerals and rocks from Alaska.

Status: The project is a continuing one, offering geochronology support to other projects in southeastern Alaska and consultation on geochronology to members of the Branch of Alaskan Geology.

The project location is shown in figure 12.

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 U.S. 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.

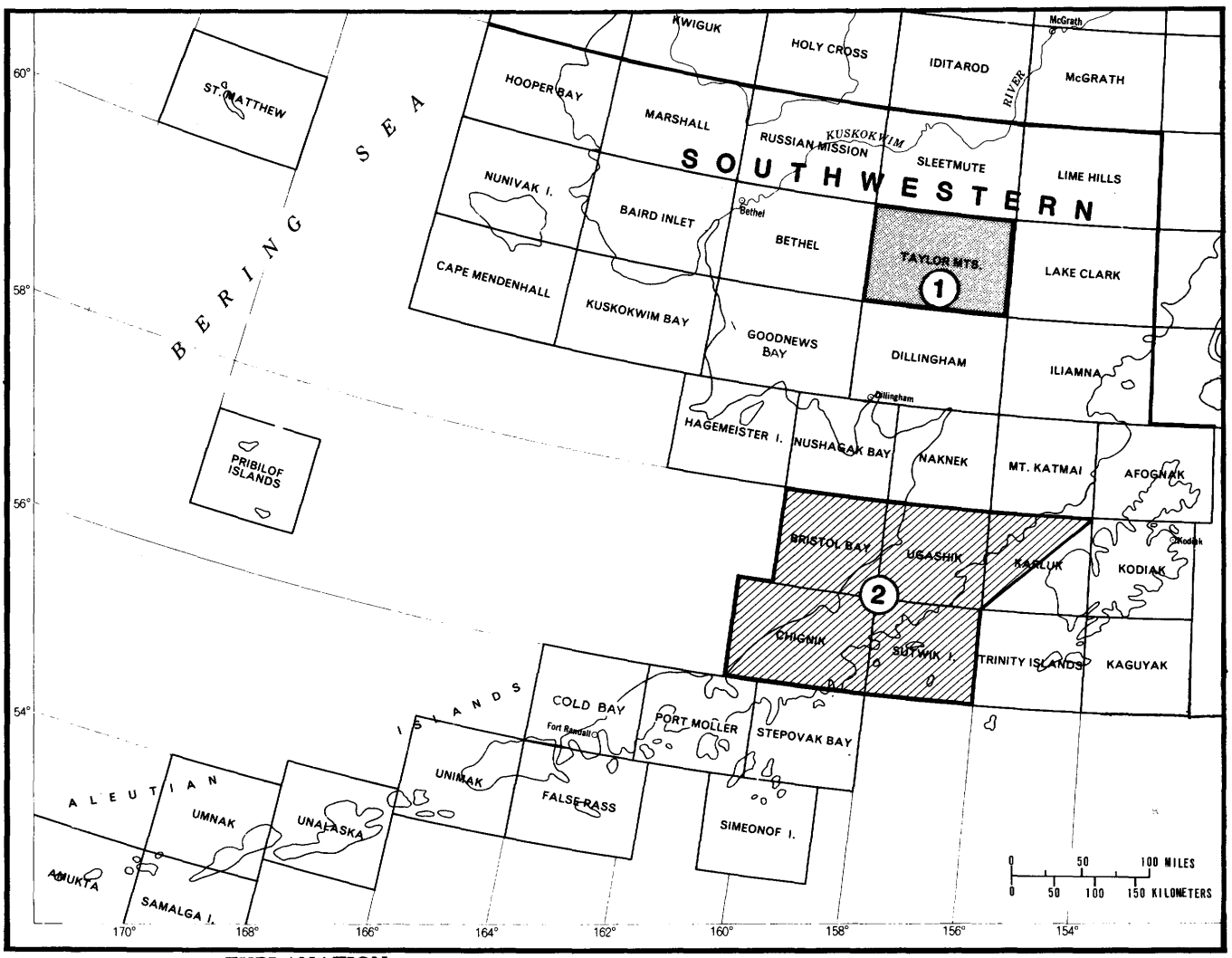
Status: The geologic mapping and mineral-resources assessment were completed, and an open-file report transmitted by the August 1, 1978, deadline agreed upon by the Survey and the Park Service. The reconnaissance geologic mapping is not satisfactorily complete. A bulletin report is in review; a "detailed-reconnaissance" 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 outside areas is underway.

The project location is shown in figure 12.

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

Chief: David A. Brew

Objectives: To conduct reconnaissance (in part) and detailed (in part) geologic and geochemical mapping and a mineral resource appraisal of a



EXPLANATION

1. Tikchik Lakes - Taylor Mountains Quadrangle Area
2. Geochronological and Petrologic Studies in Southwestern Alaska (Also in Central Alaska)

Figure 11. -- Geologic Division activities in southwestern Alaska.

broad transect across the Coast Range plutonic complex. The transect begins in metavolcanic and metaclastic rocks of a low-grade, intermediate-pressure and -temperature facies series on the southwest and progresses through higher grade schists, gneisses, and spatially associated metavolcanic and metaclastic rocks of a low-pressure - high-temperature facies series along the international boundary. This information will provide the regional framework for the Juneau Gold Belt and for mineral occurrences near the United States-Canada boundary.

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 concerning metamorphism, geochemistry of Mesozoic metavolcanic rocks, mineral resources, and structure have been published, and more are in progress.

The project location is shown in figure 12.

Project Title: Geology and Mineral Resources of the Petersburg 1:250,000-scale Quadrangle and Some Contiguous Areas

Chief: David A. Brew

Objectives: To carry out reconnaissance geologic and geochemical mapping and mineral resource assessment of this critical 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 Donald Grybeck.

Status: The 1979 field season was the second for this project. A broad transect from southwest to northeast across the project area was completely mapped, and stream-sediment samples were collected for about four-fifths of the area by the related geochemistry project (J. B. Cathrall, Chief). Compilation of data from previous mapping in the area is underway, as is a major-element study of the granitic rocks. An aeromagnetic survey has been completed, and the results open-filed.

The projected location is shown in figure 12.

Project Title: Mineral Resources of Petersburg (1:250,000) Quadrangle, Alaska

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) quadrangle in southeastern Alaska 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 project started in the 1978 field season with a second field season in 1979; a third field season is projected for the summer of 1980. Geochemical sampling and analyses of approximately 70 percent of the area have been completed (3,533 rock samples, 1,040 stream-sediment samples, and 1,004 heavy mineral concentrates from sediments). Analyses for uranium and thorium of approximately 650 stream-sediment samples and 450 rock samples from selected areas are in progress.

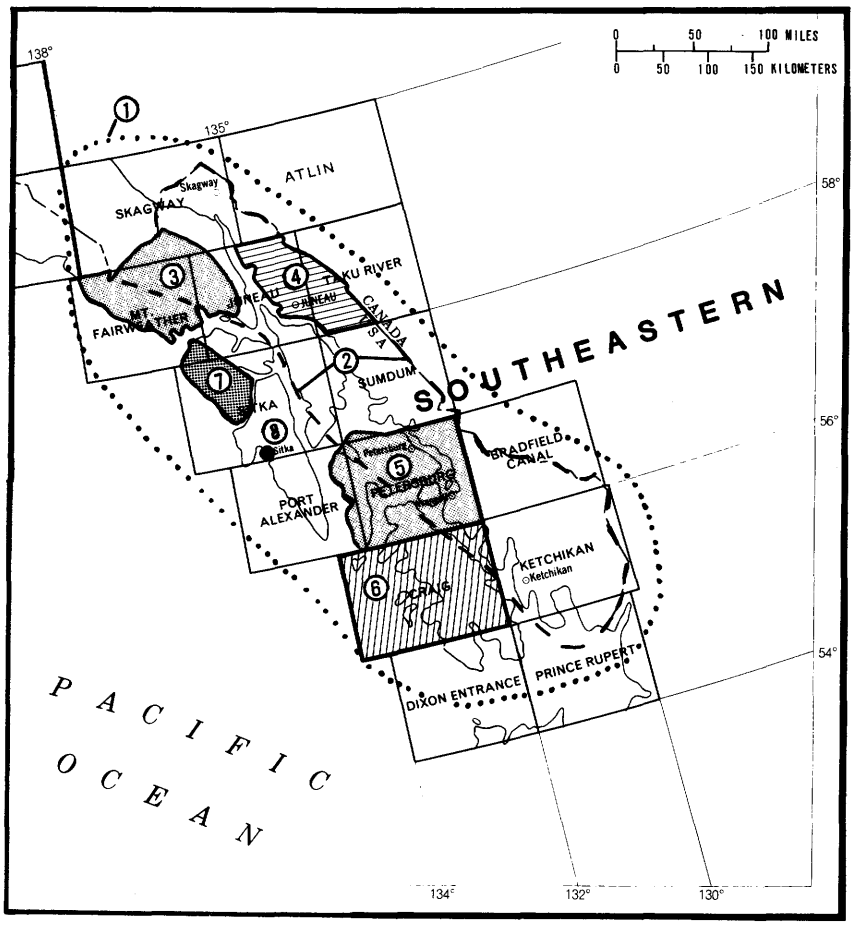
The project location is shown in figure 12.

Project Title: Craig Quadrangle

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

Objectives: Primarily to provide the public and government agencies with a modern 1:250,000-scale geologic map of the complex terrane that underlies the Craig quadrangle. This map will serve as a necessary geologic frame of reference for mineral resource assessment, multi-use planning, and development. Secondary objectives relate to developing the stratigraphic, structural, and petrologic data base needed to formulate an understanding of the geologic evolution of this segment (Craig subterrane) of the Alexander terrane in terms of modern geotectonic concepts.

Status: The project, which has been active since 1973 with interim recesses because of other higher priority assignments, has yielded 26 topical papers, 12 published abstracts of papers presented at scientific meetings in the United States and abroad, and 7 published summaries of noteworthy findings. Fieldwork having been completed, full attention is now being devoted to completion of the map for open-file release in 1980 and preparation of several topical papers. In addition, laboratory geochronologic analytical procedures (mainly uranium-lead) on an extensive suite of samples collected during the 1979 field season have been initiated and are scheduled to continue



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. West Chichagof - Yakobi Island Wilderness Study
8. Sitka Observatory

Figure 12. -- Geologic Division activities in southeastern Alaska.

throughout 1980.

The project location is shown in figure 12.

Project Title: West Chichagof-Yakobi Island Wilderness Study

Chief: Bruce R. Johnson

Objectives: To appraise the mineral-resource potential of an area at the northwest corner of the Alexander Archipelago. The appraisal is part of a U.S. Forest Service study of the suitability of the area for inclusion in the National Wilderness Preservation System. The appraisal will evolve from: (1) reconnaissance geologic, geochemical, and structural information gathered in the 1975 Geological Survey study of the northwestern Alexander Archipelago (Professional Paper 792); (2) detailed geologic mapping in selected areas covered by previous reconnaissance studies; (3) reconnaissance bedrock geochemical sampling; (4) reconnaissance stream-sediment geochemical sampling; (5) aeromagnetic surveying; and (6) detailed examination and sampling of selected known mineral occurrences and of areas containing anomalous concentrations of selected metallic elements.

Status: Work to date has concentrated primarily on data gathering and field mapping. Data from the aeromagnetic survey have been reduced, and an aeromagnetic contour map has been published. Analysis of stream-sediment, panned concentrate, water, and bedrock geochemical samples is complete, and production of geochemical anomaly maps is underway. Field mapping in the study area is

complete at a scale of 1:125,000; compilation of a geologic map at that scale is in progress. Fieldwork was also completed on the special study of the nickel deposits on Yakobi Island and at Mirror Harbor. Modal analyses of all plutonic rock samples have been completed, and thin-section petrographic studies are in progress for all samples collected during the 1979 field season.

The project location is shown in figure 12.

Project Title: Sitka Observatory

Chief: Willis E. Osbakken

Objectives: The observatory operates seismic instruments for acquiring information on the global occurrence of earthquakes; telemeters seismic and tidal data to the Alaska Tsunami Warning Center at Palmer; and records and measures, on a continuous basis, the various elements of the Earth's magnetic field and distributes 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 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 12.

OFFSHORE

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

Chief: Peter W. Barnes and Erk Reimnitz

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--river effluents, ice-rafting, currents, and ice grounding are all important segments of this regime, (3) studying the historical record to provide information concerning the stability of the present regime and its behavior in the past, and (4) relating geologically defined variables to those defined by the other major disciplines, such as biology, physical oceanography, and chemistry.

Status: This project studies the geology of the Arctic shelf environment, where ice plays a dominant role. Using sediment profiling, core sampling, diving, underwater TV and photography, thermoprobes, oceanographic sensors, and remote sensing, the effects of ice on sediments, bathymetry, heat transfer, river discharge, and sediment transport have been investigated. This has resulted in a significant advance in the understanding of the marine geologic environment of the Arctic.

The overall character and development of the sea-ice regime on the shelf are apparently controlled by the morphology of the coast and sea bed. 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 is unknown. Our seismic records have shown at least two features which may constitute hazards: unexplained hyperbolic reflectors, and acoustic anomalies which may be related to ice or gas in near-surface sediments. 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 along with 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.

Present efforts are aimed at further understanding the dominating influence of ice on the Arctic geologic environment and processes.

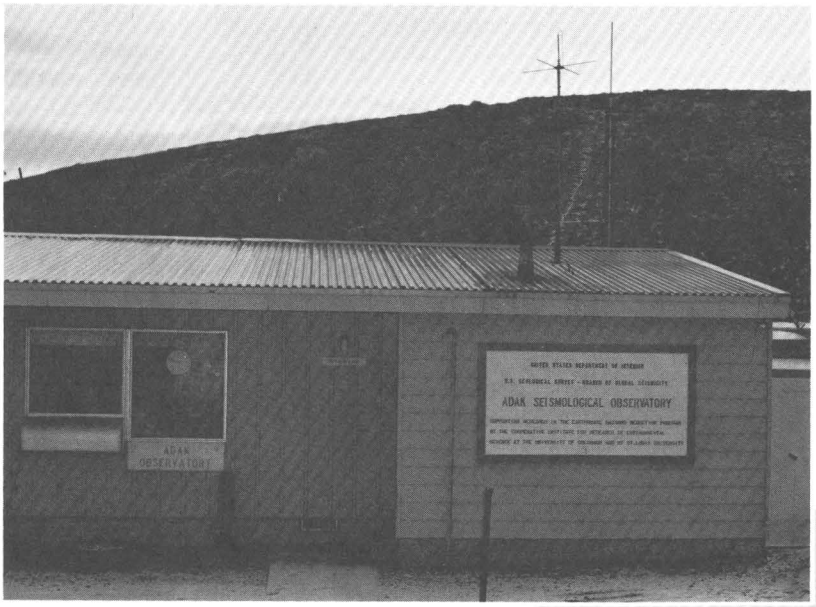
The location of the project is shown in figure 13.

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

Chief: Arthur Grantz

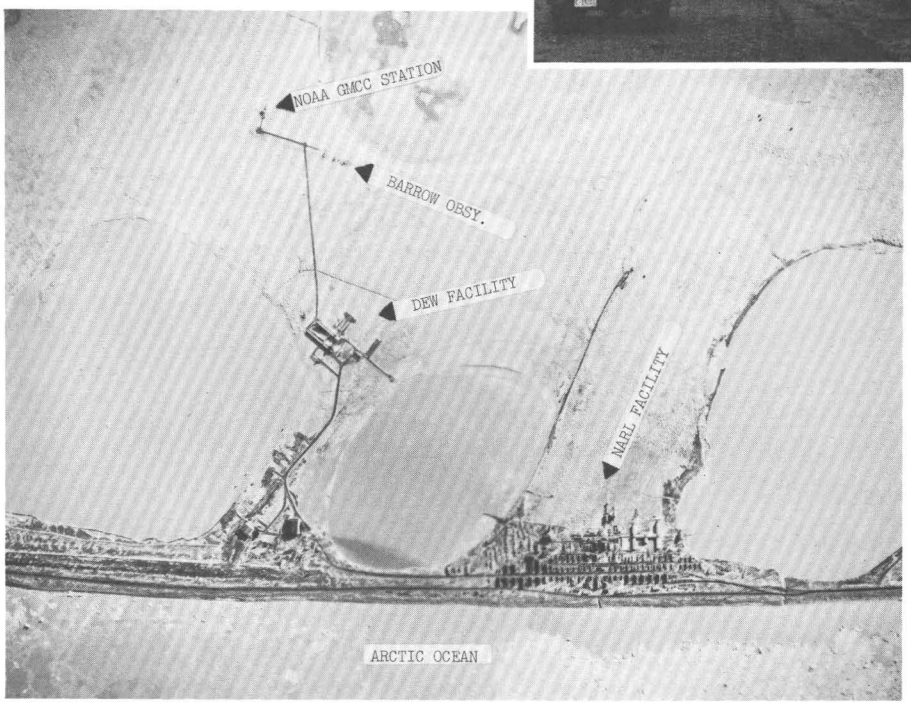
Objectives: To determine the geologic framework, mineral fuel potential and non-sedimentary geoenvironmental hazards (i.e., submarine landslides and active faults) of the Alaskan continental shelf and slope in the Beaufort and Chukchi Seas.

Status: Primary geophysical (multichannel seismic, gravity, high-resolution seismic, sonobuoy refraction) data collection is largely complet-



Adak Seismic Observatory

Sitka Seismic Observatory



Barrow Observatory site

Alaskan observatory facilities for monitoring seismic activities.

ed, and data processing and report preparation are underway. Geologic sampling, topical studies using high-resolution seismic and side-scan sonar profiling, and extension of primary geophysical data into previously ice-covered areas will be accomplished as ships become available, perhaps in 1980 or 1981.

The project location is shown in figure 13.

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. This area includes Norton Basin.

Status: This project began in 1978, and in that year about 2,500 kilometers of 24-channel seismic-reflection data and gravity data were collected, mainly over Norton Basin. In 1977 and 1978, seismic-refraction data were obtained at 35 stations over and near the basin. All geophysical data are presently being reduced and interpreted.

The project location is shown in figure 13.

Project Title: Environmental Geologic Studies of the Northern Bering Sea (Marine Geology Program)

Chief: C. Hans Nelson

Objectives: To make geologic environmental analyses of the northeastern parts of the Bering Sea. This project, in progress since 1976, is in preparation for the Outer Continental Shelf leasing program. The program is a cooperative effort of the U.S. Geological Survey and the Bureau of Land Management through interagency agreement with National Oceanic and Atmospheric Administration. High-resolution geophysical surveys and sediment sampling have been used to characterize the geologic environment and delineate a number of potential geological hazards: (1) tectonism and faulting; (2) sediment stability, including seismic stratigraphy, geotechnical characteristics, liquefaction potential, gas-charged sediment, and thermogenic gas seeps; (3) sediment dynamics, including sediment transport during storms, mobile bedforms, current scour, and ice gouging; and (4) containment dispersal pathways of artificially and naturally introduced materials.

Status: Three months of fieldwork was conducted in the northeastern part of the Bering Sea during the summer of 1978, whereas 1979 was spent reducing and interpreting new data and synthesizing the data base for a preliminary geologic environmental assessment report. Fieldwork included a one-month cruise aboard the research vessel (R/V) *Sea Sounder* and covered 2,000 kilometers of geophysical trackline, collecting data with a 3.5-kHz (kilohertz) profiler, a 7/200-kHz profiler, a 160-kilojoule sparker, a minisparker, a Uniboom, and side-scan sonar equipment. In addition, 28 vibracorer, 14 current meter, and 9 camera stations were occupied. In 2 months aboard the R/V *Karluk* the Survey covered 80 kilometers of geophysical tracklines, gathered side-scan sonar, Uniboom, and 7/200-kHz profiler data, and occupied 22 vibracorer stations in the nearshore areas of Yukon Delta, Port Clarence, Nome, and Safety Sound.

Cores were logged for lithology, photographed, radiographed, and subsampled at sea or in the laboratory. Gas composition and geotechnical properties of core samples were also measured. Selected core subsamples underwent laboratory analysis for texture, mineralogy, paleontology, radiocarbon dating, lead-210 dating, carbon content, gas and hydrocarbon fractions, and trace elements.

These data were reduced, analyzed, and interpreted for presentation in open-file reports or scientific journals. A major synthesis effort was undertaken in the fall of 1979 to present a preliminary geologic environmental evaluation for the tentative tract selection process in the spring of 1980.

Plans for summer 1980 field season emphasize reconnaissance geophysical surveying and vibracorer sampling in Chirikov Basin and topical studies in Norton Sound and eastern Chirikov Basin. Topical studies will emphasize water-current and sediment dynamics by studying the sea floor with side-scan sonar and an *in situ* flume. The dynamics studies are related to liquefaction, mobile bedforms, scour, slumping(?), and storm sand sheets.

The project area is shown in figure 13.

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

Chief: Paul R. Carlson

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 initial cruise of this new project will be reconnaissance in nature and will consist of high-resolution seismic profiling, dredging, and coring.

The project location is shown in figure 13.

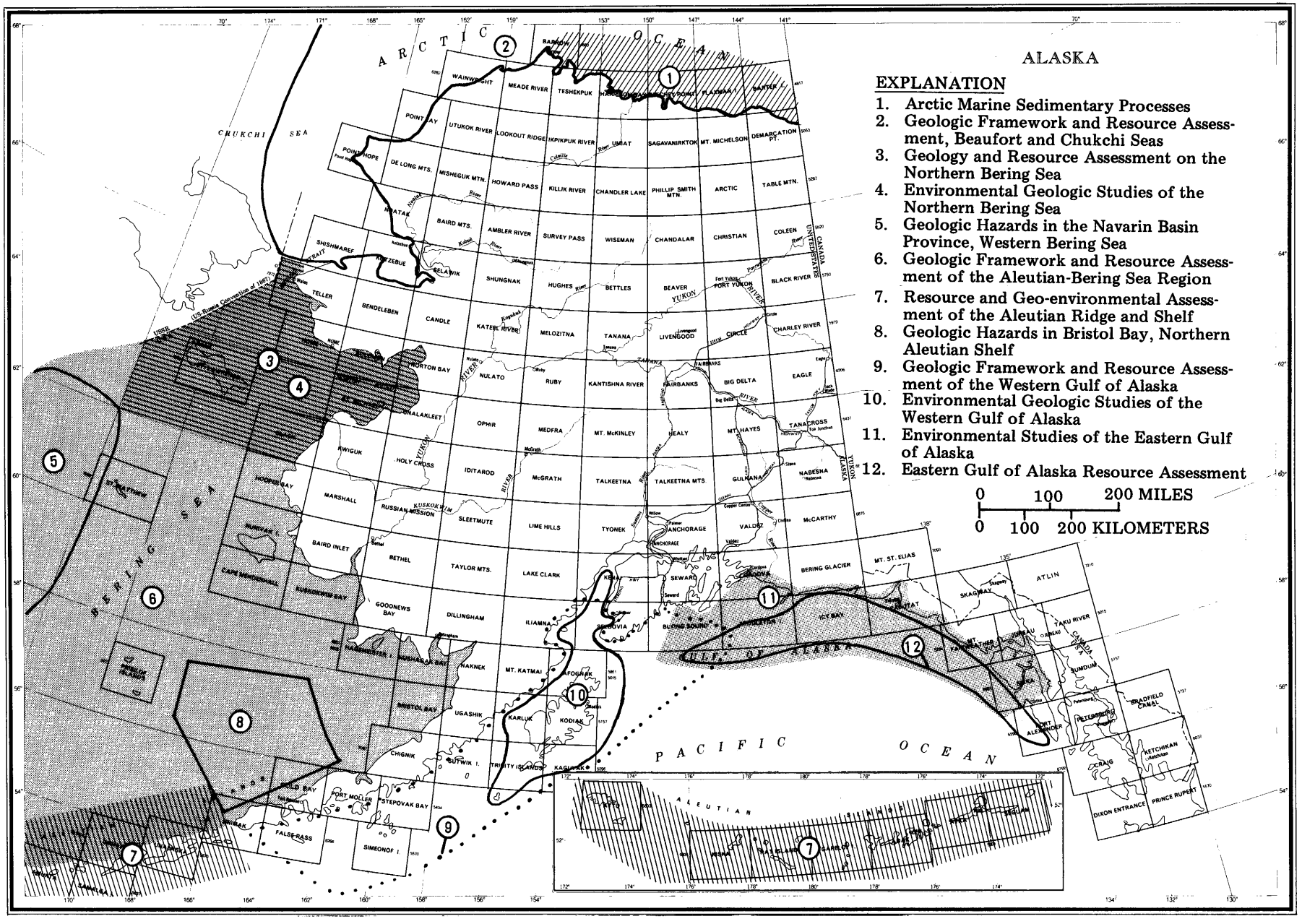


Figure 13. -- Offshore geologic activities in Alaska, Marine Geology Program.

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. 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 3,000 miles of 24-channel seismic-reflection data has been collected over the eastern Bering Sea shelf and the adjacent abyssal Aleutian basin. During 1979 these data were processed to a preliminary, working form and are currently being interpreted. In 1978, 20 dredge sites were successfully occupied along the Beringian margin and more than 8 tons of rock was recovered. These samples ranged in age from Late Jurassic to Pleistocene, and include volcanic sandstone and siltstone, limestone, tuff, basalt, and mylonite. A preliminary description including tentative age assignments of these samples was published in 1979. Resource reports on the entire shelf, St. George basin (both shelf and slope areas), and Bristol Bay basin have been transmitted to the Bureau of Land Management. Two reports concerning recommendations for treaty negotiations with the USSR have been sent to the Department of State.

Major subshelf basins have been identified and described via structure contours and sediment isopachs soon to be published as a Miscellaneous Field Studies Map. Owing to fiscal constraints, no cruise was conducted north of the Aleutian arc in 1979. We plan a geophysical cruise on the USGS R/V *S. P. Lee* in 1980 over the northwestern Bering shelf to tie data from Navarin basin to Anadyr basin, and thence to Soviet data from 25 wells drilled onshore in Anadyr (where oil and gas shows have been found). We may also attempt sampling of the margin from the National Oceanic and Atmospheric Administration R/V *Discoverer* if ship time is available.

The project location is shown in figure 13.

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 geological 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 magnetic arc that in many places includes thick masses of sedimentary deposits of Cenozoic age.

Status: The project is less than 10 percent completed. One short cruise in the region collected single-channel reflection profiles and dredged about 20 submarine outcrops. Ten days were spent on Amlia Island.

Figure 13 shows the project location.

Project Title: Geologic Hazards in Bristol Bay, Northern Aleutian Shelf (Marine Geology Program)

Chief: Gordon R. Hess

Objectives: To identify the geologic hazards in Bristol Basin, northern Aleutian Shelf. These hazards include but are not limited to surface and near-surface faults, unstable marine sediment, gas-charged sediment, sediment transport, and ice gouging. First-phase studies will determine the distribution, age, and degree of present activity of these tectonic features and sediment distribution and modification processes.

Initially, a regional overview will be obtained to determine the relation between the project area and the tectonic and sedimentation patterns of the Bering Sea. More detailed studies of specific features and their hazard potential, as well as comprehensive coverage of smaller areas, will be the objectives of later phases of data collection.

Status: Plans are presently being made for the first season of field studies in the Bristol Basin area. A small amount of previously collected seismic data is being studied to assist in the planning of this fieldwork. A proposal is being prepared for submittal to National Oceanic and Atmospheric Administration for funding of the Bristol Basin study.

The area covered by the project is shown in figure 13.

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

Chief: Roland von Huene

Objectives: To understand the regional tectonic framework, geologic history, and geodynamic aspects of the western Gulf of Alaska continental

margin, especially as it pertains to energy and mineral resources, earthquake activity and explosive volcanism. These objectives are met insofar as possible through geophysical means at sea and geologic mapping on the adjacent land since these are the least costly methods of study in the marine and terrestrial environments. The greatest potential for knowledge is through interdisciplinary efforts that bridge geology across the shoreline.

Status: Major offshore sedimentary basins have been outlined, and their age and general sediment fill have been inferred. These basins are probably too young to contain the large accumulations of hydrocarbons required for commercial production. Therefore, the major targets for petroleum development are the rocks that floor the eight or nine basins on the shelf. Perhaps further sampling of older rocks that could crop out on the continental slope will give more precise answers. Abundant hydrocarbon-trapping structures have been located in some basins; however, structures below the basins are difficult to delineate geophysically, and special techniques are required for study. Many active faults have been located and mapped, including some that were probably active during the 1964 earthquake. Future studies will complete delineation of shelf basins and concentrate on studies to project possible sedimentary environments and delineation of deep tectonic structure. A special study of Holocene earth dynamics is taking form as certain data are becoming available.

The project location is shown in figure 13.

Project Title: Environmental Geologic Studies of the Western Gulf of Alaska (Marine Geology Program)

Chief: Monty A. Hampton

Objectives: To provide a geologic environmental assessment of lower Cook Inlet and Kodiak Shelf in support of the Federal Government's Outer Continental Shelf petroleum leasing program. Geologic conditions that can affect, or be affected by, industrial activities on the shelf are identified and described, and their hazard potential is evaluated.

Status: Fieldwork in lower Cook Inlet has been completed, and final reports are in preparation. The major environmental concerns are movement of large bedforms (underwater sand dunes), seismicity, and volcanism. Work on Kodiak Shelf is nearing completion, with one more season of fieldwork planned. The major environmental concerns are seismicity, shallow faulting, gas-charged sediment, and sediment scour and fill. In the summer of 1980, fieldwork will begin in Shelikof Strait, which has been included in the area offered for lease in the upcoming lower Cook Inlet sale. Regional characterization work, utilizing high-resolution sub-bottom profiling techniques, along with sediment sampling, will be conducted on a gridwork pattern. Detailed studies of specific problem areas will be made as the areas are identified.

Measurements of geotechnical properties of Kodiak Shelf sediment are being made to provide information for predicting the engineering behavior of these submarine sediments. Similar measurements will be made on samples from Shelikof Strait.

Figure 13 shows the project location.

Project Title: Environmental Studies of the Eastern Gulf of Alaska (Marine Geology Program)

Chief: Bruce F. Molnia

Objectives: To investigate the continental shelf leading to an understanding of the geologic processes that have shaped development of the eastern Gulf of Alaska and to investigate the study area so as to understand environmental hazards that might have adverse effects on the development of mineral and petroleum resources on the shelf.

Status: The project was started in 1974 and is ongoing. Its termination is a function of whether petroleum exploration and development continues in the Gulf of Alaska. The earliest completion of the project would be FY 1982.

During the previous fiscal year the following field studies were conducted: (1) erosion studies at Sitka National Historic Park-June 1979; (2) sediment sampling cruises--NOAA R/V *Discoverer* - May, July-August 1979; (3) beach ridge age and origin study--Yakutat to Yakataga--August 1979; (4) geophysical and sediment sampling cruise--September-October 1979; and (5) sediment sampling cruise--R/V *Nunatak* --October 1979 (Glacier Bay).

Data collected by these projects as well as data collected by the R/V *Thompson* in 1974; *Surveyor*, *Cromwell*, *Greene*, and *Discoverer* in 1975; *Acona*, *Sea Sounder*, *Discoverer*, and *Campbell* in 1976; *Sea Sounder* and *Growler* in 1977; and *Sea Sounder* and *Growler* in 1978 are continuously being evaluated for an understanding of the environmental hazards, bathymetry, and geologic history of the eastern Gulf of Alaska.

The project location is shown in figure 13.

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.

Status: Acquisition of marine geophysical data is completed. Maps and reports on the structure, magnetics, gravity, and bathymetry of the region are in various stages of preparation or have been published for the northern Gulf of Alaska. In addition, 14 reconnaissance crossings of the continental margin in the eastern part of the Gulf of Alaska between Cross Sound and Dixon Entrance indicate a general absence of potentially petroliferous Tertiary basins and provide data on the tectonic style of this transform margin. No fieldwork is planned for 1980.

The project location is shown in figure 13.

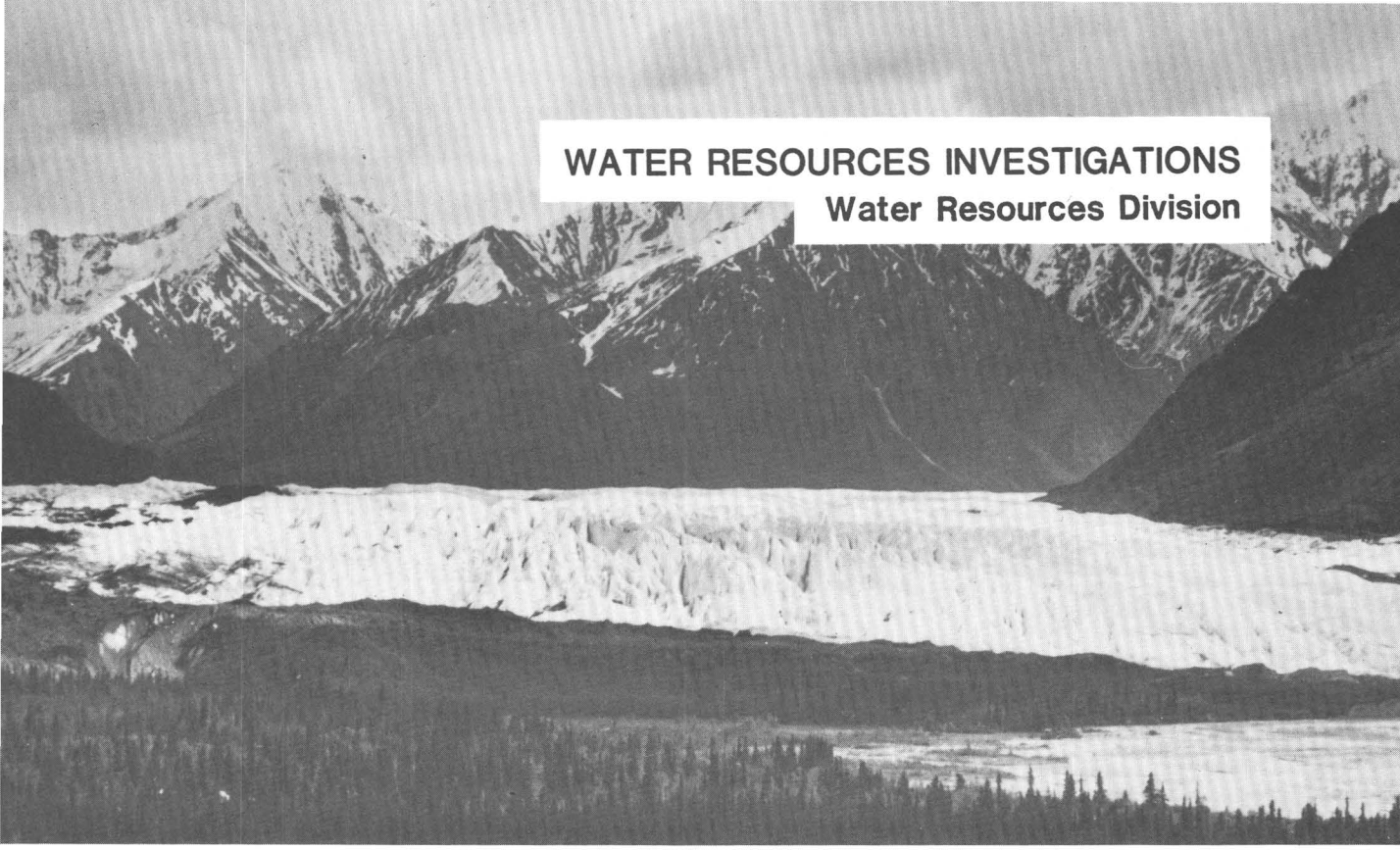
Project Title: Advanced Geopotential and Sonobuoy Studies (Marine Geology Program)

Chief: Alan K. Cooper

Objectives: The investigation of regional framework, resource assessment, and geo-environmental problems in the marine environment requires a complex synthesis of geologic and geophysical data. The primary objective of this project is to provide support to the Branch of Pacific-Arctic Geology in collecting, reducing, and interpreting the geophysical data required in this process. Particular emphasis is placed on the interpretation of marine gravity and magnetics (geopotential) data, and on refraction and "wide angle" reflection (sonobuoy seismic) data. Gravity data are used to measure the distribution of mass marine sediments and the underlying crust, and magnetic data are used to detect anomalous distribution of magnetically susceptible material, primarily oceanic crust. Sonobuoy seismic studies measure the velocity of sound through sediments and crust, as well as the depth to acoustic boundaries within the earth. The geopotential data are particularly useful in generating geologic models, although direct measurements--for example, the thickness of sediments beneath the ocean floor--are also possible.

Status: The project has developed techniques and procedures for collection, reduction, and interpretation of sonobuoy data, and has published data from 75 sonobuoy stations throughout the Bering Sea. All available marine magnetic data collected in the Bering Sea have been compiled into a single data file, and parts of it published as a magnetic residual map of the Umnak Plateau region. Presently, an effort is underway to reduce all gravity data collected by the Office of Marine Geology in the Bering Sea and other offshore areas of Alaska.

The project covers areas shown in figure 13.



WATER RESOURCES INVESTIGATIONS
Water Resources Division

For further information, contact the offices listed below.

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WATER RESOURCES INVESTIGATIONS

The water-resources investigations 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.

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.

Water-resource studies in Alaska are carried out in cooperation with a wide variety of Federal, State, and local agencies. The cooperators for FY 1980 are:

Federal

Department of the Interior
  Geological Survey
    Geologic Division (pipeline-related studies)
    Office of National Petroleum Reserve in Alaska
  Bureau of Land Management
Department of Agriculture
  Soil Conservation Service
*Department of Defense
  Army Corps of Engineers
*Department of Energy
  Alaska Power Administration
Department of Commerce
  National Marine Fisheries

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

Some of these cooperators, marked by asterisks, fund basic data collection only, whereas others support interpretation and report preparation as well.

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 118 river gaging stations, 80 crest-gage stations and 29 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.

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

NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN)

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 and specific conductance. 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 and study of attached organisms.

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 only), and Kuparuk River near Deadhorse.

NATIONAL WATER DATA EXCHANGE (NAWDEX)

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 nationwide 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 data 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 annual series "Water Resources Data for Alaska." The 1979 report is expected to be completed by September 1980.

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.

Status: This is a continuing project; all data are released in the annual 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.

Status: Data collection is continuing. The data are published in the annual series "Water Resources for Alaska, Water Year...".

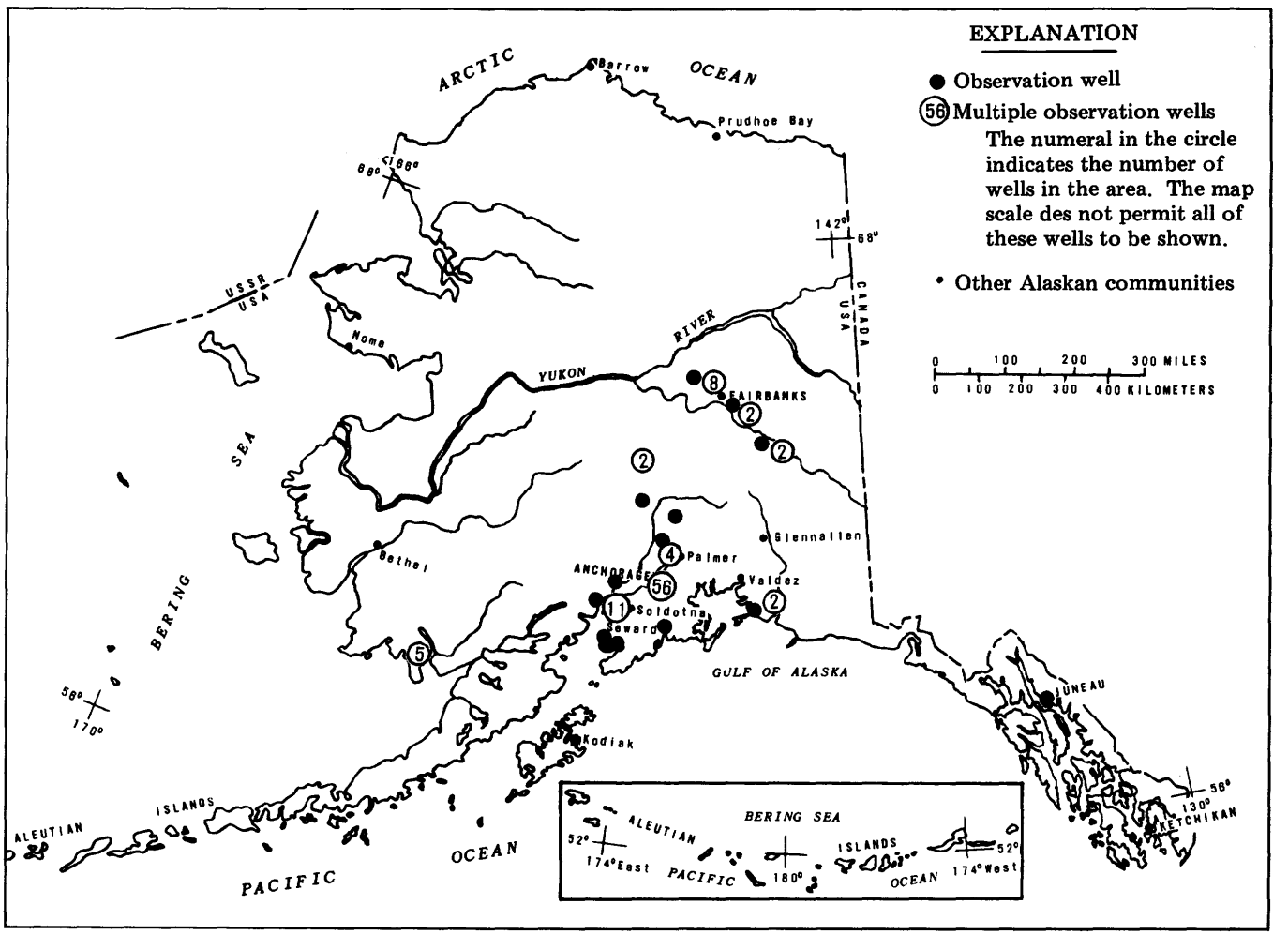


Figure 14. -- Location of ground-water observation wells.

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

Chief: Larry L. Dearborn

Objectives: To collect, compile and publish basic ground-water data aquired 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 approximately 500 new sites from throughout Alaska were entered in 1979. Processing of data from 600 wells is planned for 1980. Computer-table retrievals of verified entries were obtained for the Seward, Wasilla and Willow areas. These are available to the public on request. Similar data compilations are planned for the Eagle River-Chugiak, North Kenai, Dillingham, King Salmon-Naknek, and perhaps Kasilof-Homer areas in 1980. 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 14.

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 use informa-

tion from several thousand DNR case files have been entered into a temporary computer file. A data collection program is being formulated.

Project Title: Ground-water Stations in Alaska

Chief: Alvin J. Feulner

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 1979, the areal coverage of the observation well network was the same as in 1978. Water-level records collected at 29 federally funded Collection of Basic Records (CBR) wells will be published in the 1979 annnual Survey report "Water Resources Data for Alaska". Data for other network wells are published infrequently in reports on specific water resource studies. The network will be revised in 1980 to reflect changing data needs.

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

Chief: Mark F. 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: The major effort in 1979 involved Columbia Glacier, near Valdez, Alaska. More ground-based ice radar thickness measurements were made, and a bedrock map was produced which was compatible with continuity restraints and the measured surface velocities, thickness changes, and mass balances. Numerical modeling was begun, and a preliminary prediction of the retreat of the glacier was made. Elsewhere, extensive hydrographic studies were made of the termini of calving glaciers in Glacier Bay and other locations in southeastern Alaska. Aerial reconnaissance of most of Alaska's glaciers was also done; that work was extensive in 1979 because of exceptionally good weather. Experiments on hot-water drilling, subglacial water, a ground-based ice radar profiling system, and use of Landsat images to detect glacial surges and to produce a glacier inventory were continued or started. As part of a Geologic Division climate program, several glaciers were remapped and surface-elevation profiles established so that long-term mass changes could be determined and related to climate changes.

The project location is shown in figure 15.

Project Title: Alaska Glaciology

Chief: Lawrence R. Mayo

Objectives: To understand how climatic changes affect Alaskan glaciers and the response of glacier-fed streams by analyzing climate and glacier activity. To answer questions regarding glacier activity, hazards to construction or facilities.

Status: Many glaciers in Alaska are being studied by periodic aerial photography and by satellite images. Studies involving direct measurement of glacier mass changes and ice flow are being made at five glaciers. Climate is being monitored at two of the glaciers, Gulkana Glacier in the Alaska Range and Wolverine Glacier in the Kenai Mountains.

Black Rapids Glacier in the Alaska Range is a surge-type glacier that has advanced several times in the past 300 to 400 years over the present route of a highway and the Trans-Alaska Pipeline. Studies at Black Rapids seek to determine what changes occur in the glacier that eventually result in a surge of ice.

Snow Glacier in the Kenai Mountains dams a lake which empties abruptly each 2 to 4 years and causes flooding. Studies of the ice dam and lake are being made to discover why the lake volume changes over a wide range and why the outbursts occur when they do.

Two reports have been published in the last year. L. R. Mayo is the author of "Identification of unstable glaciers intermediate between normal and surging glaciers" published by the Academy of Sciences of the U.S.S.R., Data of Glaciological Studies, Moscow, as Publication No. 33. This is an interpretation of aerial photography that indicates that all scales of glacier flow instability exist between normal glacier flow and the spectacular surging flow. The Survey's Open-File Report 79-1168 reports the data necessary for computer simulation of the regime of Columbia Glacier. It also reports a surveying technique that incorporates vertical refraction measurements by a single theodolite and routine use of this information for precise altitude measurements over large distances.

The project location is shown in figure 15.

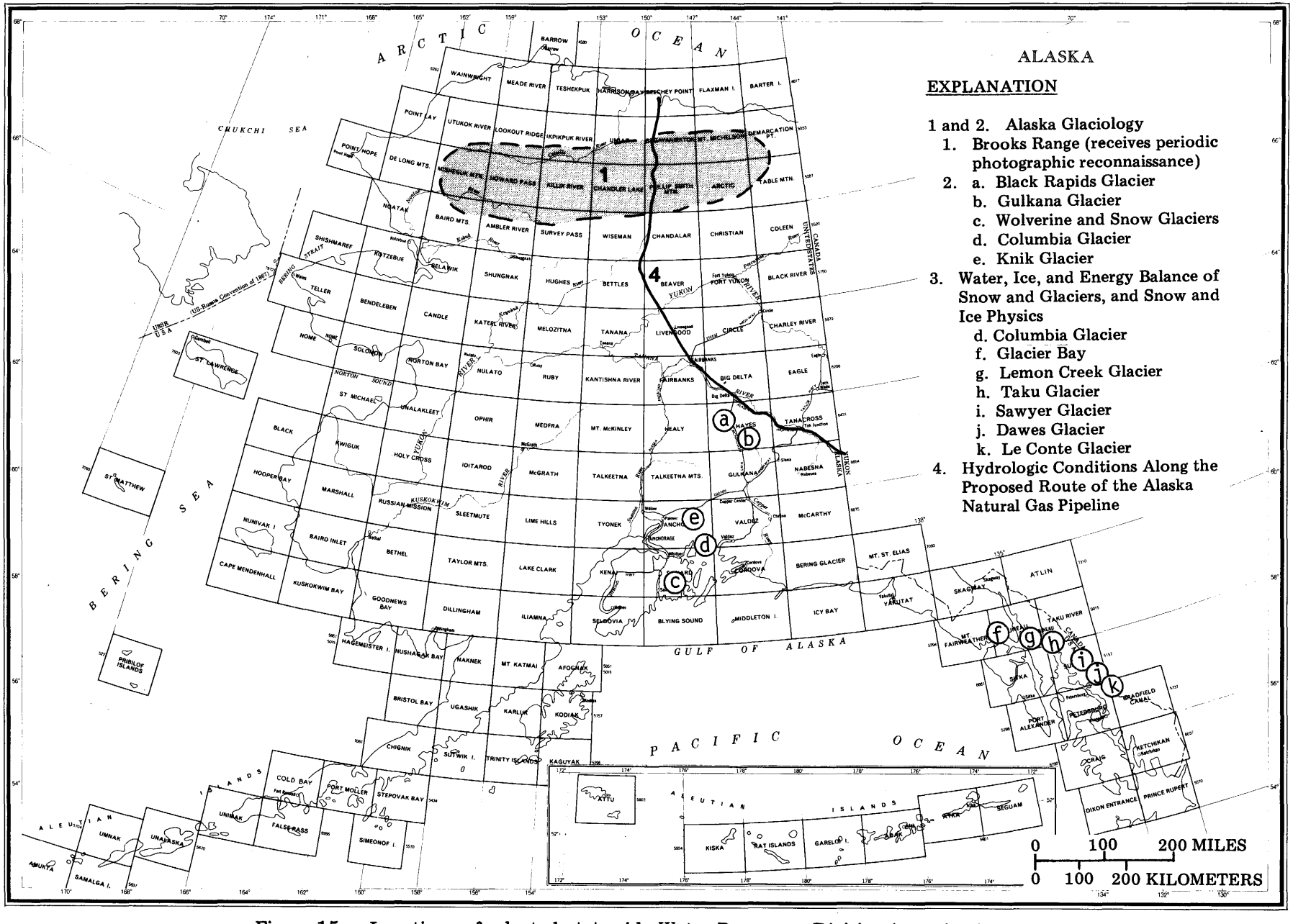


Figure 15. -- Locations of selected statewide Water Resources Division investigations.

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 and Joseph M. Childers on the Alaska Natural Gas Transportation System Working Group, by Sloan on the Interagency Fish and Wildlife Task Force, and by Harry Hulsing on the Executive Coordinating Committee.

The project location is shown in figure 15.

ProjectTitle: Water Quality Data Reduction and Evaluation for Alaska's Hydrologic Subregions

Chief: Patsy J. Still

Objectives: (1) To statistically and graphically 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 evalute 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 in the information gaps identified in (1)-(3) above.

Status: The project's first year, FY 80, should see development of a computer program and work on evaluation of data for the Yukon Hydrologic Unit.

The location of the project is shown in figure 16.

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.

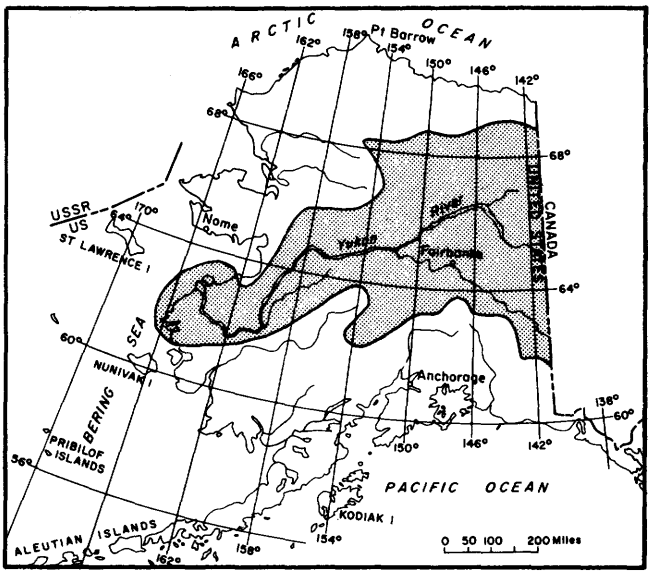


Figure 16. -- Location of Yukon hydrologic subregion.

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 pre-construction and construction periods have been described in open-file reports. Surveys are underway on the Noatak and Kobuk Rivers in northwestern Alaska.

The project location is shown in figure 17.

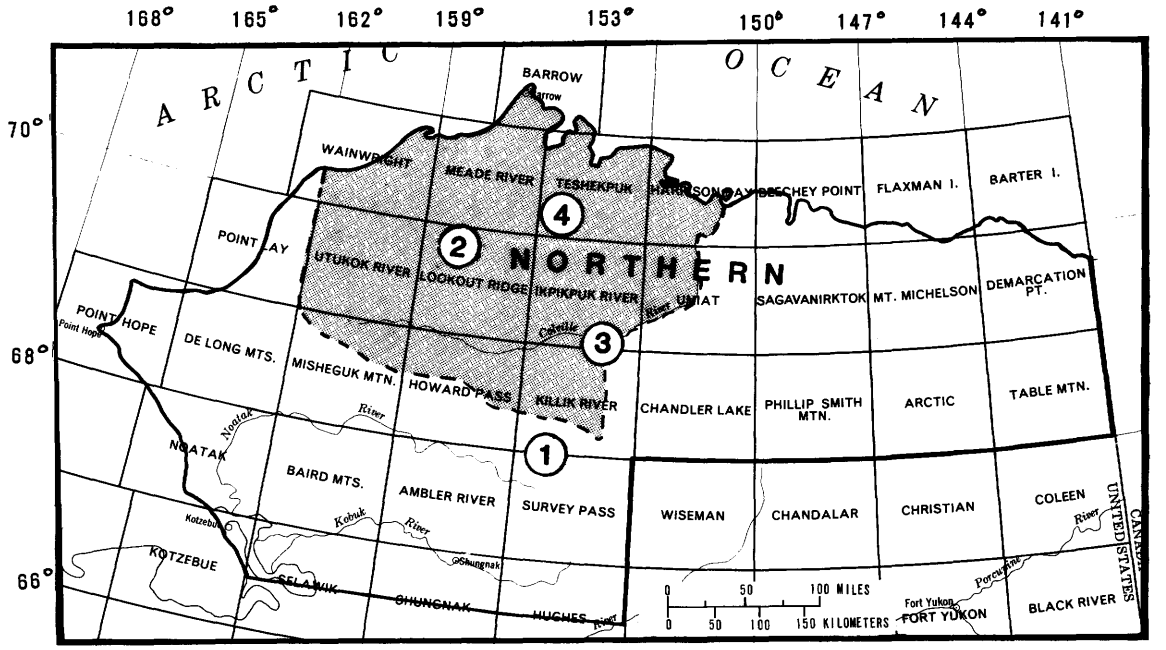
NORTHERN REGION

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 third 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



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 17. -- Water Resources Division activities in northern Alaska.

year, more samples will be gathered. Results have been discussed at several conferences, and an abstract of information presented at a conference on gas hydrates (natural physical combinations of water and natural gas in ice-like crystal form) held in Menlo Park in July 1979 is being prepared for publication.

The project location is shown in figure 17.

Project Title: Nutrient Limitation in Two Arctic Lakes Near Umiat

Chief: George A. McCoy

Objectives: To determine the nutrients that limit primary productivity using bioassays and lake fertilization.

Status: A field camp was established during the summer of 1979. Physical characterisitcs and chemical composition of waters and abundance of phytoplankton and periphyton in these lakes were analyzed. Meteorological data were collected, and bathymetric maps of the two lakes were constructed. A preliminary interpretation is that the nutrients that limit productivity are either phosphorus or both phosphorus and nitrogen. This interpretation will be studied through algal bioassays and artificial fertilization of one of the lakes. The project is scheduled for completion in 1981.

The project location is shown in figure 17.

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 supply for drilling sites and ice road construction; to measure baseline water-quality conditions and to monitor receiving water and water-supply sources for water-quality changes; to collect and provide information to ONPRA on snow depth, density and distribution; and to evaluate lake depth by means of remote sensing.

Status: Open-File Report 79-1342 "Reconnaissance Snow Surveys of the National Petroleum Reserve in Alaska, April 1977 and April-May 1978" was printed in November 1979. Results of a study of ground-water potential near the Lisburne well site were transmitted to ONPRA by letter. Miscellaneous water-quality analyses from

lakes and streams in NPRA were published in U.S. Geological Survey Water-Resources Data for Alaska reports AK-77-1 and AK-78-1.

A reconnaissance snow survey was made in late April 1979 after much of the snow pack had disappeared. An open-file report is in the review process.

Color negative aerial photographs were taken of selected lakes south of Teshekpuk Lake in early July 1979. Depth penetration was good, and in some lakes the bottom could be distinguished at as much as 20 feet of depth. In August depth profiles were measured on these same lakes by using a fathometer mounted in an amphibious plane.

Quality of ground water in NPRA and its potential effect on the occurrence of gas hydrates were discussed at a workshop in Menlo Park in July 1979. Papers presented at the workshop are being prepared as part of the workshop's proceedings. FY 80 will probably see the completion of the present exploration program and hydrology project.

The project location is shown in figure 17.

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: During the first 3 years of the program, historic records were updated for computer storage, well data were collected from local drillers, well canvassing programs were begun in the flood plain and uplands, and a test drilling program was conducted to determine if there were subsurface controls on the migration of arsenic-contaminated water. The data were compiled, and in 1978 two reports were published: "Hydrologic Information for Land-Use Planning, Fairbanks Vicinity, Alaska" (Open-File Report 78-959) and "Arsenic, Nitrate, Iron, and Hardness in Ground Water, Fairbanks Area, Alaska" (Open-File Report 78-1034). A report covering the arsenic, nitrate, iron, and hardness data collected through June 1979 in the Chena Ridge area southwest of Fairbanks has been published as Open-File Report 80-49. In addition to continuing the well canvassing program in developing areas of the uplands, emphasis is now also directed towards setting up long-term monitoring programs such as a low-flow investigation and an observation well network.

The project location is shown in figure 18.

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, has requested that the Geological Survey collect and evaluate sediment-transport and river-hydraulic data during periods of open-water when most of the runoff and sediment transport occur. Suspended-sediment and bedload-transport rates are determined as functions of stream discharge at two stations near Fairbanks. Size distributions of suspended sediment and bedload are also determined. These objectives were agreed upon by the Geological Survey and the Corps of Engineers.

Status: Data collection began in 1977. Two reports on the results of collection have been published: Open-File Reports 78-290 (for 1977) and 79-1539 (for 1977-78). Compilation and analysis are underway for the 1979 data, and a new report including all data to date is being prepared. Data will be collected through 1982, after which an interpretive report incorporating all data will be written.

The project location is shown in figure 18.

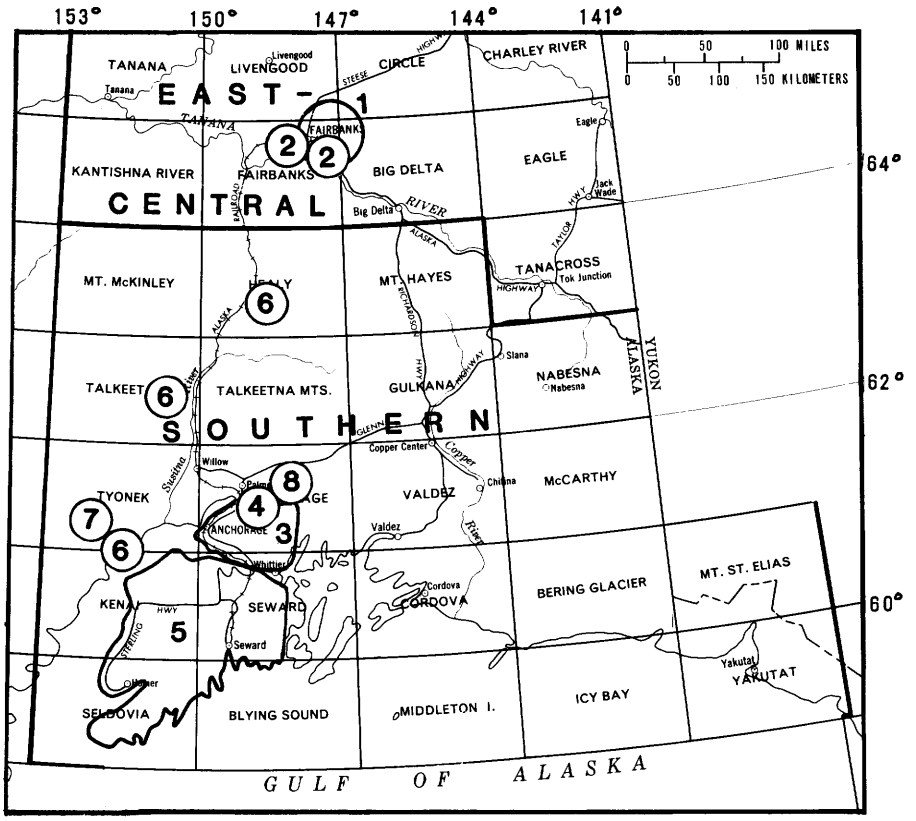
SOUTHERN REGION

Project Title: Geohydrology of the Anchorage Area

Chief: Derrill J. Cowing

Objectives: (1) To maintain a hydrologic data-collection network on 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)



EXPLANATION

1. Geohydrology of the Fairbanks North Star Borough
2. Sediment Transport in the Tanana River
3. Geohydrology of the Anchorage Area
4. Ground-water Rescources of the Middle Eagle River Valley
5. Water Resources of the Kenai Peninsula Borough
6. Hydrologic Studies Related to Coal Mining
7. Hydrology of the Capps Creek Coal Area
8. Knik Glacier

Figure 18. -- Water Resources Division activities in east-central and southern Alaska.

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 interpretation of hydrogeologic data in the Potter Creek area and preparation of a report on the results of the study, (4) design of a project work plan and implementation of the plan to collect and interpret water-quality information on 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 18.

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

Chief: Larry L. Dearborn

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. Additional resistivity surveys and seepage runs will be made. A report is planned for 1981.

The project location is shown in figure 18.

Project Title: Water Resources of the Kenai Peninsula Borough

Chief: Gordon L. Nelson

Objectives: (1) To maintain a basic hydrologic data-collection and monitoring network of streamflow, lake levels, and ground-water levels in the Kenai Peninsula Borough; (2) to evaluate surface-water availability in streams draining to Cook Inlet between Kasilof and Seldovia; (3) to evaluate the geohydrology of the Seldovia area; (4) to evaluate the geohydrology of the Fourth of July Creek alluvial fan near Seward; (5) to identify the major aquifers of the Kenai Peninsula between Kasilof and Kachemak Bay and west of the Kenai Mountains; (6) to evaluate the hydrologic effects of ground-water withdrawals in the Nikiski area; and (7) to evaluate, on a reconnaissance basis, the potential for ground-water development in the area betweek Nikiski and upper Beaver Creek.

Status: Ground-water levels, lake levels, and streamflow are being monitored throughout the Kenai Peninsula, but most intensively in the Nikiski area. Test wells were drilled in the Fourth of July Creek alluvial fan near Seward and in the lower Kenai Peninsula between Kasilof and Homer. Periodic streamflow measurements are being made at 37 sites on the lower Kenai Peninsula. Two reports, "Hydrogeology of the Seldovia area, Alaska" and "Hydrology and the effects of industrial pumping in the Nikiski area, Alaska" are in review. The interpretive studies will be complete in 1980. The project will continue past 1981 primarily as a hydrologic monitoring program.

The project location is shown in figure 18.

Project Title: Hydrologic Studies Related to Coal Mining

Chief: David R. Scully

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. A report on the reconnaissance studies of hydrology in the Beluga, Peters Creek, and Healy coal areas is in review.

The project location is shown in figure 18.

Project Title: Hydrology of the Capps Creek Coal Area

Project Chief: Gordon L. Nelson

Objectives: To identify the quantity, quality, and seasonal variations in the water resources of the Capps Creek basin. Specific objectives are: (1) To define the natural quality of surface and ground water in Capps Creek and North Capps Creek basins; (2) to study the benthic invertebrates in Capps Creek before mining occurs; (3) to define the principal aquifers of the area; and (4) to determine interactions of ground water and surface water.

Status: This project started in October 1979. Several test wells will be drilled during the summer of 1980. A gaging station has been installed and will be maintained on Capps Creek. Water samples will be analyzed for chemical and biological constituents. Interactions of ground water and surface water will be analyzed using seepage analyses of the creeks, hydrograph correlations, and analytical methods. The project is scheduled for completion by October 1, 1981.

The project location is shown in figure 18.

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

Chief: Lawrence R. Mayo

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 outburst annually prior to 1966, but has not formed since then. However, the glacier has not receeded 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 was made in May 1979 to serve as the baseline data for future comparisons. The result of the first survey has been published as Open-File Report 80-48.

The project location is shown in figure 18.

SOUTHWESTERN REGION

Project Title: Water Resources of the Bristol Bay Region

Chief: Larry L. Dearborn

Objectives: To collect, compile and publish hydrologic data pertaining to the occurrence, availability, and quality of water resources in the Bristol Bay region.

Status: This project will be dormant during 1980 due to a lack of personnel and funding. Computer filing of existing data at Dillingham, King Salmon, and Naknek will be completed. Five observation wells at Dillingham, established in 1979, will be operated under basic data collection programs.

The project location is shown in figure 19.

Project Title: St. Paul Island Water Resources

Chief: Alvin J. Feulner

Objectives: To inventory existing water supply facilities on St. Paul Island and attempt to determine if sufficient fresh water would be available on the island to maintain a shore-based fish processing plant which has been proposed to be constructed near the community of St. Paul.

Status: The fieldwork is complete and a report is in review. The project location is shown in figure 19.

SOUTHEASTERN REGION

Project Title: Ground-water Investigation of the Mendenhall Valley

Chief: To be assigned

Objectives: To determine hydrologic characteristics of shallow aquifers in the Mendenhall Valley, with emphasis on areas of potentially high yield. To determine fluctuation of ground-water levels in stressed parts of the aquifer, particularly where fluctuations indicate saltwater intrusion will be a problem. To delineate where additional hydrologic studies are needed to further define aquifer characteristics.

Status: One test well and three observation wells have been drilled. Aquifer tests indicate that preliminary transmissivity values of the principal aquifer in the valley are on the order of 22,000 feet squared per day, while storage coefficient values are on the order of 6.0×10^{-4}. The aquifer at the test site is confined at a depth of 40 to 45 feet and is made up of alternating gravelly sand, sandy gravel and medium to coarse and very coarse sand to a depth of 170 feet. The better producing zones appear to be between 50 and 100 feet. The test well passed through some fine silty sand and clay between 170 feet and about 350 feet. Traces of sea shells were found at 302 and 352 feet and may represent a beach deposit.

Water quality samples were not analyzed in the laboratory. Field specific conductances were 160 and 170 micromhos (umhos) at 80 and 65 feet; at 272 feet it was 490 umhos. In the more permeable beach(?) deposits at 352 feet, conductance was 13,500 umhos and a showing of methane gas was noted.

The project location is shown in figure 20.

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

Chief: Vernon K. Berwick

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; (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; and (3) occurrence and quality of ground water.

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. Geophysical logs and water quality samples were collected from two exploratory coreholes. Logs run included geothermal, natural gamma and gamma-gamma. Data collection in the basin is continuing.

The project location is shown in figure 20.

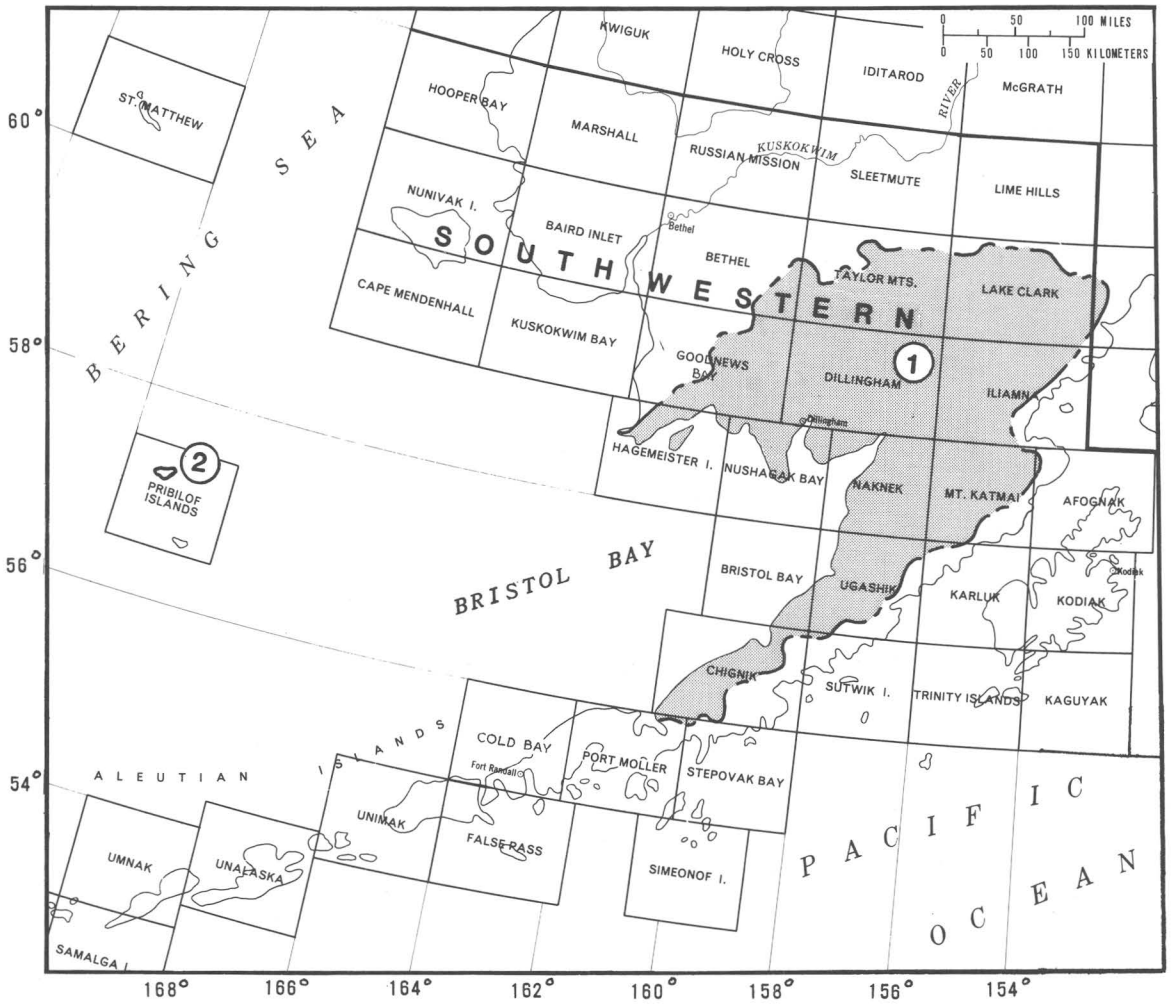
Project Title: Water Resources in the Vicinity of Craig and Klawock, Alaska

Chief: Alvin J. Feulner

Objectives: To determine low flow and periods of low flow of streams that could serve as total or partial supply sources for the communities and to determine sources of ground water adequate to supply all or part of these towns' needs.

Status: This is the first year of project work. Discharge measurements on appropriate streams and lakes will be made, and a ground-water site reconnaissance will be made.

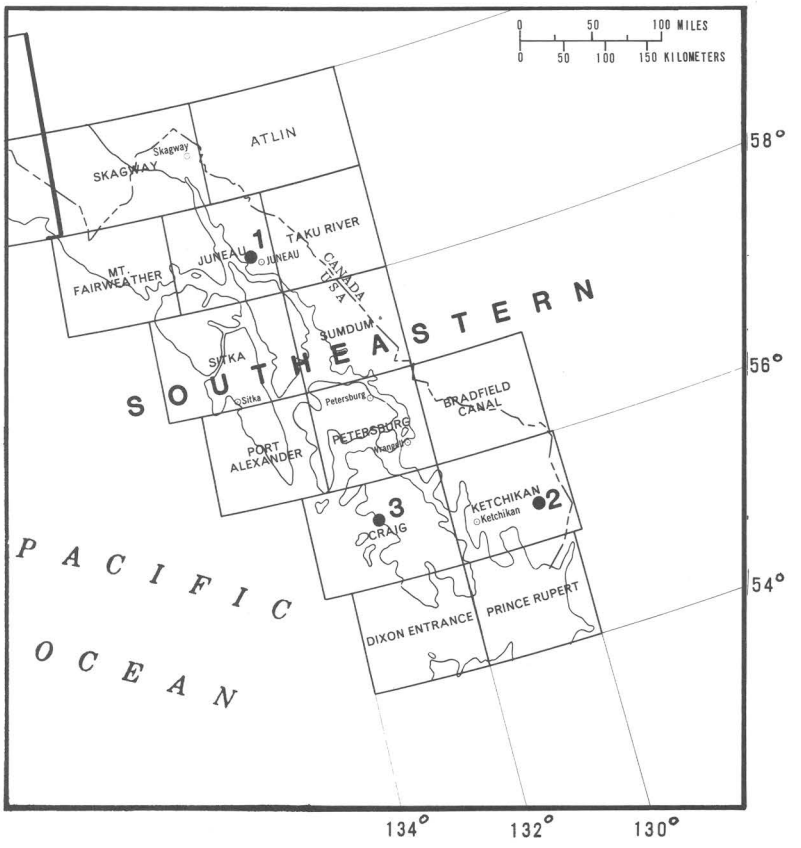
The project location is shown in figure 20.



EXPLANATION

1. Water Resources of the Bristol Bay Region
2. St. Paul Island Water Resources

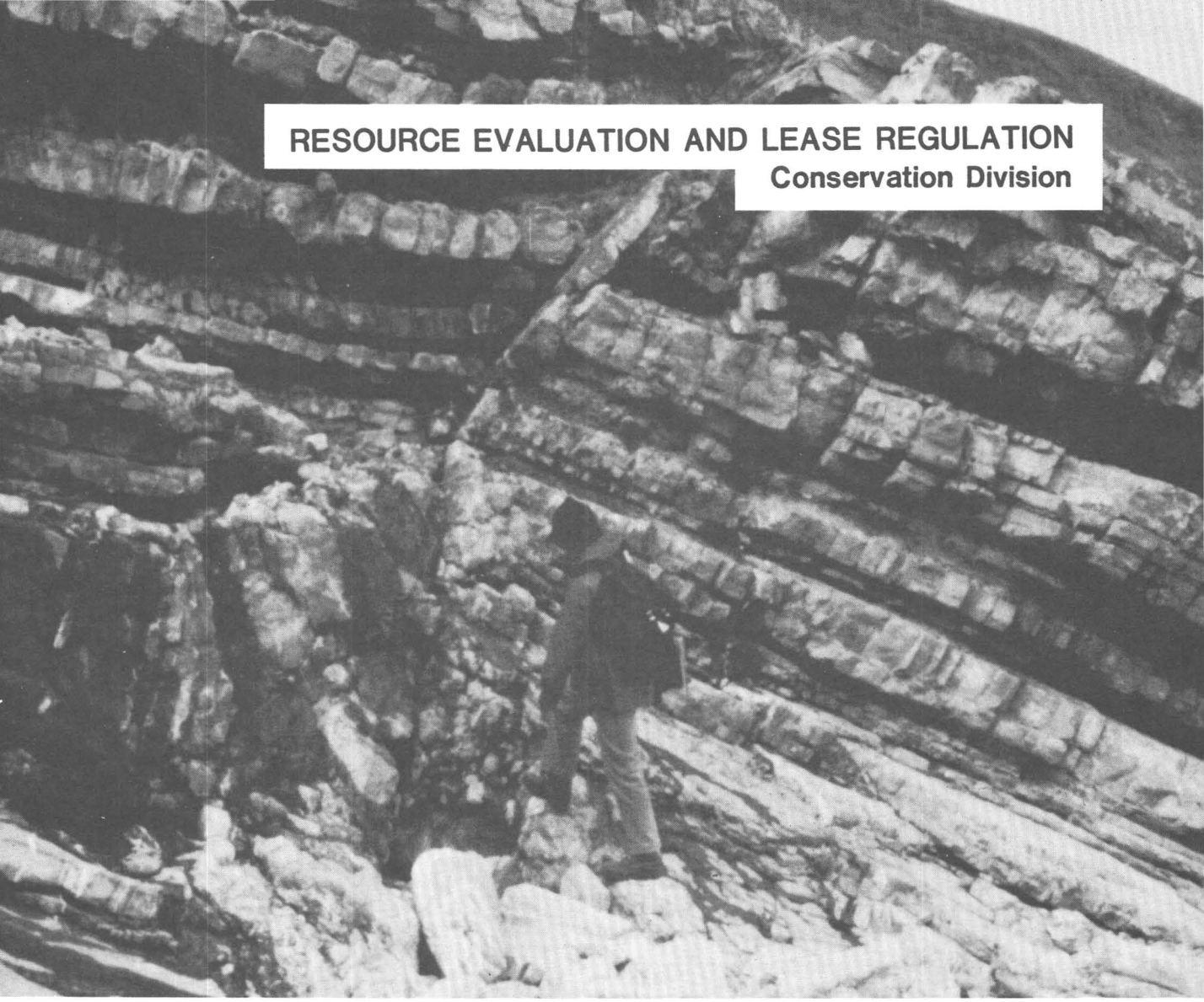
Figure 19. -- Water Resources Division activities in southwestern Alaska.



EXPLANATION

1. Ground-water Investigation of the Mendenhall Valley
2. Hydrology and Water Quality of the Keta River Basin
3. Water Resources in the Vicinity of Craig and Klawock

Figure 20. -- Water Resources Division activities in southeastern Alaska.



RESOURCE EVALUATION AND LEASE REGULATION
Conservation Division

For further information, contact the offices listed below.

Anchorage, Alaska

Joseph M. Jones	Acting Conservation Manager, Alaska Region 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4304
(vacant)	Area Geologist 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4361
Rodney A. Smith	Oil and Gas Supervisor 800 A Street, Anchorage, AK 99501 Tel. (907) 271-4303

Reston, Virginia

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

RESOURCE EVALUATION AND LEASE REGULATION

The primary functions of the Conservation Division are to examine and classify Federal lands as to their mineral resources and waterpower and water-storage values; to determine estimated petroleum values for onshore and offshore competitive lease sales; to supervise exploration and development for leases on the Outer Continental Shelf (OCS), as well as on Federal, Indian, and certain Naval and National petroleum reserve lands; and to maintain accounts and collect rentals and royalties from petroleum production.

Consistent with the national concern for environmental protection, the Division's regulations and procedures are subject to frequent reappraisal and revision in order to avoid or mitigate consequences that may result from pollution incidents, surface damage from mining, geothermal and petroleum operations, or other hazards that may be associated with mineral operations conducted under leases and prospecting permits.

The Conservation Division performs the following functions in Alaska:

REGULATORY ACTIVITIES: Supervision and inspection of oil and gas exploration and production operations on Federal lands in Alaska to insure safety, prevent pollution, and assure environmental protection are carried out by personnel in the Oil and Gas Supervisor's office. This work presently includes 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 and in lower Cook Inlet. In addition, the Oil and Gas Supervisor regulates all pre-lease exploration activities on the OCS and supervises and inspects drilling operations in the National Petroleum Reserve in Alaska (NPRA).

ROYALTY ACCOUNTING: The Oil and Gas Supervisor is responsible for the collection of all money due the Federal Government from oil and gas produced from Federal onshore leases and rental and royalty from OCS leases.

PRE-SALE REPORTS: Several years prior to scheduled lease sale dates, which are shown in table 2, the Division prepares reports and background material on OCS lease sale areas in Alaska (fig. 21). This work is closely coordinated with the Bureau of Land Management and other Federal and State agencies. Results of this coordinated effort include: (1) A summary report is prepared in cooperation with the Geologic Division and consists 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 this report begins several years prior to the lease sale and continues until the report is published at the beginning of the tract-selection process. (2) Tract selection is based on data from the summary report, as well as on other geologic and geophysical data that may exist at the time tentative tracts are selected for the lease sale. Tract selection is planned for completion 2 years prior to sale. (3) Draft and Final Environmental Impact Statements from OCS sales are based on technical and infrastructure information provided by the U.S. Geological Survey. The Bureau of Land Management uses such impact statements to assess socioeconomic and environmental impacts. Work begins on the draft statement 24 months prior to the lease sale, and the final statement is issued 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 Conservation Division's Area Geologist's office using geologic (COST Well) and geophysical (seismic) data. These estimates are further refined by detailed structural mapping and analysis. The evaluation process continues up to the lease sale date.

GEOLOGIC HAZARDS: For areas being considered for leasing, high-resolution seismic data are used to delineate geologic conditions that could be detrimental to man-made structures. All parties are made aware of these potential hazards, and thus mitigating measures can be taken, if necessary, 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. Utilizing 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 which will provide data for appraisal and regulation of Federal mineral and oil and gas resources. The projects include two geologic studies to help define the presence and distribution of oil and gas source rocks in potential oil and gas basins, and five geophysical and geotechnical studies which will provide detailed environmental data on seafloor surficial geology and foundation conditions in future OCS lease sale areas. These projects are described in more detail in the following section.

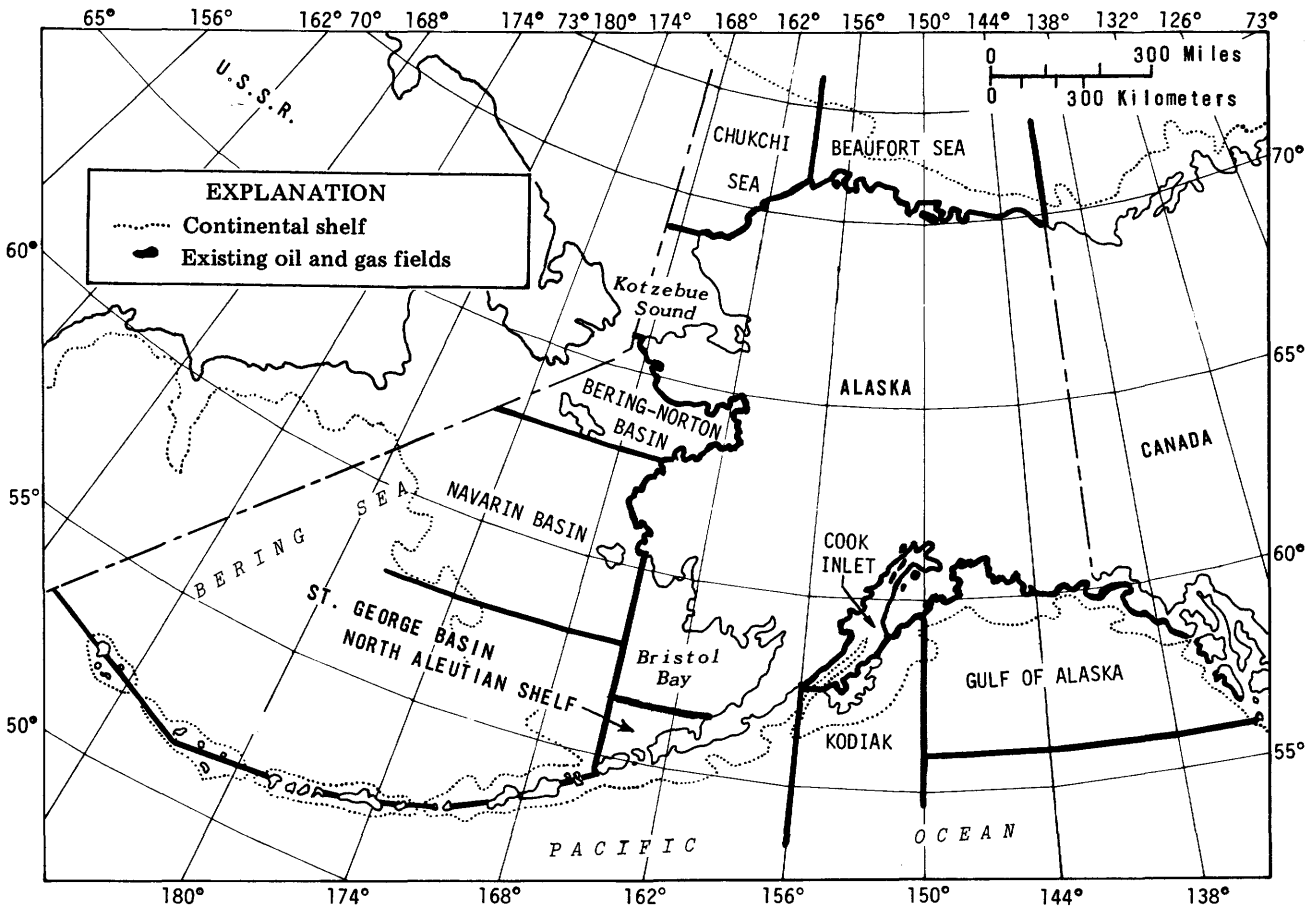
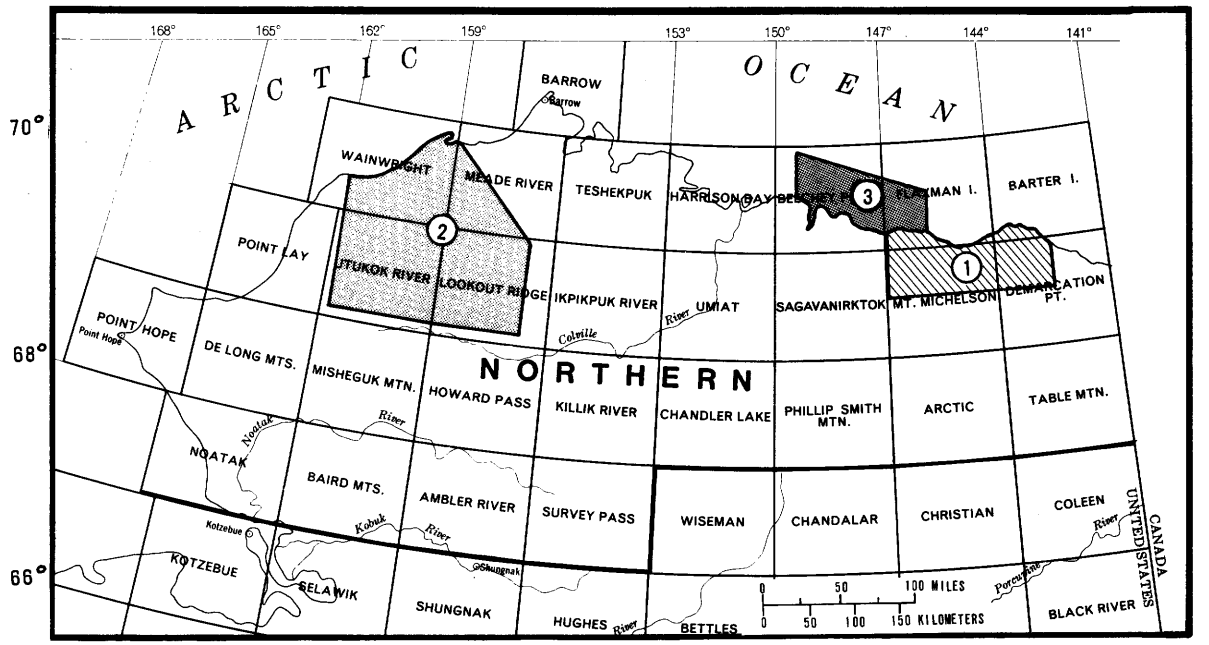


Figure 21. -- Location of proposed oil and gas Outer Continental Shelf lease tracts.

Table 2. -- Tentative proposed Outer Continental Shelf oil and gas leasing schedule. The schedule is in a constant process of revision by the Departments of the Interior and Energy. Plans for sales depend heavily on the success of drilling. For locations see map above.

C - Call for nomination T - Tract selection H - Public hearing P - Proposed notice of sale R - Energy review D - Nomination due
E - Draft Environ. Statement F - Final Environ. Statement SC - State comments due N - Notice of sale S - Sale

SALE NUMBER		1980	1981	1982	1983	1984	1985
55	Gulf of Alaska	F P SC RNS					
46	Kodiak Shelf	H F P SC RNS					
60	Cook Inlet	E H	F P SC RNS				
57	Norton Basin	T	E H	F P SC RNS			
70	St. George Basin	T	E	H F P SC RNS			
71	Beaufort Sea	T	E	H F P SC RNS			
75	No. Aleution Shelf	C D T		E H	F 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	



EXPLANATION

1. Arctic National Wildlife Range Stratigraphic Project
2. Coal Resources for National Petroleum Reserve in Alaska
3. Geotechnical Investigation, Beaufort Sea, Alaska

Figure 22. -- Conservation Division activities in northern Alaska.

PROJECTS OF THE CONSERVATION DIVISION

NORTHERN REGION

Project Title: Arctic National Wildlife Range Stratigraphic Project

Chiefs: Irven F. Palmer, Jr. (USGS), and William M. Lyle (State of Alaska)

Objectives: To provide petroleum source-rock, hydrocarbon maturation, and potential reservoir information from an area adjacent to the area of the joint Federal/State Beaufort Sea oil and gas lease sale of December 1979 for use in tract selection and evaluation preparatory to the sale.

Status: Fieldwork and contracted sample analyses are completed. Data have been published as Open-File Report 79-1634. A more comprehensive, interpretive report to be published by the State of Alaska is in preparation.

The project location is shown in figure 22.

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 to the maximum extent possible utilizing information derived from seismic survey activities and exploratory oil and gas test wells. The information is for use in land-use planning and possible future delineation of areas suitable for leasing.

Status: The project is of an indefinite term and is primarily dependent on year-to-year timing and location of oil and gas exploratory activities in NPRA. Geophysical logging and seismic shot holes in the winters of 1978 and 1979 in the northern foothills and coastal plain of western NPRA have produced a very large number of precisely located and accurate thickness measurements on coal beds which in many instances can be correlated for distances of several miles along seismic lines. In the coastal plain, tentative correlations between parallel lines up to 6 miles apart have also been possible. Reconnaissance geologic mapping of scattered exposed coal beds and shallow augering during the 1978 and 1979 summer seasons have aided in the correlation of coals between lines in the foothills. The shot holes have also produced satisfactory samples of unweathered coal suitable for rank determination. Separate reports on coal resources south and east of Wainwright and in the foothills between the Kokolik and Utukok Rivers are in preparation. The possibility of reprocessing selected common depth point seismic lines for shallow structural control in the foothills is being investigated.

A logging unit and operator will be attached to one seismic crew operating during the 1980 winter season in extreme northwestern NPRA and along several lines in the foothills. The information acquired should provide additional data between exisiting lines.

The project location is shown in figure 22.

WEST-CENTRAL REGION

Project Title: Norton Sound Stratigraphic Study

Chiefs: Irven F. Palmer, Jr. (USGS), and William M. Lyle (State of Alaska)

Objectives: To provide petroleum source-rock, hydrocarbon maturation, and potential reservoir information from the area around Norton Sound and northern Bering Sea for use in tract selection and evaluation preparatory to proposed oil and gas lease sales.

Status: Fieldwork and sample analyses have been completed, and a comprehensive interpretive report is near completion. Work on this report was interrupted by authors' involvement in preparations for the joint Federal/State Beaufort Sea oil and gas lease sale of December 1979.

The project location is shown in figure 21.

SOUTHERN REGION

Project Title: Shelikof Straits Outer Continental Shelf (OCS) Environmental Geology

Chief: John W. Whitney

Objectives: To map the bathymetry and make geologic interpretations of geophysical data as part of the assessment of potential geo-hazards to petroleum development in this OCS province.

Status: Multi-sensored high resolution seismic data was contracted for the summer of 1979. The area from the Barren Islands to just south of Kupreanof Strait was covered with a 5 x 5 kilometer grid. Acoustic instruments included single-channel sparker, multi-channel sparker, Uniboom, minisparker, fathometer and some side-scan sonar. Interpretive maps planned include bathymetry, geology, shallow structure, topography of the Quaternary unconformity, and an isopach map of the Quaternary deposits. These maps will be open-filed and will be used as part of the tract-by-tract geo-hazards evaluation for OCS Sale 60 scheduled for September 1981.

The project location is shown in figure 23.

Project Title: Geological and Geophysical Investigations of Augustine Island Volcano

Chief: John W. Whitney

Objectives: To identify and map suspected submerged portions of Augustine volcano as part of the geohazard assessment for petroleum development in lower Cook Inlet.

Status: Seismic profiling records and a National Oceanic Survey (NOS) bathymetric survey (H-9073) around Augustine Island reveal hummocky and lobate features emanating from Augustine, as well as an extensive shallow platform off the west side of the volcano. These combined features cover an area about twice that of Augustine Island itself. Verification of their volcanic origin would significantly change the volume of the material known to have been ejected by Augustine and extend the range to which pyroclastic flows are known to have travelled in the past. Fieldwork in 1978 revealed the existence of several onshore analogies of the hummocky offshore terrain. However, since dredge sampling attempts were unsuccessful, the surface materials of this offshore terrain have not been positively identified. In the summer of 1980, the Survey will sample by diving and use seismic profiling to further delineate these submerged features. In particular, attention will be focused on the extensive submerged platform, an anomalous feature of an andesite volcano.

The project location is shown in figure 23.

SOUTHWESTERN REGION

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

Chiefs: George W. Petering and Thomas N. Smith (USGS), and William M. Lyle (State of Alaska)

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

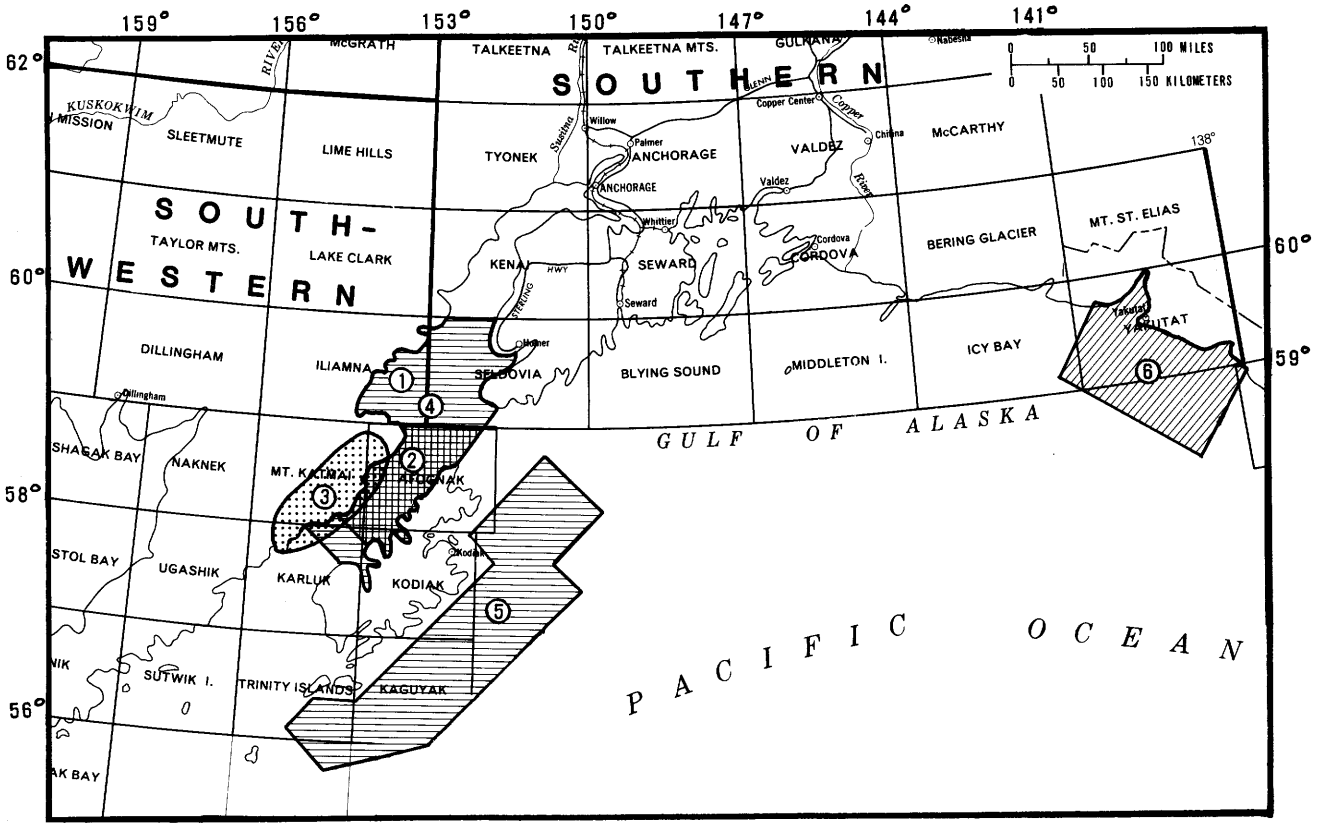
Status: The project will commence June 23, 1980, and continue through July 6, 1980. The project location is shown in figure 23.

OFFSHORE REGION

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

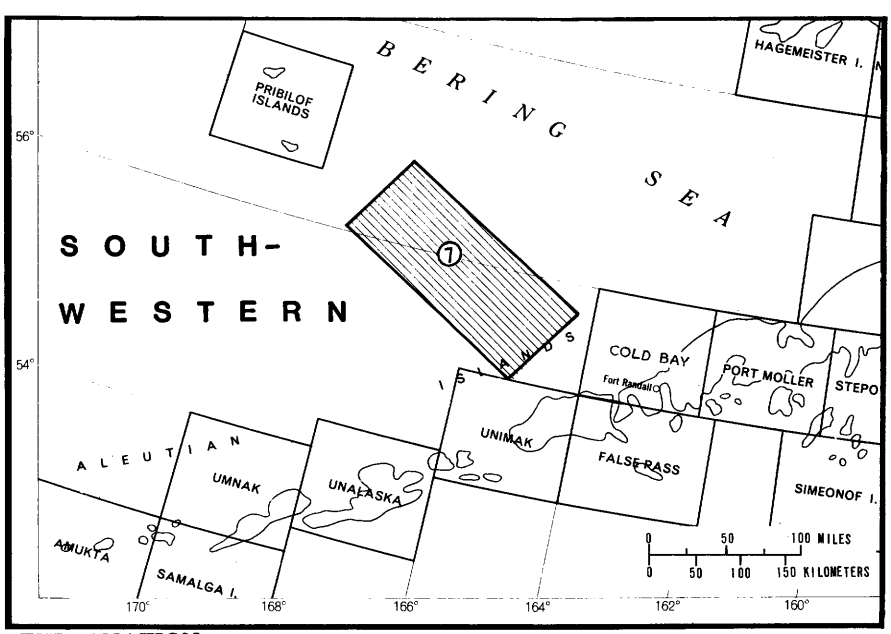
Chiefs: John W. Whitney and Glenn P. Thrasher

Objectives: To identify geologic features and conditions which might represent hazards or



EXPLANATION

1. Geological and Geophysical Investigations of Augustine Island Volcano
2. Shelikof Strait Outer Continental Shelf Environmental Geology
3. 1980 Lower Cook Inlet - Shelikof Strait Field Project
4. Shallow Geology of Lower Cook Inlet and Northern Shelikof Strait
5. Shallow Geology of the Kodiak Outer Continental Shelf
6. Shallow Geology of the Eastern Gulf of Alaska Outer Continental Shelf



EXPLANATION

7. Shallow Geology of St. George Basin, Southern Bering Sea

Figure 23. -- Conservation Division activities in southern and southwestern Alaska.

constraints to petroleum exploration and production in the area of oil and gas lease Sale 60 scheduled for September 1981.

Status: During the summer of 1979, 2,557 kilometers of multi-sensored, high resolution geophysical data were collected on a rectangular grid in Shelikof Strait between Cape Douglas and Kupreanof Strait. Bathymetric and geologic maps will be prepared from these and other data.

The project location is shown in figure 23.

Project Title: Geotechnical Investigation, Beaufort Sea, Alaska

Chief: Gerald B. Shearer

Objectives: To identify features which might represent conditions hazardous to petroleum exploration and production in this area of oil and gas lease activity. To provide subsurface control and available geophysical data, supply regional geotechnical, geochemical, and geological data for preliminary engineering design purposes, and provide information for tract selection and evaluation. Of particular interest in this area are depth to permafrost, presence of ice-rich zones of permafrost, gas hydrates and shallow gas, salinity of pore fluids, availability of gravel, and the geotechnical properties of the soil.

Status: During late winter 1978-1979, 20 rotary coreholes were drilled to depths of 100-300 feet below mudline in water depths up to 50 feet. The drilling was carried out from stable, shorefast ice. The initial report in three volumes was released on July 30, 1979. This report contains: A summary of field equipment, procedures and site conditions; a detailed log of each hole describing soil types, physical properties of unfrozen soil samples, and the test results. Additional laboratory tests of unfrozen samples, as well as an extensive testing program on frozen samples, are planned. The results of these tests will be made available when completed.

The project location is shown in figure 21.

Project Title: Shallow Geology of the Kodiak Outer Continental Shelf

Chiefs: Glenn P. Thrasher and Bruce W. Turner

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 46, scheduled for December 1980.

Status: Mapping of shallow geology and geologic hazards is essentially complete, with only touch-up work and drafting remaining. Bathymetric and geologic maps of the Kodiak Outer Continental Shelf were released as open-file reports in 1979. Effort is being concentrated currently on determining the environmental geology and shallow drilling conditions on each of the 564 blocks proposed for leasing in the upcoming oil and gas lease sale.

The project location is shown in figure 23.

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 identify features such as shallow faults, shallow gas, and unstable sediments which 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: Mapping of shallow structural horizons, isopach intervals, bathymetry, and geologic hazards is essentially complete for exclusive contract data gathered in 1976-1977. Maps will be released to the open-file.

The project location is shown in figure 23.

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

Chiefs: Bruce W. Turner and Glenn P. Thrasher

Objectives: To identify geologic features and conditions which might represent hazards or constraints to petroleum exploration and development in the area of oil and gas lease Sale 55, scheduled for October 1980.

Status: During the summer of 1979, 5,580 kilometers of multi-sensored, high resolution geophysical data were collected offshore on a rectangular grid between Malaspina Glacier and Dry Bay. Processing of these data is currently in progress. Bathymetric and geologic maps will be prepared from this information in the near future.

The project location is shown in figure 23.

SOURCES OF ADDITIONAL INFORMATION

PUBLIC INQUIRIES OFFICE, MAPS AND PUBLICATIONS

The Public Inquiries Office 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. It is a depository for open-file reports on Alaska and maintains a reference library of Geological Survey publications for use by the public, as well as a browse file containing microforms of Landsat (satellite) imagery. Also on file in the office are itineraries for the Branch of Alaskan Geology field parties and a roster of all Survey employees. The office is part of the National Mapping Division and is under the direction of the Office of Inquiries headquartered at the National Center in Reston, Virginia. The Public Inquiries Office is supervised by:

Margaret I. Erwin
108 Skyline Building
508 Second Avenue
Anchorage, Alaska 99501
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. In addition, it is the only office in Alaska that handles mail order requests for Survey maps. The office also supplies maps to 35 commercial dealers in the State. The Alaska Distribution Section is under the direction of the Branch of Distribution 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

ADMINISTRATORS OF GEOLOGICAL SURVEY OFFICES OR DIVISIONS

The following persons can be contacted for additional information.

The Geological Survey

William Barnwell, Special Assistant to the Director for Alaska
218 E Street
Anchorage, AK 99501
Tel. (907) 271-4398

Office of National Petroleum Reserve in Alaska

George Gryc, Chief, Office of National Petroleum Reserve in Alaska
2525 C Street, Suite 400
Anchorage, AK 99501
Tel. (907) 276-7422

Land Information and Analysis Office

Gene A. Thorley, Chief, Land Information and Analysis Office
104 National Center
Reston, VA 22092
Tel. (703) 860-7488

EROS Program

David Carneggie, Chief
USGS/EROS
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Anchorage, AK 99501
Tel. (907) 271-4145

National Mapping Division

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Geologic Division

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Anchorage, AK 99501
Tel. (907) 271-4150

Water Resources Division

Harry Hulsing, Chief, Alaska District
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Anchorage, AK 99501
Tel. (907) 271-4379

Conservation Division

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

SUPPORTING DIVISION AND SERVICES

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 99501
Tel. (907) 276-7422
Library: (907) 274-1346

TECHNICAL DATA UNIT

The Technical Data Unit, located in Menlo Park, California, has as its objectives to provide information about earth science publications on Alaska with emphasis on U.S. Geological Survey reports and maps. It serves as a source of topographic maps and Survey publications for geologists of the Alaskan Geology Branch or personnel of other Survey branches and divisions doing research in Alaska. The unit also provides various services for Alaskan Branch personnel and serves as depository for branch project files. For more information, contact:

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

Table 3. -- List 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
Barnes, D. F.	Morin, R. L. Ponce, D. A. Burns, E. L.	Geologic	Statewide	Gravity studies and standardization of gravity surveys	Office of Geochemistry and Geophysics Branch of Regional Geophysics 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2249
Barnes, P. W., and Reimnitz, Erk	Kempema, E. W. Minkler, P. W. Rearic, D. M. Ross, C. R.	Geologic	Offshore	Studies of Arctic marine sedimentary processes and hazards, Beaufort and Chukchi Seas	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7008 (Barnes) -7004 (Reimnitz)
Bartsch-Winkler, Susan	---	Geologic	Southern	Determining sediment transport and deposition in the coastal region near Anchorage	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2542
Berg, H. C.	Decker, J. E. Mullen, M. W. Faculty members at Cal. Tech., U. of AZ and Cal. St. U. of Los Angeles (part-time)	Geologic	Southeastern	Geotectonic and economic geology studies of southeastern Alaska	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2266
Berg, H. C.	Numerous members of USGS; faculty members of U. of AK, U. of AZ, Cal. Tech., Cal. St. U. of Los Angeles (part-time)	Geologic	Statewide	Mineral resource assessment (See also individual AMRAP quadrangle projects.)	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2266
Berwick, V. K.	---	Water Res.	Southeastern	Hydrology and water quality of the Keta River basin near Ketchikan,	Juneau Subdistrict Office P.O. Box 1508 Juneau, AK 99802 (907) 586-7216
Bird, K. J.	---	Geologic	Northern	Study of reservoir characteristics and lithofacies in the Lisburne Group, North Slope area	Office of Energy Resources Branch of Oil and Gas Resources 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7034
Bird, K. J.	Geovannetti, D. M.	Geologic	Northern	Studies of structural styles and relation to petroleum potential, Brooks Range front	Office of Energy Resources Branch of Oil and Gas Resources 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7034

Table 3. -- List 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	Statewide	Compilation of map of metamorphic facies	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2178, 2231
Brew, D. A.	Berg, H. C. Churkin, M., Jr. Ford, A. B. Grybeck, D. G. Hunt, S. J. Karl, S. M. Lanphere, M. A. Le Compte, R. Loney, R. A. Sonnevil, R. A.	Geologic	Southeastern	Geologic, geochemical mapping, mineral resource assessment, Petersburg quadrangle	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2178, 2231
Brew, D. A.	Ford, A. B. Karl, S. M. Sonnevil, R. A.	Geologic	Southeastern	Geologic, geochemical mapping, mineral resource appraisal near Juneau	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2178, 2231
Brew, D. A.	Sonnevil, R. A.	Geologic	Southeastern	Appraisal of mineral resource potential, Glacier Bay National Monument Wilderness Study Area	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2178, 2231
Brewer, Max	---	ONPRA	Northern	Archeological studies, NPRA	Office of National Petroleum Reserve in Alaska 2525 C Street, Suite 400 Anchorage, AK 99501 (907) 276-7422
Brosgé, W. P.	Nilsen, T. H. Reiser, H. N. Dutro, T. J., Jr. Moore, T. E. Gromme', C. S. Hillhouse, J. W.	Geologic	Northern	Source, transport direction, and current facies trends in Upper Devonian rocks, North Slope.	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94026 (415) 323-8111 ext. 2316
Brosgé, W. P.	Reiser, H. N. Dutro, J. T., Jr.	Geologic	Northern	Geologic mapping, Arctic and Table Mountain quadrangles, North Slope	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2316

Table 3. -- List 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
Burrows, R. L.	Parks, Bruce Emmett, W. W.	Water Res.	East-central	Analysis of sediment size and bedload-transport rates	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 ext. 214
Cady, J. W.	Grybeck, D. G. Nelson, S. W. Weber, F. R.	Geologic	Northern and East- and West-central	Interpretation and aeromagnetic and gravity data, primarily northern Alaska	Office of Geochemistry and Geophysics Branch of Petrophysics and Remote Sensing Box 25406 MS 964 Denver Federal Center Denver, CO 80401 (903) 234-5021
Cady, J. W.	Hughes, E. M. Foster, H. L. Weber, F. R.	Geologic	Northern and East- and West-central	Development and geophysical techniques for uranium exploration	Office of Geochemistry and Geophysics Branch of Petrophysics and and Remote Sensing Box 25406 MS 964 Denver Federal Center Denver, CO 80401 (303) 234-5021
Callahan, J. E.	---	Conservation	Northern	Determination of coal resources in NPRA	Office of Area Geologist 800 A Street, Suite 201 Anchorage, AK 99501 (907) 271-4401
Carlson, P. R.	Karl, H. A. Johnson, K. A. Fischer, J. M. Quinterno, P.	Geologic	Offshore	Studies of seafloor geologic hazards, Navarin Basin	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7021
Carneggie, D. M.	Wright, G.	LIA	Southern	Use of remote sensing techniques for providing resource data for monument management	EROS Data Center 508 Second Avenue Anchorage, AK 99501 (907) 271-4145
Carter, L. D.	Galloway, J. P.	Geologic	East-central	Mapping unconsolidated deposits in transportation-development corridor, Tanana River valley to Canada	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2682
Carter, L. D.	Galloway, J. P.	Geologic	Northern	Studies of Quaternary history of western Arctic coastal plain	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2682

Table 3. -- List 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
Carter, R. D.	Page, L. S. Fulop, B. M. Noyes, C. Bartholomew, B.	ONPRA	Northern	To acquire, reduce and publish, through National Oceanic and Atmospheric Administration, data on geology and geophysics in National Petroleum Reserve in Alaska	Office of National Petroleum Reserve in Alaska 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8211 ext. 2136
Cathrall, J. B.	Day, G. W. Hoffman, J. D.	Geologic	Southeastern	Mineral resource appraisal and geochemical mapping of the Petersburg quadrangle	Office of Mineral Resources Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-4813
Chapman, R. M.	Yeend, W. E. Silberman, M. L. Jones, D. L. Churkin, M., Jr. Trexler, J. H., Jr. Reed, B. L. Patton, W. W., Jr. Moll, E. J.	Geologic	West-central East-central	Mapping and regional correlation of geologic units and structures, Ruby province	Office of Mineral Resources Branch of Alaska Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2670
Childers, J. M.	Kernodle, D. R.	Water Res.	Statewide	Investigations of water resources and hydrologic hazards in arctic and subarctic Alaska	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4394
Churkin, Michael, Jr.	(See Eberlein, G. D.)				
Churkin, Michael, Jr.	Carter, Clair Trexler, J. H., Jr.	Geologic	Northern	Compilation of map of arctic tectonic features	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2256
Cobb, E. H.	---	Geologic	Statewide	Compilation of data on mineral resources	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2483
Comer, C. D.	Schaff, D. P.	Conservation	Southwestern, Offshore	Near-surface mapping and identification of geologic hazards, St. George basin	Conservation Division 800 A Street, Suite 109 Anchorage, AK 99501 (907) 271-4457
Cooper, A. K.	Childs, J. R. Magistrale, H.	Geologic	Offshore	Studies of marine gravity and magnetics, sonobuoy seismic data	Office of Marine Geology Pacific-Arctic Branch 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7094

Table 3. -- List 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
Cowing, D. J.	Emanuel, R. P. Lee, M. G. Scully, D. R.	Water Res.	Southern	Geohydrologic studies in the Anchorage area	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Crim, W. D.	Tripp, R. B. Wong, H. W. Spiesman, D. L.	Geologic	East-central	Use of geochemistry in support of AMRAP, Circle quadrangle	Office of Mineral Resources Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6170
Csejtey, Béla, Jr.	St. Aubin, D. R. King, H. D.	Geologic	Southern	Assessment of mineral potential and collection of basic data, Healy quadrangle	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2613
Curtin, G. C.	Tripp, R. B. Hampton, J. O. Huston, D. L.	Geologic	Southern	Geochemical sampling and analysis in support of AMRAP, Mount Hayes quadrangle	Office of Mineral Resources Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6171
Dearborn, L. L.	---	Water Res.	Southwestern	Hydrologic data collection, Bristol Bay area	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Dearborn, L. L.	Bailey, B. J. Best, B. J. Lee, M. G. Hopkins, G. C. Deeter, G. B.	Water Res.	Statewide	Collection of basic ground-water data	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Dearborn, L. L.	To be assigned	Water Res.	Southern	Evaluation of ground-water resources, Eagle River valley near Anchorage	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4507
Detra, D. E.	Hurrell, J. T. Tripp, R. B.	Geologic	Southwestern	Geochemical sampling and analysis in support of AMRAP, Bristol Bay, Karluk and Ugashik quadrangles	Office of Mineral Resources Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6172

Table 3. -- List 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
Detterman, R. L.	Miller, T. P. Yount, M. E. Wilson, F. H. Allaway, W. H. Detra, D. E. Case, J. E. Cox, D. P.	Geologic	Southwestern	Evaluation of mineral and energy resources of Ugashik and Karluk quadrangles (AMRAP)	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Rd. Menlo Park, CA 94025 (415) 232-8111 ext. 2244
Dickinson, K. A.	Campbell, J. A.	Geologic	Statewide	Evaluation of uranium potential in selected Tertiary basins in Alaska	Office of Energy Resources Branch of Uranium-Thorium Resources 5946 McIntyre Street CMS Research Bldg. Golden, CO 80401 (303) 837-5667
Donovan, T. L.	Forgey, R. L. Hallinan, J. R. Hendricks, J. D. Roberts, A. A.	Geologic	Northern	Study of hydrocarbon seepage relative to magnetite formation, North Slope area	Office of Energy Resources Branch of Oil and Gas Resources 2255 North Gemini Drive Flagstaff, AZ 86001 (602) 779-3311 ext. 1350
Dusel-Bacon, Cynthia	Aleinikoff, J. A. Bentz, J. L.	Geologic	East-central	Petrographic studies of gneisses, Yukon-Tanana Upland	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2202
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	Compilation of 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 Menlo Park, CA 94025 (415) 323-8111 ext. 2649
Eberlein, G. D. and Churkin, Michael, Jr.	Carter, C. (Saleeby, J. B., Cal. Tech.)	Geologic	Southeastern	Geologic mapping and development of stratigraphic, structural and petrographic data base, Craig quadrangle	(Eberlein as above) Lanphere: Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2210 (Eberlein) ext. 2256 (Churkin)

Table 3. -- List 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
Ferrians, O. J., Jr.	---	Geologic	Northern	Engineering geologic investigations for land-use planning	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2247
Ferrians, O. J., Jr.	---	Geologic	Southern	Earthquake hazards assessment, Anchorage-Susitna area	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2247
Feulner, A. J.	---	Water Res.	Southeastern	Water resources in the vicinity of Craig and Klawock	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4138
Feulner, A. J.	---	Water Res.	Southwestern	Inventory of water supplies in light of proposed shore-based processing plant, St. Paul Island	Alaska District Office 722 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4138
Feulner, A. J.	Bailey, B. J. Marshall, J. A.	Water Res.	Statewide	Maintaining network of observation wells for ground-water level data	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4138
Fisher, M. A.	Holmes, M. L. Patton, W. W., Jr.	Geologic	Offshore	Gravity, structure seismic studies of Norton Sound	Office of Energy Resources Branch of Oil and Gas Resources 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7108
Foley, R. C.	---	National Mapping	Southern	Horizontal control for State withdrawal land in cooperation with BLM, Talkeetna Mountains	Branch of Field Surveys Denver Federal Center Denver, CO 80225 (303) 234-2177
Foley, R. C.	To be assigned	National Mapping	East-central	Horizontal control for BLM on boundary of Yukon Flats National Monument	Branch of Field Surveys Denver Federal Center Denver, CO 80225 (303) 234-2177
Foley, R. C.	To be assigned	National Mapping	East-central	Horizontal control for BLM on boundary of Yukon Charley National Monument	Branch of Field Surveys Denver Federal Center Denver, CO 80225 (303) 234-2177

Table 3. -- List 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
Foster, H. L.	Weber, F. R. Cady, J. W. Crim, W. D. Menzie, W. D. Laird, J. Dusel-Bacon, C. Le Compte, J. P. Churkin, M., Jr. Keith, T. E. Aleinikoff, J. A. Stacey, J. S. Trexler, J. H., Jr.	Geologic	East-central	Geologic mapping and geochemical sampling, Yukon-Tanana Upland (AMRAP)	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2331
Gaydos, L. J.	Acevedo, W. Morrissey, L. A. Wray, J. R.	National Mapping	Northern	Vegetational mapping using Landsat digital data	National Mapping Division (Land Information and Analysis Office) Ames Research Center 240-8 Moffett Field, CA 94035 (415) 968-6368
Grantz, Arthur	May, S. B. Dinter, D. A. Greenberg, J.	Geologic	Offshore	Studies of geologic framework, geohazards, and mineral fuel potential, Beaufort and Chukchi Seas	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2259
Grantz, Arthur	Silberman, M. L.	Geologic	Southern	Stratigraphic and structural studies of the Nelchina area	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2259
Hamilton, T. D.	---	Geologic	Northern	Stratigraphic and hazard studies of unconsolidated deposits in potential transportation corridors, central Brooks Range	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2156
Hampton, M. A.	Orlando, R. C. Torresan, M. E.	Geologic	Southern, Offshore	Geologic environmental assessment of lower Cook Inlet and Kodiak Shelf	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7062
Hess, G. R.	To be assigned	Geologic	Offshore	Identification of geologic hazards in the Bristol Basin, northern Aleutian Shelf	Office of Marine Geology Pacific-Arctic Branch 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7046

Table 3. -- List 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
Hinkley, Todd	---	Geologic	Southern	Study of dusts in annual glacier strata	Office of Geochemistry and Geophysics Branch of Regional Geochemistry Denver Federal Center Denver, CO 80225 (303) 234-5628
Hoare, J. M.	Decker, J. E.	Geologic	Southwestern	Study of age and structure of Paleozoic rocks in Taylor Mountains quadrangle	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2372
Hopkins, D. M.	Hartz, R. W. Pounders, S. Smith, P. A.	Geologic	Northern	Geochronologic studies of offshore sediments, Beaufort Sea coast and shelf area	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2659
Hudson, Travis	---	Geologic	Statewide	Studies of origin, petrology, geochemistry, geochronology, regional geology of tin, tungsten and molybdenum	Office of Mineral Resources Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Johnson, B. R.	Loney, R. A. Karl, S. M.	Geologic	Southeastern	Mineral-resource appraisal, West Chichagof-Yakobi Wilderness Area	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2769
Jones, D. L.	Silberling, N. J. Gromme', S. Hillhouse, J. H. (Coney, P., Univ. of AZ)	Geologic	Statewide	Compilation of tectonostratigraphic map of Alaska	Office of Environmental Geology Branch of Paleontology and Stratigraphy 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2269
Kachadoorian, Reuben	Other Survey personnel	Geologic	Northern	Engineering geologic investigation in the National Petroleum Reserve in Alaska	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2262
Kharaka, Y. K.	Carothers, W. W. Wright, Vicki Lico, M. S.	ONPRA	Northern	Chemical and isotopic analysis of oilfield waters, NPRA	Water Resources Division 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2144

Table 3. -- List 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
Kienzle, J. K.	---	ONPRA	Northern	Acquisition and interpretation of common depth point seismic and gravity data in National Petroleum Reserve in Alaska	Office of National Petroleum Reserve in Alaska 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2137
King, H. D.	Other Survey personnel	Geologic	Southern	Geochemical mapping, Healy quadrangle (AMRAP)	Office of Mineral Resources Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6186
Krumhardt, A. P.	Wilcox, D. E. Maynard, D. L.	Water Res.	East-central	Geohydrologic studies, Fairbanks area	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 ext. 214
Lachenbruch, A. H.	Moses, T. H., Jr. Lawver, L. A.	Geologic	Statewide	Heat-flow studies	Office of Earthquake Studies Branch of Tectonophysics 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2272
Lahr, J. C.	Stephens, C. D. Rogers, J. A.	Geologic	Southern, Southeastern	Evaluation of earthquake hazards in eastern Gulf of Alaska	Office of Earthquake Studies Branch of Ground Motion and Faulting 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2510
Lahr, J. C.	Stephens, C. D. Rogers, J. A.	Geologic	Southern	Studies of current tectonic processes generating earthquakes in Alaska to evaluate hazards	Office of Earthquake Studies Branch of Ground Motion and Faulting 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2510
Lamke, R. D.	---	Water Res.	Statewide	Collection of surface-water basic data	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4393
Lanphere, M.A.	(See Eberlein, G. D.)				
Le Compte, J. R.	---	Geologic	Statewide	Analysis of Landsat imagery (AMRAP)	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2025

Table 3. -- List 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
Madison, R. J.	---	Water Res.	Statewide	Basic data collection,quality of water	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (415) 271-4138
Magoon L. B.	---	Geologic	Southern	Assessment of oil resources, Cook Inlet-Shelikof Strait	Office of Energy Resources Branch of Oil and Gas Resources 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7028
Magoon, L. B.	Claypool, G. E.	Geologic	Northern	Assessment of oil and gas source potential in National Petroleum Reserve in Alaska	Office of Energy Resources Branch of Oil and Gas Resources 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7028
Marlow, M. S.	Cooper, A. K. Hein, J. R. Jones, D. M. Sicard, D. M. Kingston, M. J. McGeary, S. E.	Geologic	Offshore	Evaluation of resource potential, Bering Sea region	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA (415) 856-7092
Mayo, L. R.	Trabant, D. C.	Water Res.	Southern	Glacier measurements to study formation of Lake George at Knik Glacier	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 ext. 214
Mayo, L. R.	Trabant, D. C.	Water Res.	Statewide	Studies of glacier response to climate	Fairbanks Subdistrict Office 101 12th Avenue, Box 11 Fairbanks, AK 99701 (907) 452-1951 ext. 214
McCoy, G. A.	---	Water Res.	Northern	Studies of nutrient limitation in arctic lakes	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (903) 271-4153
McDougall, K. A.	Bouwers, F. M. Marincovich, L. N.	Geologic	Statewide	Studies of distribution and limiting environmental conditions of Neogene and Quaternary faunas	Branch of Central Environmental Geology and Branch of Paleontology and Stratigraphy 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2185

Table 3. -- List 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
McLaurin, J. D.	---	National Mapping	Northern	Mapping at 1:50,000 in Naval Petroleum Reserve	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Northern	Mapping at 1:50,000 in coal resource area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Northern	Mapping at 1:63,360 in eastern Brooks Range	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southern	Providing large-scale topographic maps of Anchorage area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southern	Preparation of large-scale maps of Willow area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southern	Preparation of large-scale maps of Whittier area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southern	Preparation of large-scale maps of Seward area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southern	Preparation of large-scale maps of Valdez and vicinity	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351

Table 3. -- List 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
McLaurin, J. D.	---	National Mapping	Southern	Preparation of large-scale maps of Cordova area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southern	Preparation of 1:63,360 maps of Bering Glacier - Mount St. Elias area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southern	Preparation of bathymetric/topographic maps for Anchorage, Cook Inlet and coastal zone areas	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southwestern	Preparation of new 1:250,000-scale maps of Bethel - Russian Mission area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	Southwestern	Preparation of new maps for Port Moller area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
McLaurin, J. D.	---	National Mapping	West-central	Mapping at 1:50,000 in Hughes-Shungnak area	Rocky Mountain Mapping Center Building 25, P.O. Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-2351
Meier, M. F.	Post, A. S. Hodge, S. M. Rasmussen, L. A. Taylor, P. L. Sikonia, W. G. Krimmel, R. M. Heliker, C. C. Brown, C. S.	Water Res.	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 Project Office - Glaciology 1201 Pacific Avenue, Suite 850 Tacoma, WA 98402 (206) 593-6502
Miller, T. P.	Grauch, R.	Geologic	Statewide	Reconnaissance study of uraniferous plutonic rocks	Office of Mineral Resources Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150

Table 3. -- List 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.	Smith, R. L.	Geologic	East-central, Southwestern	Reconnaissance study of geothermal resources, mapping and petrologic studies of young volcanic rocks	Office of Mineral Resources Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Molenaar, C. M.	Huffman, A. C. Kirk, A. R. Bartsch-Winkler, S. May, F. E. Scott, R. A.	Geologic	Northern	Stratigraphic, petrographic and paleontologic studies of Cretaceous rocks, North Slope	Office of Energy Resources Branch of Oil and Gas Resources Box 25046 Federal Center Denver, CO 80225 (303) 234-4642
Molnia, B. F.	Rappeport, M. L.	Geologic	Southeastern, Offshore	Studies of geologic processes and environmental hazards to development, eastern Gulf of Alaska	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7019
Mortensen, C. E.	Myren, Douglas Iwatsubo, E. Y. Murray, T. L.	Geologic	Southern	Monitoring crustal deformation associated with strain accumulation prior to earthquakes	Office of Earthquake Studies Branch of Tectonophysics 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2583
Nelson, C. H.	Thor, D. R. Larsen, M. C. Larsen, B. Howard, J. D. Southard, J.	Geologic	Offshore	Environmental analyses of northeastern Bering Sea and identification of geohazards	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7023
Nelson, G. L.	Scully, D. R. Emanuel, R. P. Johnson, P. R. Savard, C. S. Bailey, B. J.	Water Res.	Southern	Data collection, monitoring and evaluation of hydrologic conditions in the Kenai Peninsula area	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Nelson, G. L.	Scully, D. R. McCoy, G. A.	Water Res.	Southern	Surface-water, ground-water, water-quality, and benthic invertebrate studies of Capps Creek coal area	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153

Table 3. -- List 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
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
Nelson, S. W.	Mull, C. G. Winkler, G. R. Silberman, M. L. Hudson, T. Pickthorn, W. J. Case, J. F. Barnes, D. F. Crozer, N. A. Miller-Hoare, M. L. (Blasko, D. P., BOM) (Jansons, Uldis, BOM) (Hoekzema, R. B., BOM) Hessin, T. D.	Geologic	Southern, Southwestern	Mineral appraisal of part of Chugach National Forest under RARE II	Office of Mineral Resources Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Nokelberg, W. J.	Zehner, R. E. Herzon, P. O. Miyaoka, R. Curtin, G. C. Yeend, W. E. Aleinikoff, J. A. Lange, I. M. Lanphere, M. A. Doe, B. P. Whelan, J.	Geologic	Southern	Geologic mapping, geochemical and geophysical surveys of Mount Hayes quadrangle (AMRAP)	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2277
Nystrom, D. A.	---	LIA	Statewide	Compilation of information for planning for impacts of oil and gas development	Land Information and Analysis Office Resource Analysis Land Information National Center, Mail Stop 750 12201 Sunrise Valley Drive Reston, VA 22092 (703) 860-7116
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	Office of Mineral Resources Branch of Exploration Research 5946 McIntyre Street Golden, CO 80401 (303) 234-6151

Table 3. -- List 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
Osbakken, W. E.	Dzugan, G. W.	Geologic	Southeastern	Operation of Sitka Observatory	Office of Geochemistry and Geophysics Branch of Electromagnetism and Geomagnetism Sitka Observatory Box 158 Sitka, AK 99835 (907) 747-3332
Palmer, I. F., Jr. (and Lyle, W. M., State of Alaska)	Bolm, J. G. Maxey, L. R.	Conservation	Northern	Investigations of petroleum source-rock and reservoir characteristics, Beaufort Sea oil and gas lease area	Office of Area Geologist 800 A Street, Suite 201 Anchorage, AK 99501 (907) 271-4363 (Division of Geologic and Geophysical Surveys 3001 Porcupine Drive Anchorage, AK 99501 (907) 277-6615)
Palmer, I. F., Jr. (and Lyle, W. M., State of Alaska)	---	Conservation	West-central	Studies of source rocks and potential reservoirs, Norton Sound	(Lyle, same as above) Office of Area Geologist 800 A Street, Suite 201 Anchorage, AK 99501 (907) 271-4363
Patrick, L. D.	---	Water Res.	Statewide	Collection, storage and dissemination of water use data	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153
Patton, W. W., Jr.	Moll, E. J.	Geologic	West-central	Petrologic and geochemical studies, mapping in Nulato, Unalakleet and Norton Bay quadrangles (Hughes-Shungnak project)	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2248
Petering, G. W., Smith, T. N. (and Lyle, W. M., State of Alaska)	Bolm, J. G.	Conservation	Southwestern	Geologic investigation of upland areas adjacent to lower Cook Inlet-Shelikof lease sale area	Conservation Division 800 A Street, Suite 201 Anchorage, AK 99501 (907) 271-4412 (Petering) 271-4406 (Smith) (See Palmer for Lyle's address)
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	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2201

Table 3. -- List 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	Hudson, T. Hunt, S. J. Dixon, K.	Geologic	Statewide	Evaluation of earthquake hazards; studies of tectonic processes	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2201
Reed, B. L.	---	Geologic	Statewide	Study of tin resources	Office of Mineral Resources Branch of Alaskan Geology 1209 Orca Street Anchorage, AK 99501 (907) 271-4150
Reimnitz, Erk	(See Barnes, P. W.)				
Roberts, A. A.	Cunningham, K. C.	Geologic	Northern	Study of microseepage of helium from petroleum reservoirs, northern Alaska	Office of Energy Resources Branch of Oil and Gas Resources Box 25046 Denver Federal Center Denver, CO 80225 (303) 234-3803
Rohde, W. G. and Krebs, Paula (BLM)	David Lindon	LIA	Statewide	Statistical sampling procedures for vegetation maps.	EROS Data Center Sioux Falls, SD 57198 (605) 594-6511
Savage, J. C.	Lisowski, M.	Geologic	Southern	Measurement of crustral strain Yakataga area	Office of Earthquake Studies Branch of Tectonophysics 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2633
Schmoll, H. R., and Yehle, L. A.	Chleborad, A. F. Gardner, C. A. Pasch, A. D. Agard, S. S.	Geologic	Southern	Engineering geology in coal lands, Cook Inlet basin	Office of Environmental Geology Branch of Engineering Geology Box 25046 MS 903 Denver Federal Center Denver, CO 80225 (303) 234-3290, -2999, -3721
Scholl, D. W., and Vallier, T. L.	Stevenson, A. Dates, M.	Geologic	Southwestern, Offshore	Study of seafloor processes through geologic and geophysical data collection, Aleutian Ridge and Shelf	Office of Marine Geology Branch of Pacific-Arctic Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7089 (Scholl) -7048 (Vallier)
Scully, D. R.	Krumhardt, A. P. Kernodle, D. R.	Water Res.	Southern	Hydrologic data collection in areas of coal potential	Anchorage Subdistrict Office 1209 Orca Street Anchorage, AK 99501 (907) 271-4153

Table 3. -- List 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
Shearer, G. B.	Holden, K. D.	Conservation	Northern, Offshore	Identification of geologic hazards, providing technical data for exploration tract selection, Beaufort Sea area	Conservation Division 800 A Street, Suite 109 Anchorage, AK 99501 (907) 271-4445
Silberman, M. L.	Gray, L. B. Conner, C. L. Pickthorn, W. J. (leave) 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	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2267
Sloan, C. E.	Feulner, A. J. Glude, W. J.	Water Res.	Northern	Collection of hydrologic information for ONPRA	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4393
Sloan, C. E.	Hulsing, Harry Childers, J. M.	Water Res.	Statewide	Hydrologic studies in support of Alaska Natural Gas Pipeline	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4393
Smith, J. G.	---	Geologic	Southeastern	Geochronology of southeastern Alaska	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2231
Smith, T. N.	(See Petering, G. W.)				
Still, P. J.	---	Water Res.	Statewide	Basic data collection, stream sediment	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (415) 271-4138
Still, P. J.	Lamke, R. D. Madison, R. J. Brunett, J. O.	Water Res.	Statewide	Reduction of historical water-quality data and evaluation of its adequacy for planning, management and future studies	Alaska District Office 733 West 4th Ave., Suite 400 Anchorage, AK 99501 (907) 271-4138

Table 3. -- List 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
Stricker, G. D.	---	Geologic	Statewide	Evaluation of coal resources and assessment of Btu values and other coal characteristics	Office of Energy Resources Branch of Coal Resources Box 25046 MS 972 Denver, CO 80225 (303) 234-3560
Thrasher, G. P.	(See also Turner, B. W., or Whitney, J. W.)				
Thrasher, G. P., and Turner, B. W.	Schaff, D. P. Lybeck, L. D.	Conservation	Southwestern, Offshore	Identification of geologic conditions and hazards to petroleum exploration and development, Kodiak Shelf area	Conservation Division 800 A Street, Suite 109 Anchorage, AK 99501 (907) 271-4445
Townshend, J. B.	Papp, J. E. Sauter, E. A. Tilton, S. P. Nelson, M. N. Fritsch, P. E.	Geologic	East-central (location of observatory)	Operation of College Observatory to produce geomagnetic and seismic data for national and international use	Office of Geochemistry and Geophysics Branch of Electromagnetism and Geomagnetism College Observatory Yukon Drive on West Ridge Fairbanks, AK 99701 (907) 479-6146
Turner, B. W.	(See also Thrasher, G. P.)				
Turner, B. W. and Thrasher, G. P.	Schaff, D. P. Lybeck, L. D.	Conservation	Southern, Offshore	Identification of geologic conditions and hazards to petroleum exploration and development, eastern Gulf coast area	Conservation Division 800 A Street, Suite 109 Anchorage, AK 99501 (907) 271-4444
Vallier, T. L.	(See also Scholl, D. W.)				
von Heune, R. E.	Moore, G. W. Fisher, M. A. Cochran, G.	Geologic	Southwestern, Offshore	Studies of tectonic framework, geologic history and geodynamic aspects of western Gulf of Alaska continental margin	Office of Marine Geology Pacific-Arctic Branch 345 Middlefield Road Menlo Park, CA 94025 (415) 856-7105
Wahrhaftig, Clyde	---	Geologic	Southern	Evaluation of coal in central Alaska Range	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2664
Weber, F. R.	Foster, H. L. Hamilton, T. D.	Geologic	East-central	Description of Quaternary history of Yukon-Tanana Upland.	Office of Mineral Resources Branch of Alaskan Geology Box 80568 Fairbanks, AK 99708 (907) 479-7245

Table 3. -- List 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
White, F. E., Jr.	To be assigned	National Mapping	Southern	Preparation of large-scale maps of Kenai-Soldotna area	Branch of Field Surveys Denver Federal Center Denver, CO 80225 (303) 234-2177
Whitney, J. W.	---	Conservation	Southern	Bathymetric mapping and geologic interpretations, Shelikof Strait OCS area	Office of the Area Geologist 800 A Street Anchorage, AK 99501 (907) 271-4361
Whitney, J. W.	---	Conservation	Southern	Mapping and identification of submerged features, Augustine Island	Office of Area Geologist 800 A Street Anchorage, AK 99501 (907) 271-4361
Whitney, J. W., and Thrasher, G. P.	Shearer, G. B. Lybeck, L. D. Schaff, D. P. Turner, B. W.	Conservation	Southwestern, Offshore	Identification of geologic conditions and hazards to exploration, lower Cook Inlet and Shelikof Strait	Conservation Division 800 A Street, Suite 109 Anchorage, AK 99501 (907) 271-4457
Wilson, F. H.	Shew, N.	Geologic	East-central, Southwestern	Geochronologic studies, computer storage of dates, central and western Alaska	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2664
Witmer, R. J.	---	ONPRA	Northern	Dating and correlation of strata in test wells on National Petroleum Reserve in Alaska	Office of National Petroleum Reserve in Alaska 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2138
Yeend, W. A.	---	Geologic	Statewide	Studies of origin and potential resources of placer deposits	Office of Mineral Resources Branch of Alaskan Geology 345 Middlefield Road Menlo Park, CA 94025 (415) 323-8111 ext. 2156
Yehle, L. A.	(See Schmoll, H. R.)				

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
Bureau of Land Management (BLM); National Aeronautics and Space Administration (NASA); U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory	University of Colorado, Institute of Arctic and Alpine Research		Vegetation Mapping of Northern Alaska Using Landsat Digital Data	Gaydos, L. J.	National Mapping
BLM; NASA			Denali Resource Map Assessment Project	Rohde, W. G. and Krebs, P., (BLM)	LIA
BLM; National Oceanic and Atmospheric Administration (NOAA) (OCSEAP)			Eastern Gulf of Alaska Seismic Studies	Lahr, J. C.	Geologic
BLM	Univ. of Alaska		Geological and Geophysical Investigations of Augustine Island Volcano	Whitney, J. W.	Conservation
BLM			Yukon Flats BLM Control	Foley, R. C.	National Mapping
BLM			Yukon Charley BLM Control	Foley, R. C.	National Mapping
BLM			Talkeetna Mountains BLM Control	Foley, R. C.	National Mapping
BLM; NOAA			Environmental Geologic Studies of the Northern Bering Sea	Nelson, C. H.	Geologic
Bureau of Mines (part of National Park Service study)			Mineral Resources of Glacier Bay National Monument Wilderness Study Area	Brew, D. A.	Geologic
Bureau of Mines; USGS Conservation Div.	Department of Natural Resources (ADNR), Division of Geological and Geophysical Surveys (DGGS)		Geotectonics, Metallogenics and Resources of Southeastern Alaska	Berg, H. C.	Geologic
Bureau of Mines			West Chichagof-Yakobi Wilderness Study	Johnson, B. R.	Geologic
Department of Agriculture, Forest Service	ADNR, DGGS		Mineral Resources of the Petersburg (1:125,000) Quadrangle	Cathrall, J. B.	Geologic

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
Department of the Interior			Hydrologic Conditions along the Proposed Route of the Alaska Natural Gas Pipeline	Sloan, C. E.	Water Resources
Department of the Interior			Arctic Marine Sedimentary Processes	Barnes, P. W., and Reimnitz, Erk	Geologic
Department of Commerce, National Marine Fisheries			Water Supply Inventory for Processing Plant, St. Paul Island	Feulner, A. J.	Water Resources
Environmental Protection Agency (EPA)			Nutrient Limitation in Two Arctic Lakes near Umiat	McCoy, G. A.	Water Resources
National Oceanic Survey			Alaskan Bathymetric and Topographic Maps	McLaurin, J. D.	National Mapping
NOAA; BLM; USGS Conservation Div.			Geologic Hazards in Bristol Bay, Northern Aleutian Shelf	Hess, G. R.	Geologic
NOAA; BLM; USGS Conservation Div.			Environmental Studies of the Eastern Gulf of Alaska	Molnia, B. F.	Geologic
NOAA; BLM			Northern Alaska Cenozoic	Hopkins, D. M.	Geologic
USGS Office of National Petroleum Reserve in Alaska (ONPRA)			North Slope Cretaceous Studies	Molenaar, C. M.	Geologic
ONPRA			Helium Detection, National Petroleum Reserve in Alaska	Roberts, A. A.	Geologic
ONPRA			Quaternary Environments of the National Petroleum Reserve in Alaska	Nelson, R. E.	Geologic
ONPRA			National Petroleum Reserve in Alaska Hydrology	Sloan, C. E.	Water Resources
ONPRA			Geothermal Studies	Lachenbruch, A. H.	Geologic
ONPRA			Geologic Framework and Resource Assessment, Beaufort and Chukchi Seas	Grantz, Arthur	Geologic
ONPRA			Paleozoic Biostratigraphic Framework of Alaska	Dutro, J. T., Jr.	Geologic
ONPRA			National Petroleum Reserve in Alaska (data compilation)	Carter, R. D.	Geologic

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
ONPRA			Coal Resources of the National Petroleum Reserve in Alaska	Callahan, J. E.	Conservation
ONPRA			Geochemistry of Oilfield Waters, National Petroleum Reserve in Alaska	Kharaka, Y. K.	Water Resources
U.S. Army Corps of Engineers, Alaska District and Cold Regions Research and Engineering Laboratory			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
Department of State; BLM; NOAA; USGS Conservation Div.			Geologic Framework and Resource Assessment of the Aleutian-Bering Sea Region	Marlow, M. S.	Geologic
EPA			Hydrologic Studies Related to Coal Mining	Scully, D. R.	Water Resources
National Park Service			Wrangell-St. Elias National Monument Analysis Project	Carneggie, D. M.	LIA
Dept. of Agriculture, Soil Conservation Service; Dept. of Energy, Alaska Power Admin.; and others	Dept. of Transportation and Public Facilities; Alaska Power Authority; and others	Thomas Bay Power Commission and others	Collection of Basic Records Program (surface water, ground water, water quality)	Division personnel	Water Resources
U.S. Army Corps of Engineers			Tanana River Sediment Study	Burrows, R. L.	Water Resources
	Departments of Environmental Conservation, Fish and Game		Hydrology and Water Quality of Keta River Basin near Ketchikan	Berwick, V. K.	Water Resources
	ADNR, DGGS		Alaska Mineral Resource Assessment (AMRAP)	Berg, H. C.	Geologic
	ADNR, DGGS		Geochemistry and Geochronology of Igneous Rocks and Ore Deposits in Alaska	Silberman, M. L.	Geologic
	ADNR, Dept. of Forest Land and Water Management (DFLWM)		Alaska Water Use Data Program	Patrick, L. D.	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
	ADNR, DFLWM	Kenai Peninsula Borough	Water Resources of the Kenai Peninsula Borough	Nelson, G. L.	Water Resources
	ADNR, DGGS		Water Resources of the Bristol Bay Region	Dearborn, L. L.	Water Resources
	ADNR, DGGS		1980 Lower Cook Inlet-Shelikof Strait Field Project	Petering, G. W., and Smith, T. N. (and Lyle, W. M., ADNR)	Conservation
	ADNR, DGGS		Metamorphic Facies Map	Brew, D. A.	Geologic
	ADNR, DGGS		Arctic National Wildlife Range Stratigraphic Project	Palmer, I. F. (and Lyle, W. M., ADNR)	Conservation
	ADNR, DGGS		Norton Sound stratigraphic study	Palmer, I. F., (and Lyle, W. M., ADNR)	Conservation
	ADNR, DGGS		Knik Glacier	Mayo, L. R.	Water Resources
		Fairbanks North Star Borough	Geohydrology of the Fairbanks North Star Star Borough	Krumhardt, A. P.	Water Resources
		Municipality of Anchorage	Geohydrology of the Anchorage area	Cowing, D. J.	Water Resources
		City of Craig	Water resources in the vicinity of Craig and Klawock, Alaska	Feulner, A. J.	Water Resources
		Municipality of Anchorage	Ground-water resources of the middle Eagle River valley near Eagle River, Alaska	Dearborn, L. L.	Water Resources
		City and Borough of Juneau	Ground-water investigation of the Mendenhall Valley, Juneau	(To be assigned)	Water Resources


U. S. S. R.
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BERING SEA
CANADA
BERING SEA
ALEUTIAN ISLANDS
PACIFIC OCEAN